IFIP TC 9 WG 9.4 2007 Conference
Taking Stock of E-Development

Sao Paulo, Brazil

Preface

One of the most common questions asked by researchers and practitioners related to IT in developing countries has been: Can ICTs impact the development of a nation? The answer now is clearly yes. It is our belief, that with the widespread use and institutionalization of ICTs, we have moved on to address questions that seek to understand how ICTs are being used in development. Taking stock of the diversity of applications and understandings of ICTs, even at what appears to be still an early stage in ICT usage, is already a major task which calls for developments in theoretic analysis that are informed by and enable pragmatic action in terms of policy and in specific projects. The IFIP 9.4 group has, for almost 20 years, been contributing to the dynamics of research and changes in policies in the deployment and use of ICTs in developing countries. An examination of the proceedings of previous conferences shows a close relationship between practice and research.

For our 9th conference, here in Sao Paulo, we are proud to present a selection of articles that represent advances, shifts and concerns in our main areas of interest: research and practice related to ICTs in developing countries. We received an unprecedented number of submissions (92), from which we selected a total of 61 papers. All papers were screened and reviewed by two different reviewers; all of them researchers related to the IFIP 9.4 group. As the reader will realize the articles form a rich and intriguing amalgam ranging from completed research to reports on research in progress. Indeed, the papers adopt varied theoretical approaches and provide empiric content from different regions. The authors and their fieldwork come from all (inhabited) continents. The topics covered range from open source, Internet kiosks, education, health and general government policy. It is not an exaggeration to say that with such heterogeneous topics and approaches, these proceedings will provide a reader with a current account of our area of research and practice which will be discussed, scrutinized and debated over the three days of the conference.

These proceedings would have not been possible without the participation and help of many members of the IFIP 9.4 group. First, we would like to thank the programme committee and all the reviewers who generously and thoroughly examined their assigned manuscripts and took up the challenge to give constructive, if critical, analysis. Secondly, the IFIP executive committee who provided the necessary resources and logistics as well as their valuable guidance and advise. Third, we want to highlight the formidable work of the organization committee chaired by our colleague Nicolau Reinhard and the technical assistance and constant support of Cesar Alexandre de Sousa. Finally, we want to thank the authors and conference participants that with their work and enthusiasm have made possible the growth and development of this group.

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A FRAMEWORK-BASED ASSESSMENT OF SUB-SAHARAN AFRICA'S INTERNET READINESS: THE KENYAN CASE

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Abstract

In this study we use the Global Diffusion of the Internet (GDI) framework (Wolcott & Goodman, 2003) to explore Internet diffusion in Kenya using the six GDI dimensions: Pervasiveness, Dispersion, Sectoral Absorption, Connectivity Infrastructure, Organizational Infrastructure, and Sophistication of Use. Given strong support from their local governments (Musa, Meso, & Mbarika, 2005), Kenya in our study has made Herculean progress towards joining the "Information Society." Despite the limitations in obtaining real-time statistics (2004/2005), our study provides vital information that local and foreign investors could use as a baseline assessment to start up Internet-based businesses in Kenya. It also brings the sub-Saharan region to the forefront of mainstream information technology research, hence helping to fill a long existing void that requires attention.

Keywords: Internet Readiness, Developing Countries, GDI Framework, Sub-Saharan Africa, Socio-Economic Development.

A FRAMEWORK-BASED ASSESSMENT OF SUB-SAHARAN AFRICA'S INTERNET READINESS: THE KENYAN CASE

1. BACKGROUND AND MOTIVATION

> *"Africa missed the industrial revolution, we can't afford to stand aside and let the communication revolution go by too." (African Telecommunications Report, March 1987, p. 7).*

Almost two decades ago, President Felix Houphouet Boigny of the Ivory Coast issued this warning to his countrymen about the importance of joining the communications (information) age. In this same spirit, academic and practitioner literature have heralded the Internet as a major impetus for a plethora of business applications as well as for socio-economic development. While basic diffusion of the Internet is now an old story for the developed world, the same is not true for the Sub-Saharan African (SSA) region, home to 33 of the 48 least developed countries (LDCs) of the world. Even as recently as 1999, not every country in the SSA region was connected to the Internet (Eritrea sealed Africa's full entry into the Internet age in 2000). If we agree with previous literature that the Internet is fundamental to the socio-economic growth of the SSA region (Mbarika, Okoli, Byrd, & Datta, 2005; Odedra, Lawrie, Bennett, & Goodman, 1993; Petrazzini & Kibati, 1999) — for example, through attracting new businesses to SSA that require Internet presence — then it is most essential that we investigate Internet readiness in the region.

Conventional wisdom declares that the Internet provides new ways of exchanging information. The Internet has become increasingly important to organizations in many of their business affairs (Ah-Wong et al., 2001; Straub, Hoffman, Weber, & Steinfield, 2002a, 2002b). In fact, the use of the Internet as a vehicle for electronic commerce (e-commerce) has become standard operating practice in a majority of today's corporations. The world is rapidly moving toward Internet-based economic structures and information societies that comprise networks of individuals, firms, and countries linked electronically in interdependent and interactive relationships.

Sub-Saharan Africa may be a late starter on the Internet and other information technologies, but it is currently making rapid progress. The countries in this region are experiencing growth in Internet connectivity, the use of computers, and in the diffusion of wireless communications (International Telecommunication Union, 2005; World Bank, 2002). In the early 1990s, most of Sub-Saharan Africa was characterized as a technological desert (Goodman, 1994; Odedra, Lawrie, Bennett, & Goodman, 1993). However, recent statistics show considerable advances in this region (Mbarika, Okoli, Byrd, & Datta, 2005):

For a holistic perspective on the different components of ICT infrastructure, it is helpful to evaluate a country or region's infrastructural preparedness to engage in Internet and e-business activities. Since 1997, the Mosaic Group has undertaken the Global Diffusion of the Internet Project (GDI), an extensive investigation of the spread of the Internet into countries all around the world (Press, 1997; Press et al., 1998; Wolcott, Press, McHenry, & Goodman, 2001). One of the primary products of GDI has been a framework for assessing the most pertinent dimensions of Internet diffusion at the national level. This GDI framework is similar in concept to several of the e-readiness assessment tools created and gathered by non-governmental organizations such as InfoDev, the World Bank's Information for Development program. However, unlike the other e-readiness tools, the GDI framework has been rigorously developed and refined over a long period of time. In the section that follows, we discuss this

framework and present the SSA context. This is followed by a discussion of the GDI framework within the country-specific context of Kenya. We conclude our study with implications for research and practice.

2. GDI FRAMEWORK OF INTERNET DIFFUSION: SUB-SAHARIAN AFRICA IN GENERAL

The GDI framework (Wolcott, Press, McHenry, & Goodman, 2001) has six dimensions that it uses to conceptualize the state of Internet diffusion in a country. For each dimension, a possible score between 0 and 4 is awarded based on a set of evaluation criteria. In the ensuing section, we briefly comment on these dimensions within the context of SSA:

1. **Pervasiveness** of use among individuals measures the number of Internet hosts and users per capita. Based on data from the International Telecommunication Union (International Telecommunication Union, 2005), SSA had approximately 3.1 Internet users per 1,000 citizens (7.5 if South Africa is included).

2. **Geographical Dispersion** measures the extent to which Internet use is spread throughout the country, ranging from being accessible in just a few major cities to widespread availability including rural access. In most SSA countries, there are only one to three cities with Internet access. In SSA, about 70% of the population lives in rural areas (Kifle, Mbarika, & Cobb-Payton, 2005), and this rural majority has little, if any, Internet access, and hence few options for e-commerce. This economic divide is largely due to disparity in income and literacy between urban and rural Africans.

3. **Sectoral Absorption** captures the commitment to Internet use (as measured by leased lines and Internet servers) in the four major sectors of academia, commerce, healthcare, and government. While the Internet is used to some degree in SSA in all four sectors, fewer than 5% of these organizations have Internet connections beyond dial-up.

4. **Connectivity Infrastructure** assesses the extent and robustness of the physical structure of the network that supports the Internet (Wolcott, Press, McHenry, & Goodman, 2001). It includes the domestic backbone, international links, Internet exchanges, and methods of accessing the Internet. By the GDI system, most Sub-Saharan countries would probably be classified as "thin" — there is frequently no domestic backbone, and most international links are less than 2Mpbs and access to the Internet less than 64Kbps (International Telecommunication Union, 2005).

5. **Organizational Infrastructure** refers to the market environment for Internet service providers (ISPs), including the extent and nature of privatization of national telecommunications. Virtually all SSA countries would be classified as "controlled" — there is usually just a single public telecommunications operator owned and controlled by the government. However, there is a widespread move for privatization and licensing for Second National Operators (i.e., one or more operators licensed by the government to offer telecommunication services on a national level) to allow for competitive, market-driven telecommunication markets (Hamilton, 2001).

6. **Sophistication of Use** tries to measure how innovatively the Internet is used in a country, and to what extent the Internet transforms traditional practices for both individuals and organizations. Most SSA countries would probably be classified as "minimal" — the user community struggles to employ the Internet in conventional, mainstream applications.

The GDI Framework is unique in that it has two general emphases. On one hand, it looks at the absolute degree to which the Internet is being used (as measured in Connectivity and Organizational Infrastructure, and Sophistication of Use). On the other hand, it has a strong diffusion focus, examining how widely the Internet is used geographically (Geographic Dispersion), and among individuals (Pervasiveness) and organizations (Sectoral Absorption). The GDI framework therefore provides a well-tested foundation, which we can use to explore diffusion of the Internet in the country-specific cases. In light of this foundation, the next section discusses the case of Kenya.

3. GDI FRAMEWORK OF INTERNET DIFFUSION: THE KENYAN CONTEXT

In studies of economic development, the continent of Africa is divided into two general regions. In the north, there is Morocco, Algeria, Tunisia, Libya, and Egypt. All the other countries are classified as Sub-Saharan Africa. However, the Republic of South Africa, while technically "sub" of the Sahara desert, is often treated distinctly because of its unique socioeconomic and ethnic situation. Sub-Saharan Africa is further divided into sub-regions: Central Africa, East Africa, the Horn of Africa, Southern Africa, and West Africa. In one study, we cannot study a broad range of countries, and provide a richer and deeper account of the Internet diffusion process. We would like to be sufficiently thorough as to give some meaningful insights. Thus, we have selected one fairly populous and economically significant country for this study: Kenya.

Figure 1. The Sub-Saharan African Region Located between the Tropics of Cancer and Capricorn

3.1. A Brief Introduction to Kenya

Kenya became an independent nation in 1963 and after over two decades of single party control, the nation is slowly beginning the process of democratization and economic reforms (Ochieng, 1985). Though known historically as an agricultural economy, for farming, herding, and hunting, Kenya is also the regional hub for trade and finance in East Africa. Nairobi, the capital city and the technological hub of the nation, is home to approximately 1.4 million people and is the publishing center for several newspapers including the *Daily Nation*, *Taifa Leo*, and *The East African Standard*, as well as some private radio and television stations such as The Kenyan Television Network. Table 1. gives a snapshot of the Kenyan economy.

Key Facts	Kenya (.ke)
Population	33,829,590
Area	582,650 sq km
Labor Force	11.4 million (2004 est.)
GDP per Capita	$1,100 (2004 est.)
GDP Real Growth Rate	2.2% (2004 est.)
Inflation Rate	9% (2004 est.)
Key ICT Measures	
Telephone Lines	328,400 (2003)
Telephones – mobile cellular	1,590,800 (2003)
Telephone Lines per 100	1.562
Telephones – mobile cellular per 100	7.564
Television Broadcast Stations	8 (2002)

Table 1. Key Indicators for Kenya

Source: CIA World Factbook (CIA, 2005)

Kenya was introduced to the Internet in 1994. However, the telecommunications sector (including the Internet) in Kenya was tightly regulated up until 1998, with the enactment of the Kenya Communications Act. This act dissolved the former Kenya Posts and Telecommunications Corporation (KPTC) and created two new entities: Kenya Telcom (TelKom) and Postal Corporation of Kenya (Posta). The Communications Commission of Kenya (CCK) was also established to regulate those sectors. CCK is the licensing and regulatory authority for telecommunications, radio communications and postal services (Export Processing Zones Authority, 2005).

Despite the liberalization, the Kenyan government has a tight grasp on Kenya's media outlets and the Internet. Until recently, the sole Internet backbone, JamboNet was exclusively controlled by Telkom. Spurred by inadequacies (stability, performance and general availability) of the backbone, the lobby group Telecommunications Service Providers Association of Kenya (TESPOK), a group composed of ISPs and other telecommunications service providers in Kenya, was established in 1999. TESPOK views the TelKom monopoly and JamboNet inadequacies as a major hindrance to Internet growth (Bedi, 2004; Buruchara, 2003). In 2004, Telkom's exclusive of the backbone ended, opening the door to competition.

3.2. Pervasiveness

Our first area of examination, pervasiveness, is simply the number of Internet users per capita (Wolcott, Press, McHenry, & Goodman, 2001). One difficulty in determining the number of Internet users is estimating the average number of people who share an Internet account and estimating the average number who use the Internet outside of the home or office at lease once a month (Foster, Goodman, Osiakwan, & Bernstein, 2004). Thus, pervasiveness is captured in orders of magnitude change in the number of users.

Estimates of the number of Internet users in Kenya range from 368,000 (International Telecommunication Union, 2005) to approximately 1,030,000 (Export Processing Zones Authority, 2005) of the 33.8 million Kenyans have access to the Internet, giving a ratio of Internet users per capita of 1.4 in Kenya. This corresponds to level 3 (*Established* connection to the Internet) in the GDI framework Scales (Table 2). Currently, television and Internet access are reserved for the wealthy, most of who live in Nairobi and other major cities. The Internet has a very slow diffusion outside of major urban areas.

Level 0	Non-existent: The Internet does not exist in a viable form in this country. No computers with international IP connections are located within the country. There may be some Internet users in the country; however, they obtain a connection via an international telephone call to a foreign ISP.
Level 1	Embryonic: The ratio of users per capita is on the order of magnitude of less than one in a thousand (less than 0.1%).
Level 2	Nascent: The ratio of Internet users per capita is on the order of magnitude of at least one in a thousand (0.1% or greater).
Level 3	Established: The ratio of Internet users per capita is on the order of magnitude of at least one in a hundred (1% or greater).
Level 4	Common: The ratio of Internet users per capita is on the order of magnitude of at least one in 10 (10% or greater).

Table 2. Pervasiveness of the Internet in Kenya

Given Kenya's low per capita income of $1,100, the high cost (>$300) associated with installing a high speed Internet connection coupled with exorbitantly high monthly access charges (>$100) will likely continue to dissuade many would-be users (Telkom Kenya, 2005).

Kenya has about 30,000 dial-up subscribers and 30,000 e-mails accounts, most of the 30 million Kenyans are computer illiterate. Computer attitudes and Internet awareness further compound the problem. Computers are considered luxury toys for most of the Kenyan students in a country that can not provide electricity to most villages and some towns. In fact, many village residents are unaware of the existence of the Internet

3.3. Geographic Dispersion

Geographic Dispersion measures the concentration of the Internet within a nation. That is, the locations where users can access the Internet, ranging from a single city to nationwide availability with points-of-presence (POPs) or toll-free access in all first-tier political subdivisions and common rural access roads (Wolcott, Press, McHenry, & Goodman, 2001) — however, toll-free access is nonexistent in most African countries.

The most common POPs in Kenya are cybercafés. Cybercafés are community centers where users can surf the Internet. They started in Europe more than a decade ago as a kind of café where people relax and snack while they use the Internet, though African cybercafés rarely include the "café" part. Nonetheless, millions of Africans are able to easily communicate with friends and family members. Considering per capita incomes averaging less than $500 in most of Sub-Saharan Africa, families can hardly afford personal computers at home, and, if they do, they can barely afford Internet access charges.

Although, there is an increase in the number of PCs at work places and homes in most of Sub-Saharan Africa, most are not networked and few have Internet access. It is only recently, that some Sub-Saharan African countries began liberalizing their telecommunications regimes allowing licensing of Internet Service Providers (ISPs). These ISPs, local entrepreneurs, and in some cases the incumbent telecommunications company, responded to these constraints by building cybercafés. Given these conditions, cybercafés will likely continue to be the dominate form of Internet access for some time to come.

Kenya has 7 top level administrative districts and an addition area which includes the capital, Nairobi. In Kenya, most of the telecommunications infrastructure is located in Nairobi, the capital city. Access providers are reluctant to cover rural areas due to the heavy investment needed to make those areas operational. Some of these areas do not even have electricity. 85% of the cybercafés are located in Nairobi due to the lower cost and higher demand compared to rural areas. Kenya has 11 cities with POPs, as shown in Table 3 with Internet access available in over 50% of Kenya's 8 districts. Thus, the Geographic Dispersion reaches level 3 "*Highly Dispersed*" (Table 4).

Major City	Number of POPs
Nairobi	90+
Mombasa	25
Nakuru	10
Other Cities (8)	70+
Total	*200- 300*

Table 3. Distribution and locations of POPs (Cybercafés) in Kenya

Level 0	Non-existent. The Internet does not exist in a viable form in this country. No computers with international IP connections are located within the country. A country may be using UUCP connections for e-mail and USENET.
Level 1	Single location: Internet points-of-presence are confined to one major population center.
Level 2	Moderately dispersed: Internet points-of-presence are located in multiple first-tier political subdivisions of the country.
Level 3	Highly dispersed: Internet points-of-presence are located in at least 50% of the first-tier political subdivisions of the country.
Level 4	Nationwide: Internet points-of-presence are located in essentially all first-tier political sub-divisions of the country. Rural access is publicly and commonly available.

Table 4. The Geographical Dispersion of the Internet (Wolcott et al 2001)

Kenya hosts about 200-300 Cybercafés that provide Internet service via POP locations for the price of about $0.07 (Jensen, 2003). Cybercafés have been engaged in price wars that have lead to a big drop in prices from $0.13 in 1999 to $0.06 per minute in 2002. This competition caused 30 of these Cybercafés to close since they were operating at prices under $0.04 per minute, which is about the minimum operating price. Rural areas are faced with the lack of electricity, and Internet services providers are reluctant to service those areas because of the very low demands (due to computer illiteracy, lack of power and lack of funds to buy computers) and the heavy investment needed to make those areas operational.

3.4. Sectoral Absorption

The third area of evaluation is the sectoral absorption dimension, which is the degree to which Kenya effectively utilizes access to the Internet, namely in the education, public, and governmental sectors of the country (Wolcott, Press, McHenry, & Goodman, 2001).

In the government sector, there are some government Web sites such as www.kenya.go.ke that provide information about the national assembly, the ministries, the electoral commission, the presidential office, and the attorney general. None of these sites are interactive; for example, sites' visitors do not have access to administrative forms like visa applications. In the educational sector, most Kenyan schools have neither a telephone line nor Internet access. IT training in schools and universities desperately needs to be addressed in Kenya, since most graduates are computer illiterate due to the limited to non-existent availability of PCs in schools. In Kenya, e-commerce has not yet taken off due to absence of enabling legislation (Export Processing Zones Authority, 2005). Use of the Internet in healthcare is mainly confined to a few health related Web portals such as the Christian Health Association of Kenya (www.chak.or.ke). Thus, Kenya's sectoral absorption is at level 1 "Rare" (Table 5).

Sector	Minimal (1 point)	Medium (2 points)	Great Majority (3 points)
Academic: Primary and Secondary Education, University Education	< 10% have leased-line Internet connectivity	10%.90% have leased-line Internet connectivity	> 90% have leased-line Internet connectivity
Commercial: Distribution, Finance, Manufacturing, Retail, Service	< 10% have Internet servers	10%.90% have Internet servers	> 90% have Internet servers
Health: Hospitals, Clinics, Research Centers, Physicians/Practitioners	<.10% have leased-line Internet connectivity	10%.90% have leased-line Internet connectivity	> 90% have leased-line Internet connectivity
Public: Central Government, Regional and Local Governments, Public Companies	<10% have Internet servers	10%.90% have Internet servers	> 90% have Internet servers

Table 5. The Sectoral Absorption of the Internet (Wolcott et al 2001)

Sectoral Total Points	Sectoral Absorption Dimension Rating	
0	Level 0	Non-Existent
1-3	Level 1	Rare
4-6	Level 2	Moderate
7-9	Level 3	Common
10-12	Level 4	Widely used

Table 6. Sectoral Absorption Scale (Wolcott et al 2001)

3.5. Connectivity Infrastructure

The fourth dimension, the connectivity infrastructure, is based on the country's use of domestic and international backbone bandwidth, exchange-points, and use high-speed Internet connections (Wolcott, Press, McHenry, & Goodman, 2001).

The main backbone infrastructure is Telkom Kenya's JamboNet. Other smaller ISPs use this gateway for their upstream connectivity, while some of the larger ISPs use satellite broadcast to increase their incoming bandwidth. Telkom Kenya also leases additional data lines for back up purposes and spill over traffic. Fiber tracts are also currently being laid between major cities. The network between Nairobi and Mombasa is currently in use with plans to network other major towns on either side of the country (Press, 2001). Estimates of Kenya's domestic bandwidth exceed 2 Mbps for a domestic backbone rating of 2 "Expanded." Kenya's international bandwidth capacity has been estimated to be in the 30 Mbps range (Export Processing Zones Authority, 2005) or a level 2 "*Expanded*" international links rating.

Kenya created the Kenya Internet Exchange Point (KIXP) in November 2000, of which the following ISPs took part: ISPKenya, AfricaOnline, Kenya Web and SwiftGlobal (Kimutai, 2002). Though a government dispute over licensing resulted in the facility being shut down for almost a year, it is currently up and running (Export Processing Zones Authority, 2005). While DSL is available in Kenya, quality issues leave the majority of Kenyans with access of less than 64 Kbps. This equates to an Internet exchanges rating as well as an access methods rating of 2 "*Expanded*." Thus, Kenya's connectivity infrastructure is at level 2 "*Expanded*" and the aggregate rating is also level 2 "*Expanded*."

Levels		Domestic Backbone	International Links	Internet Exchanges	Access Methods
Level 0	Non-Existent	None	None	None	None
Level 1	Thin	≤ 2 Mbps	≤ 128 Kbps	None	Modem
Level 2	Expanded	2 Mbps -100 Gbps	128 Kbps – 45 Mbps	1	Modem 64 Kbps Leased Lines
Level 3	Broad	200 Mbps - 100 Gpbs	45 Mbps – 10 Gbps	More than 1; Bilateral or Open	Modem > 64 Kbps leased lines
Level 4	Extensive	> 100 Gbps	> 10 Gbps	Many; both Bilateral and Open	< 90% modem 64 Kbps Leased Lines

Table 7. The Connectivity Infrastructure of the Internet (Wolcott et al 2001)

3.6. Organizational Infrastructure

Organizational Infrastructure, the fifth criteria of our evaluation, can be described as a measure based on the state of the ISP industry and market conditions. Therefore, a nation that has a high score would have many ISPs and a high degree of openness and competition in both the ISP and telecommunication industries (Wolcott, Press, McHenry, & Goodman, 2001).

Telkom Kenya is the only licensed provider of Telecommunications services, but TESPOK (Telecommunications Service Provider Association of Kenya) is lobbying for the deregulation of VSAT (Very Small Aperture Terminals) services as an alternative. The Kenyan government, under international pressure (IMF, World Bank), decided to liberalize the Telecommunications Industry through the Telecommunications Act of Kenya, 1998. The complete application of this resolution will enable competition and has already granted licenses to 72 ISPs.

Despite other legislative constraints that make it difficult to operate an ISP in Kenya even with a license, Kenyans enjoy a broader market, better service, and cheaper access to the Internet through its 32 operating ISPs. And, despite this progressive movement in terms of Internet service, TelKom Kenya still holds a complete monopoly over telephony services as the government has declared Voice Over IP illegal for international calls. Though Kenya's telecommunications sector is still limited to a number of competitors and restricted in terms of which international traffic access (VSAT) and services (VOIP), the infrastructure is expanding. Thus, Kenya's organizational Infrastructure is at level 2 "*Controlled*"

Kenya's Operating ISPs
AfricaOnline
Swift Global
TelKom
Kenya Online
ISP Kenya
UUnet
Nairobi Net
ClubInternet

Table 8 Main ISPs in Kenya

Level 0	None: The Internet is not present in this country
Level 1	Single: A single ISP has a monopoly in the Internet service provision market. This ISP is generally owned or significantly controlled by the government.
Level 2	Controlled: There are only a few ISPs and the market is closely controlled through high barriers to entry. All ISPs connect to the international Internet through a monopoly telecommunications service provider. The provision of domestic infrastructure is also a monopoly.
Level 3	Competitive: The Internet market is competitive. There are many ISPs and low barriers to market entry. The provision of international links is a monopoly, but the provision of domestic infrastructure is open to competition, or vice versa.
Level 4	Robust: There is a rich service provision infrastructure. There are many ISPs and low barriers to market entry. International links and domestic infrastructure are open to competition. There are collaborative organizations and arrangements such as public exchanges, industry associations, and emergency response teams.

Table 9 The Organizational Infrastructure of the Internet (Wolcott et 2001)

3.7. Sophistication of Use

Lastly, each country's sophistication of use, the level to which a country uses the Internet for everyday processes, must be taken into account. This dimension defines how a country is using the Internet. For example, if a country is merely using the Internet as a substitute for other communication media like faxes and telephones, it would lower than a nation using the Internet in more innovative ways

In Kenya, organizations and individuals use e-mail as an alternative to phone calls (local or long distance) and letters. Telkom has blocked some Internet features like messenger (chat) and VOIP to protect their long distance call revenues, as those features are much cheaper than long distance or international calls. Consequently, many Kenyans want the government to speed up the deregulation process of the telecom industry.

Kenya does not possess an e-government site, but http://www.kenya.gov.ke provides some information about the different Ministries, the office of the President, the national assembly, the electoral commission, and the Office of the general attorney. The government is funding some projects that will make the e-government dream a reality for the Kenyans. A strong e-government site will improve most of the administrative processes like offering visas to visiting tourists. However, though such resources would be valuable to visitors, there is not yet much of an e-government initiative targeted towards Kenya's own citizens.

The use of cards credit/debit cards is being studied, but this idea faces many barriers like the lack of a strong banking system in Kenya (most Kenyans don't have banks accounts), the lack of Kenyan credit card use (which is less than 1%), and the absence of enabling legislation. One the B2B side, some progress has been made. For example, Kenya is connected to e-sokoni (http://www.e-sokoni.com), an Eastern Africa business-to-business trading hub. It hosts nearly 200 suppliers and offers a means for businesses to order their non-production supplies (e.g., fuel, stationeries, vehicle spares, etc.) through an electronic system securely

accessible over the Internet. Kenya's large firms, like Homegrown and British American Tobacco, are using e-sokoni for their trading transactions.

E-commerce in Kenya offers a new way of doing business to the Kenyans firms, and provides Kenya with some quick and efficient means of accessing the Global markets, but the lack of connectivity infrastructure, the unawareness of new technologies, the lack of security over the transactions networks, and the high cost associated with the access to the Internet and the technical training of the personnel discourage many Kenyans businesses to go too far in integrating e-commerce in their business processes. Thus, Kenya's sophistication of use is at level 2 "*Conventional*".

Level 0	None: The Internet is not used, except by a very small fraction of the population that logs into foreign services
Level 1	Minimal: The user community struggles to employ the Internet in conventional, mainstream applications.
Level 2	Conventional: The user community changes established practices somewhat in response to or in order to accommodate the technology, but few established processes are changed dramatically. The Internet is used as a substitute or straightforward enhancement for an existing process (e.g., e-mail vs. post). This is the first level at which we can say that the Internet has taken hold in a country.
Level 3	Transforming: The use of the Internet by certain segments of users results in new applications, or significant changes in existing processes and practices, although these innovations may not necessarily stretch the boundaries of the technology's capabilities.
Level 4	Innovating: Segments of the user community are discriminating and highly demanding. These segments are regularly applying, or seeking to apply, the Internet in innovative ways that push the capabilities of the technology. They play a significant role in driving the state-of-the-art and have a mutually beneficial and synergistic relationship with developers.

Table 10 The Sophistication of Use of the Internet

4. IMPLICATIONS AND CONCLUSION

The monopolistic environment prevailing in the Kenyan economy has caused a relatively low diffusion of the Internet into rural areas, and has prevented World Bank and the IMF from providing this country with the funds necessary to develop adequate Telecommunications Infrastructures throughout the country despite the adoption of the Kenya Telecommunications Act of 1998. The Kenyan government understands that future economic growth depends heavily on strong IT architecture. The Ministry of Information, Transport and Communications and the CCK (Communications Commission of Kenya) are taking steps toward the liberalization of the Telecommunications Industry through the easier deliverance of more licenses (Export Processing Zones Authority, 2005). The complete implementation of the Telecommunication Act of 1998 will certainly lead to economic growth, and the creation of thousands of jobs for Kenyans through the creation of local IT businesses and attraction of international vendors.

The low capacity of the telecommunications infrastructure has resulted in pay unaffordable prices for Internet access in Kenya, and the primary reason some international companies are

reluctant to operate in the country. Internet access is in Kenya is still expensive, especially one accounts for the average annual income. Each year, Kenya loses thousands of potential jobs and millions of dollars in revenue due to the monopoly, which discourages international businesses from setting up shops.

Dimensions Of Internet Diffusion	Levels
Pervasiveness	Level 3: "*Established*"
Geographic Dispersion	Level 3: "Highly dispersed"
Sectoral Absorption	Level 1: "*Rare*"
Connectivity Infrastructure	Level 2: "*Expanded*"
Organizational Infrastructure	Level 2: "*Controlled*"
Sophistication of Use	Level 2 "C*onventional*"

Table 11 A pictorial breakdown of the progress made

With Globalization becoming a major factor for business success, many US and European companies such as Exxon Mobil, Microsoft, IBM, GM, SAP, are establishing major presences in Africa. Given that the Internet is a vital component for these companies to operate successfully, there is a major need for further research in this area.

Given the importance of social, economic and political factors in the diffusion of the Internet, Internet-based applications that address these needs are imperative to the long term diffusion success. The diffusion of the Internet currently supports and will continue to support vital socio-economic and political applications such as:

1. **Telemedicine:** provide many medical services that the patients would have otherwise foregone if there were no other solution.
2. **E-Governance:** Bribery and corruption are characteristic of most governments in Sub-Saharan Africa,. E-Government is a heralded approach to address such poor governance practices and to promote the use of information technologies (IT) for day-to-day governance and transparency.
3. **Online education:** With the poor education infrastructure of SSA there is little opportunity for this knowledge to transfer with beneficial effect, online education can help fill the educational gap as Africans with Internet access can obtain world-class education..
4.   **E-commerce:** The business use of the Internet is critical for sustainable development. Rather than giving Africans the fish of foreign aid, it is critical that Africans learn to fish for themselves by developing viable economic models that fit well with their socioeconomic environment. **Telecenters:** Community telecenters are locations where a small center with different telecommunication devices, such as fax and Internet access, can be placed for the services of a community.

It is important to stress that the specific contexts must be considered in accessing Internet readiness. The design and implementation of Information Technology have historically adopted a Western approach, which has been problematic when adopting these technologies in the African context. There is therefore a need for researchers to develop adequate

Information Technology transfer models and theories within the African context. The GDI framework enables us to show the status of Internet diffusion in Kenya.

Future studies should take into account socio-cultural aspects (language, habits, and countries cultural diversity) that could affect Internet diffusion. However, though valuable for description, the framework is limited in its ability to explain the diffusion process and to propose guidelines for improving it. Hence, it is necessary in the future to further develop the framework into an explanatory theory.

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Appendix A Selected telecommunications indicators for Sub-Saharan Africa

Key to Table

Country	Name of the country
Popn	Population in thousands
GDP	Per capita GDP in US$
Land	Landline teledensity—number of land lines per 100 citizens
Cell	Mobile teledensity—number of mobile phone subscriptions per 100 citizens
TD	Total teledensity—Landline teledensity plus mobile teledensity
Hosts	Total number of Internet servers (hosts)
Internet	Number of Internet users per 1,000 citizens
PC	Number of personal computers per 1,000 citizens
	All data is for 2003, or most recent available from 2000 to 2002

Country	Popn	GDP	2001 Land	2001 Cell	TD	1999 Land	1999 Cell	TD	Hosts	Internet	PC
Angola	13,937	$715	0.61	0.93	1.54	0.75	0.00	0.75	7	2.9	1.9
Benin	6,801	$413	0.92	3.22	4.14	0.31	0.00	0.31	574	7.4	2.2
Botswana	1,720	$2,939	8.72	24.13	32.85	2.46	0.00	2.46	1,617	29.7	40.7
Burkina Faso	11,959	$220	0.54	0.75	1.29	0.20	0.00	0.20	409	2.1	1.6
Burundi	6,988	$89	0.32	0.74	1.06	0.18	0.00	0.18	3	1.2	0.7
Cameroon	15,830	$623	0.70	4.27	4.97	0.35	0.00	0.35	439	3.8	5.7
Cape Verde	439	$1,239	15.99	9.78	25.77	2.59	0.00	2.59	48	36.4	79.7
Central African Rep.	3,957	$265	0.23	0.32	0.55	0.18	0.00	0.18	6	1.3	2.0
Chad	7,872	$212	0.15	0.43	0.58	0.07	0.00	0.07	11	1.9	1.7
Comoros	762	$303	1.35	N/A	1.35	0.81	0.00	0.81	12	4.2	5.5
Congo	3,300	$967	0.67	6.72	7.39	0.74	0.00	0.74	36	1.5	3.9
Congo (Dem. Rep.)	52,647	$143	0.02	1.06	1.08	0.09	0.00	0.09	134	0.9	N/A
Cote d'Ivoire	16,490	$711	2.04	6.23	8.27	0.67	0.00	0.67	4,397	5.5	9.3
Djibouti	656	$894	1.54	2.29	3.83	1.18	0.00	1.18	498	6.9	15.2
Equatorial Guinea	505	$4,289	1.74	6.34	8.08	0.36	0.00	0.36	3	3.6	6.9
Eritrea	3,980	$146	0.90	N/A	0.90	N/A	N/A	N/A	859	2.3	2.5
Ethiopia	67,347	$96	0.53	0.07	0.60	0.27	0.00	0.27	41	0.7	1.5
Gabon	1,299	$3,611	2.47	21.50	23.97	2.70	0.00	2.70	79	19.2	19.2
Gambia	1,372	$333	2.80	7.29	10.08	1.05	0.00	1.05	568	18.2	13.8
Ghana	21,674	$209	1.27	2.07	3.34	0.30	0.00	0.30	313	7.8	3.8
Guinea	7,665	$381	0.34	1.18	1.52	0.19	0.00	0.19	251	4.6	5.5
Guinea-Bissau	1,253	$173	0.89	N/A	0.89	0.63	0.00	0.63	20	4.0	N/A
Kenya	31,930	$386	1.03	4.15	5.18	0.88	0.00	0.88	2,963	12.5	6.4
Lesotho	2,167	$330	1.32	4.25	5.57	0.69	0.00	0.69	45	9.7	N/A
Liberia	3,238	N/A	0.22	0.06	0.28	0.12	0.00	0.12	11	0.3	N/A
Madagascar	15,911	$277	0.37	1.02	1.40	0.31	0.00	0.31	509	3.5	4.4

Country	Popn	GDP	Land	2001 Cell	TD	Land	1999 Cell	TD	Hosts	Internet	PC
Malawi	10,437	$158	0.70	0.82	1.52	0.33	0.00	0.33	17	2.6	1.3
Mali	10,629	$318	0.53	0.50	1.03	0.15	0.00	0.15	158	2.4	1.4
Mauritania	2,682	$365	1.18	9.22	10.39	0.32	0.00	0.32	79	3.7	10.8
Mauritius	1,210	$3,957	27.03	28.91	55.95	5.99	0.23	6.22	3,462	99.1	116.5
Mayotte	148	N/A	6.98	14.66	14.66	3.44	0.00	3.44	N/A	N/A	N/A
Mozambique	18,234	$215	0.46	1.40	1.86	0.37	0.00	0.37	1,925	1.7	4.5
Namibia	1,875	$1,697	6.48	8.00	14.48	4.04	0.00	4.04	3,709	26.7	70.9
Niger	11,747	$165	0.19	0.14	0.33	0.12	0.00	0.12	119	1.3	0.6
Nigeria	120,079	$409	0.58	1.34	1.92	0.30	0.00	0.30	1,030	3.5	7.1
Reunion	744	N/A	41.04	65.88	65.88	28.63	0.00	28.63	1	205.2	71.3
Rwanda	8,171	$208	0.28	1.36	1.64	0.19	0.00	0.19	1,233	3.1	N/A
Sao Tome & Principe	151	$331	4.13	1.31	5.44	1.90	0.00	1.90	1,069	72.8	N/A
Senegal	10,077	$506	2.23	5.49	7.72	0.65	0.00	0.65	761	10.4	19.8
Seychelles	81	$7,571	26.91	55.35	82.25	13.27	0.00	13.27	266	145.2	160.8
Sierra Leone	4,952	$152	0.48	1.34	1.82	0.33	0.00	0.33	277	1.6	N/A
Somalia	10,162	N/A	0.98	0.34	1.33	0.17	0.00	0.17	4	8.8	N/A
Sudan	32,539	$396	2.06	0.59	2.65	0.25	0.00	0.25	600	2.6	6.1
Swaziland	1,032	$1,130	3.40	6.10	9.50	1.75	0.00	1.75	1,329	19.4	24.2
Tanzania	34,444	$271	0.47	1.95	2.41	0.31	0.00	0.31	1,731	2.3	4.2
Togo	4,873	$301	1.05	3.49	4.54	0.29	0.00	0.29	80	41.0	30.8
Uganda	24,700	$243	0.22	1.59	1.81	0.17	0.00	0.17	2,242	4.0	3.3
Zambia	10,696	$312	0.82	1.30	2.12	0.86	0.00	0.86	1,621	4.9	7.5
Zimbabwe	11,635	$654	2.47	3.03	5.51	1.25	0.00	1.25	2,382	43.0	51.6
SSA	**632,994**	**$346**	**0.89**	**1.94**	**2.81**	**0.43**	**0.00**	**0.43**	**37,948**	**5.3**	**7.0**
South Africa	**45,454**	**$2,293**	**10.66**	**30.39**	**41.05**	**9.49**	**0.02**	**9.51**	**198,853**	**68.2**	**72.6**
Algeria	31,293	$1,773	6.10	1.28	7.38	3.44	0.02	3.46	821	16.0	7.7
Egypt	67,313	$1,279	11.04	6.68	17.72	3.35	0.01	3.36	3,061	28.2	16.6
Libya	5,555	$6,207	11.83	1.26	1.26	4.95	0.00	4.95	83	22.5	23.4
Morocco	29,643	$1,162	3.80	20.91	24.71	1.99	0.01	1.99	2,680	23.6	23.6
Tunisia	9,781	$2,152	11.74	5.15	16.89	3.99	0.01	4.01	341	51.7	30.7
North Africa	**143,585**	**$1,605**	**8.55**	**8.13**	**16.67**	**3.19**	**0.01**	**3.20**	**6,986**	**26.0**	**17.4**
Africa	**822,033**	**$668**	**2.77**	**4.58**	**7.35**	**1.46**	**0.00**	**1.46**	**243,787**	**12.4**	**13.0**
World	**6,188,825**	**$5,346**	**17.70**	**18.93**	**36.54**	**10.23**	**0.30**	**10.53**	**157,616,680**	**101.3**	**98.7**

The Internet: An Engine for Socio-Economic Change in Mali?

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Abstract: The Internet made in-roads in Mali since early 1992. However, the diffusion of the Internet has been erratic up to now as recent statistics show that only 60,000 Malians are subscribed. Moreover, most of the users live in the Capitol city, Bamako, where cyber cafés are the preferred Internet access locations. These Internet centers provide multiple services such VOIP, fax, and foods, a cheaper and affordable means of access while offering citizens an opportunity to socialize. The monopolistic environment in Mali appears to be the primary reason of the current condition. In this study we will use the Global Diffusion of the Internet (GDI) Framework to assess the diffusion of the Internet in Mali. The six GDI dimensions: Pervasiveness, Dispersion, Sectoral Absorption, Connectivity Infrastructure, Organizational Infrastructure, and Sophistication of Use will allow us to share a clear picture of the Internet diffusion process while identifying the most significant barriers.

Keywords: Internet Diffusion, Internet Readiness, GDI framework, Developing Countries,

The Internet: An Engine for Socio-Economic Change in Mali?

1.   INTRODUCTION

The opportunities and possibilities information and communication technologies (ICT) can afford is at the heart of debates in studies on developing countries. Such studies play an important role for many sub-Saharan Africa (SAA) countries that attempt to develop or adopt strategies for acquiring and harnessing ICT. Although Malians make use of ICT in the form of telecenters, Mali is still considered to be a late adopter of ICT. Since the Internet is the primary information and communication technology used in Mali, we focus its diffusion in the context of Mali.

The global diffusion of the Internet (GDI) framework developed by Wolcott et al. (2001) serves as the basis from which we assess the diffusion of the Internet in Mali. The GDI framework assesses Internet diffusion along six dimensions. The six dimensions, which are discussed in detail in Section 4, are pervasiveness, geographic dimension, sectoral absorption, connectivity infrastructure, organizational infrastructure, and sophistication of use. The GDI framework has been rigorously tested as it has been employed to study the diffusion of the Internet in nearly 40 countries. Application of this widely used framework to study the diffusion of the Internet in Mali should enable us to do a couple of things. One, use of the GDI framework should provide insight about the technological developments taking place in Mali. Second, use of the GDI framework affords us the ability to systematically contrast and compare Internet diffusion efforts in Mali to similar efforts in other developing countries. In this conceptual study, we focus on the Internet as a possible engine for socio-economic change. This study is also driven by the following research questions:

- *What is the current state of Internet diffusion in Mali?*

- *How can the Internet help to bring about socio-economic change in Mali?*

To address these questions, we pull together threads from our review of existing literature and interviews with key influential stakeholders in Mali's ICT sector. In one way or another, these stakeholders are all involved in Internet diffusion efforts in Mali.

The remainder of this paper is organized into four sections. Following this introduction, Section 2 provides demographic information on Mali. Section 3 discusses and details Internet practices in Mali. Section 4 discusses the GDI framework in the context of Mali, followed by the conclusion in Section 5.

2.   OVERVIEW OF MALI

Mali is a relatively small country of 13.1 million people (see Table 1) located in West Africa (World Bank, 2006). Mali is considered to be one of the poorest countries in the world. This status is evidenced by its gross national income of $1000 US per capita in 2005. Formerly French Sudan, Mali gained its independence in 1960 from France. Similar to many African countries, Mali has endured decades of political turmoil, dictatorship, and economic disparity. Economically, France has continued to aid its former colony, but overall the Mali remains desperately poor. Drought, changes in the terms of international trade, poor government policies and corruption, as well as political instability have all taken their toll on the country.

Variables	Statistics
Population	12,291,529 (July 2005 est.)
Population growth rate	2.74% (2005 est.)
GDP	$11.83 billion (2005 est.)
GDP per capita	$1,000 (2005 est.)
Inflation rate	4.5% (2002 est.)
Telephones (main lines in use)	75.000 (2005)
Telephones (mobile cellular)	400,000 (2004)
Internet hosts	270 (2005)
Internet Service Providers (ISP)	13 (September 2006)*
Internet users	60, 000 (September 2006)*
Teledensity	1.78 main telephone lines per 100 inhabitants (2002 estimate)
Literacy rate	46.4% of those age 15 and over can read and write (2003 estimate)

Table 1. Mali Statistics

Source: World Fact Book, 2006

Figure 1.Map of Mali

3.   THE INTERNET IN MALI

The telecommunications industry in Mali is regulated by the Société des télécommunications du Mali (SOTELMA), a state corporation established in 1989 which reports directly to the Minister of Communications. Until 2001, SOTELMA was the sole provider of

telecommunication services in the country. With its creation, the corporation began projects aimed at expanding the telecommunications infrastructure in three specific areas. First, it established a DOMSAT network (réseau national de télécommunications par satellite) to provide digital links to the four cities of Gao, Timbuktu, Kidal and Kéniéba in Northern Mali. The project integrates communications infrastructure for telephone, fax, data transfer, and radio and television transmissions. Secondly, SOTELMA installed a cellular network in the capital city, Bamako, and its surrounding areas providing cellular services through its subsidiary, Malitel. Finally, SOTELMA established a VSAT-based Internet hub.

SOTELMA actually began providing Internet services in 1992 with an x.25 access line and its first client was ORSTOM, a French development aid agency. ORSTOM used the X.25 line to provide email service through the RIO. Two years later, two private companies (BINTTA and SPIDER) also started providing e-mail services. BINTTA's service was with RIO and SPIDER's was based on the FIDOnet/Internet email service (Dabou, 2004).

In 1996, USAID, through the Leland Initiative, financed a satellite bandwidth acquisition for three years so SOTELMA could provide full Internet service. The corporation in turn licensed four companies – BINTTA, SPIDER, DATATECH, and CEFIB – to provide full Internet services. By September 2006, Mali had 13 Internet Service Providers (ISP). Most of these ISP are small Bamako-based providers with a VSAT connection that use wireless systems to provide service to their clients via a cyber café. While the Internet has grown rapidly in Mali, access remains problematic because of telephone system infrastructure, cost of computers, and awareness.

Malians access the Internet mostly in cyber cafés – fee-based telecenters. Many of these cyber cafés are located in Bamako, the capital city. They range from small single-point connections to complex multi-user centers. Cyber cafés can also be found in many of the small towns, especially those surrounding Bamako, even though most cyber cafés in the small town suffer from poor connection. Also, the farther away the cities are from Bamako, the more difficult and expensive it is to set up cyber cafés. The exception is Timbuktu, a name that is synonymous with remoteness. There is an extensive ICT activity in the area. For instance, there are at least eight satellite connections into Timbuktu, most of which serve special interests except for SOTELMA and another carrier, Ikatel. Relative to other remote cities in the country, Timbuktu has a fair number of trained IT staff and four telecenters including one at the local radio station. The city is to some degree over saturated with Internet terminals, precluding any new private, commercial interests from being sustainable (Detecon & Diebold Consultants, 2003).

A particular point of pride for Timbuktu is its telecenter project, created in partnership with SOTELMA. The public telecom provides Internet service to the city via satellite, leasing capacity on Intelsat. As a result of the partnership, SOTELMA provided three hours of free Internet access during the pilot phase of the project. The telecenter was initially set up in a room in a hospital because of the availability of power and telephone lines. That location was not central, however, and the telecenter was later moved to the main town square (la Place de l'Indépendance) next to City Hall (la Mairie).

The telecenter was so successful that the city's mayor introduced a $10 departure tax for all air passengers leaving Timbuktu to help support the project. In general, the community was enthusiastic about the project expecting that it would reduce the cost of communications, increase access to professional information, and provide opportunities for the city to get connected with the external world. Early reports indicated that the center was already achieving its goals even in the first months of operation. According to logs for a three-month period in 1999, the top three activities at the telecenter were computer use, e-mail and Internet

access, and training in computer skills. The three largest user groups were students, staff of Non-governmental organizations (NGOs) and medical staff from the hospital. About 35% of the telecenter users were women (Hudson, 1999). Given its original location at the hospital, health workers were identified as one of the target user groups. They clearly recognized the need for information, and most learned quickly how to use the facilities (Hudson, 1999).

4. ANALYTIC FRAMEWORK DIMENSIONS

In this section, we employ the GDI framework to systematically examine the diffusion of the Internet in Mali. The GDI framework considers six dimensions in measuring the level of Internet diffusion in a country.   The six dimensions are pervasiveness, geographical dispersion, sectoral absorption, connectivity infrastructure, organizational infrastructure and sophistication of use.

4.1. Pervasiveness

The pervasiveness dimension considers the number of Internet subscribers and hosts per capita in a country. It departs from other approaches of measuring Internet growth because the outcome is not necessarily an absolute number; rather it emerges from a five-level ranking system see Table 2). The dimension ranges from 0 (non-existent) to 4 (pervasive).Thus, a country may be at level 0 (non-existent), 1 (embryonic), 2 (established), 3 (common) or 4 (pervasive). "The intent is to depict the fraction of a population that uses the Internet regularly" (Wolcott and Goodman, 2003). Since the regulatory framework was not established until 1999, it is difficult to obtain hard historical data about the Internet in Mali, therefore we will use estimates. By early 1998, about a thousand Internet accounts were created and the number is increasing daily (Eggers and Siefken, 2000). According to recent statistics, there were 60,000 Internet users in Mali (0.6 percent of the population) as of September 2006, thus bringing Mali to Level 2 (established).

Level 0	Non-existent: The Internet does not exist in a viable form in the country. No computers with international IP connections are located within the country. There may be some Internet users in the country; however, they obtain a connection via an international telephone call to a foreign ISP.
Level 1	Embryonic: The ratio of users per capita is on the order of magnitude of less than one in a thousand (less than 0.1%).
Level 2	**Established: The ratio of Internet users per capita is on the order of magnitude of at least one in a thousand (0.1% or greater).**
Level 3	Common: The ratio of Internet users per capita is on the order of magnitude of at least one in a hundred (1% or greater).
Level 4	Pervasive: The ratio of Internet users per capita is on the order of magnitude of at least one in 10 (10% or greater).

Table 2. Pervasiveness of the Internet in Mali

4.2. Geographic Dispersion

A measure of the geographic spread of the Internet is measured by the number of Internet points-of-presence (POPs) located in a nation's first-tier political subdivisions or regions as they are known in Mali. Bamako, the country's capital, remains the only area with an Internet POP. As indicated in Table 3, Mali is rated at Level 1, Single Location, for geographic dispersion. Interestingly enough, the telecenter in Timbuktu has attracted more than 2000 people since it opened in 1998. This is an amazing feat, especially considering its limited ability to accommodate only 20 subscribers at one time (Boukhari, 2000). Nevertheless,

success of the Timbuktu project offers some hope for the diffusion of the Internet in other cities and rural areas.

Level 0	Non-existent: The Internet does not exist in a viable form in this country. No computers with international IP connections are located within the country. A country may be using UUCP connections for e-mail and USENET.
Level 1	Single location: Internet points-of-presence are confined to one major population center.
Level 2	Moderately dispersed: Internet points-of-presence are located in multiple first-tier political subdivisions of the country.
Level 3	Highly dispersed: Internet points-of-presence are located in at least 50% of the first-tier political subdivisions of the country.
Level 4	Nationwide: Internet points-of-presence are located in essentially all first-tier political sub-divisions of the country. Rural access is publicly and commonly available.

Table 3. Geographic Dispersion of the Internet in Mali

Sector	Minimal (1 Point)	Medium (2 Points)	Great Majority (3 Points)
Academic primary and secondary schools, universities	>0%-10% leased line Internet connectivity	10%-90% leased line Internet connectivity	90% leased line Internet connectivity
Commercial	>0%-10% Internet Servers	10%-90% Internet Servers	90% Internet servers
Health (hospitals and clinics) connectivity	>0%-10% leased line Internet connectivity	10%-90% leased line Internet connectivity	90% leased line Internet
Public (top- and second-tier government entities)	>0%-10% Internet Servers	10%-90% Internet Servers	90% Internet Servers

Table 4. Absorption of the Internet by Sectors of Mali's Economy

4.3. Sectoral Absorption

The sectoral absorption dimension assesses the extent of adoption of the Internet by various economic sectors. A government corporation, SOTELMA, began the process of diffusing the Internet in Mali even though the private sector and civil society had been using the Internet in some form before SOTELMA. However, sectoral absorption remains moderate at Level 2 because only about one percent of Internet activity occurs across several sectors. Tables 4 and 5 describe in more detail the sectoral absorption.

Sectoral Point Total	Absorption Dimension Rating
0	Level 0: Non-existent
1-3	Level 1: Rare
4-6	Level 2: Moderate
7-9	Level 3: Common
10-12	Level 4: Widely Used

Table 5. Sectoral Absorption of the Internet in Mali

4.4. Connectivity Infrastructure

The connectivity infrastructure dimension assesses the connectivity and access capacity of the infrastructure. It includes the domestic backbone, international links, Internet exchanges, and methods of accessing the Internet. Table 6 illustrates Mali's connectivity infrastructure level.

	Levels	Domestic Backbone	International Links	Internet Exchanges	Access Methods
Level 0	*Non-Existent*	None	None	None	None
Level 1	*Thin*	≤ 2 Mbps	≤ 128 Kbps	None	Modem
Level 2	*Expanded*	2 Mbps -100 Gbps	128 Kbps – 45 Mbps	1	Modem 64 Kbps Leased Lines
Level 3	*Broad*	200 Mbps -100 Gpbs	45 Mbps – 10 Gbps	More than 1; Bilateral or Open	Modem > 64 Kbps leased lines
Level 4	*Extensive*	> 100 Gbps	> 10 Gbps	Many; both Bilateral and Open	< 90% modem 64 Kbps Leased Lines

Table 6. Connectivity Infrastructure of the Internet in Mali

4.4.1. International Links

The first international Internet protocol (IP) connection in Mali was established in 1992 by SOTELMA when it began functioning as an ISP. The connection at that time was about 128Kbps, putting the country at Level 1 (Thin) for international connectivity. Over the years, the international bandwidth has increased to about 18 Mbps placing the country at Level 2(expanded) for its international connectivity.

4.4.2. Domestic Backbone

SOTELMA maintains a monopoly on the sale of international bandwidth to ISPs in the country. As a result, most of the ISPs in the country attempt to bypass SOTELMA by acquiring VSAT capacity, an alternative deemed illegal. SOTELMA is protecting monopolistic enterprise by attempting to criminalize provision of voice-over-IP (VOIP) via VSAT even though there is no specific law banning the practice. Although Mali is not close to having a domestic backbone with speeds reaching 200Mbps, it does operate at speeds around 2Mbps putting the domestic connectivity at Level 2 (Expanded) (Sarrocco, 2001).

4.4.3. Internet Exchanges

An umbrella association of ISPs in Mali, Association des Fournisseurs Internet au Mali (AFIM), in May 2006 held a conference to discuss the possibility of setting up a local Internet exchange point (IXP) in Bamako to route traffic locally and enhance interconnectivity. Currently, all outbound traffic is routed through international exchange points.

4.4.4. Access Methods

Most access to the Internet in Mali is via dial-ups and modem connections, thus placing the country on Level 2 (established) in terms of access.

4.5. Organizational Infrastructure

The organizational infrastructure dimension measures the strength of the Internet industry by assessing the level of competition and the existence of organizations that support and promote the industry (Bernstein & Goodman, 2005). SOTELMA received its VSAT license from the Malian government, and created a monopoly on VSAT licenses, thus making the purchase of VSAT from outside agencies illegal. The result is that many of the ISPs in the country are dependent on the state telecommunications agency and have to lease their lines from SOTELMA, which also operates the domestic backbone. As the indicators in Table 8 illustrate, Mali is at Level 2 (Controlled) in organizational infrastructure.

Ikatel, which is a new Internet provider hitting the market in Mali is partly owned by France Telecom. Ikatel has 120,000 subscribers, which is considerably more than Malitel. Ikatel also has better service than Malitel but its coverage is restricted to two cities outside of Bamako. Malitel is currently running its 70,000 subscribers on far too little capacity, which has an inevitable impact on the quality of its services. Ikatel has a full service license but has yet to roll out fixed line service (Dabou, 2003).

Level 0	None: The Internet is not present in this country.
Level 1	Single: A single ISP has a monopoly in the Internet service provision market. This ISP is generally owned or significantly controlled by the government.
Level 2	Controlled: There are only a few ISPs and the market is closely controlled through high barriers to entry. All ISPs connect to the international Internet through a monopoly telecommunications service provider. The provision of domestic infrastructure is also a monopoly.
Level 3	Competitive: The Internet market is competitive. There are many ISPs and low barriers to market entry. The provision of international links is a monopoly, but the provision of domestic infrastructure is open to competition, or vice versa.
Level 4	Robust: There is a rich service provision infrastructure. There are many ISPs and low barriers to market entry. International links and domestic infrastructure are open to competition. There are collaborative organizations and arrangements such as public exchanges, industry associations, and emergency response teams.

Table 7. Organizational Infrastructure of the Internet in Mali

4.6. Sophistication of Use

Sophistication of use refers to the extent to which the Internet is used for innovative or transforming purposes within a country (Bernstein & Goodman, 2005). The Internet in Mali is used primarily for communication through email (Dabou, 2004). Mali recently reduced the custom duties on computers from 67% down to 5% in an attempt to make computers more

affordable for Malians (USAID, 2006). Mali is at Level 2 (Conventional) for sophistication of use (see Table 8).

Timbuktu's multipurpose community telecenter (MCT), a pilot project launched in 1997, belongs to the community, which was deeply involved in its establishment. The MCT offers a range of services: Internet, e-mail, software installation, scanner, word processing, etc. The Internet has become the primary tool for information scouring, trade and communication. The MCT connects the town of Timbuktu with the rest of the world. The inhabitants believe that the MCT will promote the development of other services such as tourism and crafts, agriculture, livestock breeding and fishing, industry, teaching, culture and medicine (telemedicine). International partners in the Timbuktu project include the International Telecommunications Union (ITU), International Development Research Centre (IDRC), United Nations Educational, Scientific, and Cultural Organization (UNESCO), Foods and Agriculture (FAO), and the World Health Organization (WHO). National partners include SOTELMA, the national commission for UNESCO and the Ministry of Culture and Tourism. Because of the success of the Timbuktu project, only individuals living in extremely remote villages have not heard of the Internet.

Level 0	None: The Internet is not used, except by a very small fraction of the population that logs into foreign services.
Level 1	Minimal: The user community struggles to employ the Internet in conventional, mainstream applications.
Level 2	Conventional: The user community changes established practices somewhat in response to or in order to accommodate the technology, but few established processes are changed dramatically. The Internet is used as a substitute or straightforward enhancement for an existing process (e.g., e-mail vs. post). This is the first level at which we can say that the Internet has .taken hold. in a country.
Level 3	Transforming: The use of the Internet by certain segments of users results in new applications, or significant changes in existing processes and practices, although these innovations may not necessarily stretch the boundaries of the technology's capabilities.
Level 4	Innovating: Segments of the user community are discriminating and highly demanding. These segments are regularly applying, or seeking to apply, the Internet in innovative ways that push the capabilities of the technology. They play a significant role in driving the state-of-the-art and have a mutually beneficial and synergistic relationship with developers.

Table 8. Sophistication of Use of the Internet in Mali

5.   CONCLUSION

The statistics in Table 1, demonstrates the weaknesses in Mali's economy, education, health and infrastructure. Mali has an inadequate GDP per capita that makes it hard for the citizens of this country to make much needed improvements across all sectors of its society. The USAID and International Monetary Fund have donated money and provided loans to Mali to improve the harsh conditions of the country.

Since the capital to implement telecommunications infrastructures is not in place, it might be in the best interest of Mali for the government to focus on encouraging the development of ISPs and technology related businesses and to move away from its monopolistic approach towards telecommunications. Such a move could very well stimulate competition in the telecommunications industry. Competition in the telecommunications industry could serve many purposes. It could serve as the impetus for improvement in the telecommunications infrastructure, thus benefiting the country as a whole, and competition could also help eliminate the monopolization of the telecom industry by SOTELMA. Although though

eliminating SOTELMA's monopoly would reduce the revenue for SOTELMA, it would in the long run help the Mali by improving the infrastructure and giving the average citizen fast, affordable, and reliable Internet access to the global economy. These issues are further illustrated by the matrix of determinants of Internet diffusion and Malian government initiatives listed in Table 9.

Determinants	Malian Government Initiatives
Access	Increase the number of Phone Lines
Perceived value	Educate people of the importance of the Internet to generate revenue and knowledge
Ease of Use of the Internet	Extend cybercafés in other areas to promote an increase in Internet use.
Cost of Internet Access	Promote ISP competition Reduce the cost of leased lines
Adequacy and Fluidity of Resources	Create education programs with computers in primary and secondary schools. Stabilize the economy to improve investment.
Regulatory and Legal Framework	Allow the private industry to obtain VSAT licenses. Encourage competition in the Internet industry.
Demand for Capacity	Increase the awareness of the importance of the Internet to individuals. Make the Internet more accessible.
Culture of Entrepreneurship	Improve the investments of the private sector.
Forces for Change	Increase ISP competition by getting rid of SOTELMAs monopolistic hold on the telecommunications infrastructure.
Enablers of Change	Implement a technology curriculum in the education systems

Table 9 Malian Government Initiatives to Promote Internet Growth

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THE COMPLEXITIES OF COMMUNITY PARTICIPATION IN ICT FOR DEVELOPMENT PROJECTS: THE CASE OF "OUR VOICES"

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Abstract

Community participation is often suggested as a means to a relevant, contextual rural information system (such as a telecentre). Yet, the ICT for development field has much to learn from development literature on the complexities of community participation. We first review the critical literature on participation in development and then analyze our case against this. Findings from our ethnographic study on a village community radio and IT project in south India show that even though the project is contextual (for example, it disseminates local information in an audio rather than written format) and participatory (for example, it conducted a Participatory Rural Appraisal and has a management committee drawn from the community), it faces a number of challenges – participation is a top-down concept and the "insiders" learn what the "outsiders" want to hear, rather than vice versa as Chambers hoped for in his work on participation. Finally, even though the villagers are interested, they find a lack of time to participate. The research concludes that community participation in rural information systems projects is far more complex and contradictory than "ICT for development" implementers have described so far.

Keywords: participation, ICT for development, rural information systems, telecentres, community radio

THE COMPLEXITIES OF COMMUNITY PARTICIPATION IN RURAL INFORMATION SYSTEMS PROJECTS: THE CASE OF "OUR VOICES"

1. INTRODUCTION

The "ICT for development" rhetoric continues in India – consider for example the India Telecentre Forum, held in New Delhi in August 2006, which attracted hundreds of policy-makers, donors and technical experts. Or the Government of India's Mission 2007, which aims to have telecentres (or what are called Common Service Centres) in 600,000 villages by 2007 - a mere two months away at the time of writing (Mission 2007, n. d.). Key words that crop up in this rhetoric include "context", "needs-based", "sustainability" and "community participation". Yet, what is meant by being contextual, answering the community's needs, or being participatory? Literature on rural IS initiatives emphasizes these terms, but does not deconstruct what these mean (Caspary and O'Connor, 2003; Roman and Colle, 2002; Colle, 2005; Proenza, 2001; Whyte, 2000; Gómez et al, 1999). And how accurate is it to say that a participatory initiative will lead to sustainability? We look at a case study of Our Voices, a telecentre – in this case a community radio and IT centre - in a south Indian village. Our Voices aims to be strongly participatory – it emphasizes information more than technology through the use of community radio, it involves the local community (particularly women) in the running of the centre and aims to respond to their needs. Yet each of these faces challenges and contradictions. This paper explores these challenges, thereby deconstructing the rhetoric of participation. We first review the emphasis on community participation in ICT for development literature. In Section 3 we trace the roots of participation in development. Section 4 introduces the ethnographic method used here and tells the story of Our Voices. Section 5 analyzes Our Voices against the main challenges to participation as outlined in the development literature and Section 6 concludes.

2. PARTICIPATION IN RURAL INFORMATION SYSTEMS PROJECTS

At the height of the "ICT for development" wave, the World Bank was estimated to have funded between $1 to $2 billion on "ICT for development" projects, while InfoDev (the Information for Development programme hosted by the World Bank) had a budget of $10 to $15 million per year (Wakelin and Shadrach, 2001). It was felt that access to information (be it health, agriculture, education or government schemes) would at some level lead to individuals being able to act on that information and empowering themselves (Heeks, 1999). Now, however, major questions are being asked about the sustainability and impact of such projects. Kuriyan et al (2006) discover that the Akshaya kiosks in Kerala find it difficult to be both financially and socially sustainable. In their two year study of 300 rural telecentres across India, Kiri and Menon (2006) find that in order to be sustainable, most centres are run like cyber-cafes, gaming booths or computer education centres. Most rural telecentres try to finance themselves by adding services, such as photocopying, data entry, desktop publishing, digital photography and printing (Kiri and Menon, 2006; Rangaswamy, 2006). Kiri and Menon (2006) conclude that "in terms of rural ICT bridging the digital divide, most services provided by rural kiosks today do not address the needs of the illiterate mother-to-be or the retired government clerk, trying to find out why he has not achieved his monthly pension amount" (Kiri and Menon, 2006, p. 15).

One way to combat the technological determinism of these projects is to have more of a focus on information and less on technology. For example, Our Voices in south India uses a mixture of information downloaded from the internet as well as programmes made by local people which is then broadcast to a catchments of around 40 villages, through a combination of loudspeakers, tapes and radio played through a TV channel. Kothmale Community Radio in Sri Lanka combines radio and the internet – broadcasters browse the internet daily, supplying listeners with information they need, with the help of studio guests, for example doctors in the case of health information (Pringle and David, 2002). Similar initiatives include Uva Community Multimedia Network in Sri Lanka, Tansen Community Media Centre in Nepal, and Jakar Community Media Centre in Bhutan (Slater and Tacchi, 2004)[1].

The final suggestion for making rural information systems projects relevant is to invite community participation (Caspary and O'Connor, 2003; Roman and Colle, 2002; Colle, 2005; Proenza, 2001; Whyte, 2000; Gómez et al, 1999). Roman and Colle (2002) call for a "conscientious attention to participation" (p. 12) because it "conveys a sense of community ownership; it provides indigenous wisdom; it helps reflect community values and needs; it provides important resources, such as volunteers or technical expertise, at a favourable cost" (p. 13) (favourable to whom?). Kanungo (2004) states that collective ownership of a telecentre enables access to everyone regardless of social status. He writes of the MSSRF Village Knowledge Project in Pondicherry that project staff lived in the setting in order to understand the issues. "Such actions perform the function of keeping the village folk engaged, keeping stakeholders engaged, continually sounding out different individuals so as to regenerate the idea and continually seek affirmation amongst the participants" (Kanungo, 2004, p. 417-8). In a similar vein, Gómez et al (1999) call for research on "community involvement, participation and use" (p. 8) and Whyte (2000) emphasizes the need for community participation in evaluation. Yet the literature does not explain further what participation constitutes and how it can be undertaken. There is a need to deconstruct several elements of these statements – is there such a thing as a community? Is participation a free and fair process – indeed, what does it involve? In order to deconstruct this myth, we first critically assess how the notion of participation has arisen in development.

3. THE EVOLUTION OF PARTICIPATION IN DEVELOPMENT

"Participation" and its companion concepts "sustainability" and "empowerment" are at the centre of contemporary development discourse (Michener, 1998). White (1996) writes that no respectable project can be funded without provision for participation, while Gardner and Lewis (1996) state that participation "has now become so ever-present in development jargon as to be often virtually without meaning" (1996, p. 111). Where has this concern for participation arisen from?

It may be argued that participation as a concept may be as old as democracy itself. However, in development, it began emerging in the 1960-70s in the ideas of Paulo Freire (1972), Fals Borda (1969; 1972) and Rahman (1995). Freire argues that "development can only be achieved when humans are 'beings for themselves', when they possess their own decision-making powers, free of oppressive and dehumanizing circumstances; it is the 'struggle to be more fully human'" (Freire,

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[1] It must be noted, however, that this is a fast-moving field and it is difficult to know what stage these projects are at now.

1972, p. 29).   Chambers brought participation into mainstream development by emphasizing Participatory Rural Appraisal (PRA) (1993, 1994, 1997). PRA includes participatory mapping and modelling (for example asking village communities to map their environment, asking them how they perceive their own situations such as health, education, poverty and well-being, and involving them in producing seasonal calendars to understand their needs better).   Other methods include interviews and focus groups, with the difference being that these are conducted by "insiders" rather than outsiders (Chambers, 1997). For Chambers, participation is where "the positivist, reductionist, mechanistic, standardized-package, top-down models and development blueprints are rejected, and in which multiple, loca, and individual realities are recognized, accepted, enhanced and celebrated" (1997, p. 188).

However, it is argued that this emancipatory nature was somewhat hijacked into supporting development projects, where participation, rather than the end in itself, became a means to an end (i.e. the development project) (Hickey and Mohan, 2004; Leal and Opp, 2005). From the 1990s to the current era, Hickey and Mohan find that a more institutional approach to participation has appeared, with initiatives such as participatory budgeting and participatory poverty assessments. It is argued that such "planner-centred" participation is more about an efficient mechanism for delivering a development project and reducing cost, rather than a genuine understanding of a community's needs (Mosse, 2001; Nelson and Wright, 1995).

Indeed, throughout the development literature, it is difficult to find a clear definition of what "participation" actually is. For example, the World Bank defines participation as "a process by which people, especially disadvantaged people, influence decisions that affect them" (World Bank, 1992, p. 177). It states "as participation increases, vital information not in the public domain becomes available and the voices of interested parties can help make governments more accountable; both in turn enhance performance" (World Bank, 1994, p. 3). However, it still doesn't define *how* that participation will actually take place.

4. THE CHALLENGES OF PARTICIPATION

4.1. A top-down concept

One criticism of participation is that it can be a top-down notion imposed by the organization implementing the project (Michener, 1998; White, 1986). An NGO respondent in southern India commented "*participation is just a box we tick. We look for gender, ICT for development, participation – they are just the buzz words to get funding*". Lohmann (1994) critiques an allegedly participatory World Bank Forest Management programme in an area of Thailand. He writes "I have in front of me hundreds of pages of a Pre-Investment Study for … the Conservation Forest Area Protection, Management and Development Project …" (p. 58). The study calls for the eviction of the Karen people living in the area, but the document has not been translated in Thai or Karen, although local NGOs have requested at least Thai translations. The participatory project has "much less communicated to, much less discussed with, much less agreed to by the local Karen people in the sanctuary to be affected" (p. 58). Hildyard et al (2001) provide an example of a participatory project in south India, where village women were given World Bank loans to buy a dairy cow on the condition that the women attended a dairy management course. However 90% of the women did not use the money for cows. When questioned by the staff, the women showed a relative or friend's cow to prove they had bought one. In answer to the World Bank's questions, the women

answered "you did not ask us if we wanted dairy animals" or "I would rather have a loan to start a tea business" (CIIR, 1995 cited in Hildyard et al, 2001).

Similarly, Michener (1998) analyzes a Save the Children Fund education programme in Burkina Faso. It is intended to be participatory, but the SCF schools are modeled after an experimental SCF project in Mali, which is adopted from one developed in Bangladesh (i.e. the project wants people to be involved in their own "upliftment", but takes a blueprint devised in another context). The plan is to form a school management committee in the villages where schools have been implemented, but Michener finds that in two out of three of the villages, the committee was not functional. Cleaver and Kaare (1998) tell a similar story of Zimbabwean aid committees formed to fulfill donor needs, but which never resolved issues (cited in Cleaver, 2001). For Cleaver, this emphasis of institutions in participation is ironic, as the concept was originally meant to overcome the shortfalls of state bureaucracies (Cleaver, 2001). In all these examples, one asks – is community participation not required in the concept stage, but only advocated in the implementation of development projects? And therefore, who defines what the initial community needs are?

4.2. Co-optation

Michener (1998) argues that "unlike policy makers who have the luxury of expounding participatory rhetoric, field staff are faced with the realities of project implemention" (p. 2110). She cites definitions of participatory development given by SCF field agents in Burkina Faso - that the community takes responsibility for the local materials and teachers' salaries, that "it must engage itself in all processes of development and play an important role in decision making at every level", that "contribution can be physical or financial" and participation is "implicating the population and instilling in them a sense of responsibility" (cited in Michener, 1998, p. 2110). For Michener (1998), this kind of participation is more to do with administrative task-sharing and less to do with empowerment.

On the other hand, the intended "participants" might feel they are participating, but in different ways to those anticipated by development agencies. For example, in Michener's analysis (1998), parents of school children felt they were contributing by paying school fees, giving the child breakfast and releasing the girls from household duties. They did not feel school management was their responsibility and saw the SCF field staff in a paternalistic and supervisory role, although the project implementers wanted them to participate. Possibly after years of development interventions, the villagers did not see themselves as part of the decision-making. For Dichter, this is because "when asked what it is they need, they will feed back what they have in effect been taught to need" (Dichter, 1989, p. 132). Mosse (2001) argues that instead of outsiders listening and learning according to Chambers (1997), it is the "insiders" who learn what the outsiders want to hear – the "needs" become socially constructed and the dominant interests become community interests. Writing about a forest management programme in western India, he notes how villagers put forward a preference for eucalyptus even though it was not a tree they had experience of. The NGO realizes that this is because the State Forest Department, which was sponsoring the NGO programme was favouring eucalyptus, so the villagers felt it was a low-risk strategy to ask for something they were likely to get.

4.3. Lack of resources

Another challenge to participation is that even if a community does want to participate in a development project, they may simply lack the skills, resources or time (Brett, 2003; Moser, 1993 cited in Michener 1998). Dichter (1989) argues that PRA has "romantic notions of communal altruism" (p. 130), such as the emphasis on volunteers or meetings – which mean time away from work or household duties at no or minimal pay, with no guarantee of a positive outcome. White (1996) illustrates the dilemma of Bangladeshi NGO workers asked to participate in a project meeting – if they don't go, they will be told they are not interested in their peoples' development. If they do go, they have no guarantee that their voices will be heard, and they will have wasted valuable time.

On the other hand, even if a community is participatory, any achievements may simply be curtailed by the community's context. Cleaver (1996) provides an example of Sando village in Zimbabwe which had problems gaining access to water. The villagers had built their own school, established income-generating clubs and were in every sense creative and resilient. Yet they could not get their borehole to function or ensure other water supplies because of their location deep in the forest, with a water table more 100m below the ground, and with no resources to influence the local politicians. The villagers established the Windmill Fund to purchase a windmill pump and set up a system of collection of money from households but were unable to raise enough money. Several years after initiating the fund, they were still forced to travel 10km to use a borehole (Cleaver, 1996, cited in Cleaver 2001).

We now look at how these challenges of participation are reflected in *Our Voices.*

5. EMPIRICAL INVESTIGATIONS

5.1. Ethnographic research

This research takes an ethnographic approach and forms part of larger doctoral research on participative processes in rural information systems. Ethnography involves much more time (Myers, 1999) and observation and immersion into the life of those studied (Lewis, 1985; Agar, 1986; Atkinson and Hammersley, 1995; Hammersley, 1992) than a case study method. It asks "what is life like for this group of people" (Carspecken, 1996) and is preferable where the problem is under-researched, and the situation is complex (LeCompte and Schensul, 1999; Miles and Huberman, 1994). These descriptions do seem to apply to this research – the relatively new and complex phenomenon of implementing a rural information system in India. Furthermore, an ethnographic perspective allows one to go to "where the action is" (Grills, 1998) and to flush out hidden agenda, disagreements and personal issues – again critical when considering the issue of participation, as simple interviews would not obtain the same results. Reading ethnographic research in IS (e.g. Bentley et al (1992) on the work of air traffic controllers; Trauth (2000) on Ireland's information economy; Orlikoswki (1993) on CASE) also made this approach appealing. Ethnographic research is not without its limitations – chiefly the amount of time required to observe, analyze and write up (Myers, 1999) and the critique that it lacks analytic generalizability. However, Myers (1999) argues that just as it is possible to generalize from one case to theory, one can generalize from one ethnography to theory. In order to undertake ethnographic research, six

months were spent researching Our Voices. Part of the week was spent living in a neighbouring village (where the only accommodation was available) and the remainder in the state capital writing up notes. Over 200 people were interviewed and observed and major festivals and events were attended in the village. The most severe limitation however, was inability to speak the local language, which necessitated an interpreter at all times, except towards the end of the stay when proficiency in the language was greater, and when speaking in Hindi/Urdu to the Muslim community in the village.

5.2. Our Voices

Our Voices is a community radio and telecentre (in this case, a room with four computers and a printer), which is part of the Arivu Resource Centre in the village of Bhairavi (population 3000)[2]. For the purposes of this discussion, we will focus only on the community radio aspect of the telecentre. Bhairavi is in a south Indian state, around 100 km north-west from the state capital. Our Voices was started in 1999 by Jaan (an NGO focusing on rural development in south Indian states and operating in the area since 1984) and Maatu (a media advocacy NGO). Both NGOs are headquartered in the state capital. Our Voices was given financial support by an international development donor in 2001 under its ICT Innovations for Poverty Reduction initiative (see UNESCO, n. d. ; Slater and Tacchi, 2004). At the same time, in 2001, "the need for a community based management structure was identified" (UNESCO, n. d.). In 2002, the IT room was set up, with equipment provided by the donor. Donor funding ended in 2004 and Our Voices became a joint initiative between Jaan and Maatu. In 2005, Our Voices became incorporated into Jaan. Currently (November 2006), the entire project is called Arivu Resource Centre and functions as the information wing of the Jaan's activities in the area. Maatu provides the technical support but the Maatu manager who used to live in the village has now moved back to the state capital.

The centre comprises three rooms – a resource centre downstairs used as a meeting area and office, and a recording studio for the community radio and IT room upstairs. The centre has several aims. Firstly, the local dialect is a mix of three languages – that of the state, and of the two neighbouring states, as the district is near the border. A PRA conducted by the two NGOs involved in 1999 showed that villagers were not getting "relevant information" (as defined by Maatu) in this dialect. The PRA found "the community wanted locally relevant information on crops, market prices, and health (particularly women's health)" (UNESCO, n. d.). The title, "Our Voices", implies ownership and self-representation. Programme information is contextual, because, according to UNESCO "the villages of India are reduced to being hapless consumers of media that is irrelevant to them". The nearest All India Radio station was broadcasting from the state capital, disseminating "city-based" information in the mainstream state language. The concepts of "relevant" and "city-based" information will be discussed later. The project implementers state that "by providing information about employment, better farming techniques and health we hoped for new sustainable job opportunities, improved farming knowledge and healthier life" (UNESCO, n. d.).

Our Voices aimed to broadcast daily, from 7pm – 8.30pm, as most people are at home at this time and power is available. The term "broadcast" is misleading, as community radio broadcasting on radio frequencies is currently illegal in India. The station therefore broadcasts in four different ways – as an audio channel on cable TV, through a radio set attached to the cable output, through

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[2] All names have been changed, including those of people, the NGOs and villages.

loudspeakers, and on tapes played at self-help group meetings. Jingles and programmes are recorded by children and local people. Most programmes are in the form of plays, interspersed with public service announcements (e.g. to boil water before drinking). Programme topics include the medicinal value of local plants; road governance; sanitation and women's health. The table in the Appendix illustrates the weekly content for Our Voices.

Arivu Resource Centre (including Our Voices) is managed by a management committee, comprising 12 self-help group (SHG) leaders from Bhairavi and the surrounding villages. In total, the SHGs represent 230 women and 25 men. The management committee decides what topics are of interest for the radio and who to interview. Members of the community are also invited to make programmes and volunteer at the station.

However, Our Voices now faces several challenges. The radio set medium had been phased out soon after implementation (one of the reasons given was that the villagers started taking the radios out to their fields and listened to FM radio instead of Our Voices). During the research conducted between August 2006 – February 2007, one set of loudspeakers had been disconnected allegedly by villagers fed up of hearing the radio. The village cable TV operator had been taken over by the town cable operator who could not carry the channel because of technical difficulties (although possibly more because he did not make a profit on the station). Instead, the village now receives 80 cable TV channels.

6. THE CHALLENGES OF PARTICIPATION IN OUR VOICES

6.1. A top-down concept?

According to project documents, Our Voices intended to be a participatory project. But what does this really mean? Firstly, as Cleaver (2001) comments, it is ironic that institutions have been put into place to enable participation. To serve on Our Voices's management committee – to participate in the running of the station – one has to be the head of a self-help group (SHG). In the words of the Resource Centre Manager *"it is not every group, but only good groups … means you behave well, keep good books"*. Further research needs to ascertain what is meant by "good groups" and how these are selected. Instead of the "outsiders listening and learning" therefore (Chambers, 1997), governance structures have been imposed on the management of Our Voices. Establishing governance structures in itself is not an issue, but does it mean that these structures exclude other members of the community? What is the interaction between the management committee and the rest of the village? In an interview with the Co-operative Bank Manager, we were told *"my wife had some ideas for programmes. She went to the station. But they told her she had to belong to a SHG. Our Voices is a 'group', 'group' thing."* [Interview in August 2006, translated from local language].

Further, the very concept of what is "relevant information" for the community (as defined by UNESCO above) is interesting. Ramesh, the previous Maatu project manager commented:

> *The thing is, the [local language] channels, which are based out of [the state capital], they're all entertainment based, and they're* all *copying the STAR network, basically copying the same pattern, started off with soap operas, religious kind of episodic programmes, long drawn out like villagers like, sensational crime reporting, news, but not really locally relevant, but entertaining all the same. And they play a lot of movies, so what happens on the field is, the guys, it's largely an agrarian community, the farmer, comes back from the field at 7pm when it's dark, switches on the TV, sees a movie's just starting, obviously just wants to relax and see the movie. At the same time, we might be giving a programme about an agricultural scheme, which the government might have for him, which might* significantly *increase his yield, but he's not interested in listening to it, because it's boring. You know, he wants to watch the movie. That's the competition we've got, the challenge we have to overcome.* [Interview with Ramesh, August 2006].

Therefore, despite the station's aim to be contextual because the other stations broadcast irrelevant, "city-based information", it is exactly the latter that the potential audience is interested in. Many of those interviewed said they did not listen to Our Voices *because* it was not mainstream entertainment and because the evening timings conflicted with their favourite soap operas.

Ramesh makes another contradictory statement:

> *First few months, took a lot of energy and effort co-ordinating the project. These guys, you have to keep telling them that programming should be in a certain direction. Because it's really development, development, development. We can either approach community radio as what the community wants. If you make it that way, it will be music only. But at [the donor agency] we can't justify all this equipment to play music all day. There has to be a development angle. So you kind of need to keep pushing programming in a certain direction* [Interview with Ramesh in December 2004]

And goes on to state the advantages of the loudspeaker broadcast:

> *With loudspeakers it's an entirely different story, because there is no other media we have to compete with. Unlike the TV, there's no control from the viewer, he can't switch off the loudspeaker, it's there, blaring in your face* [Interview with Ramesh in August 2006].

It is interesting, therefore, that the project is intended to be participatory, but resorts to using a media where the listener has no control.

Further, a process of negotiation and establishing a hierarchy is clearly in place:

> *Initially at least it was like that, they [the community] would only ask for songs from the loudspeakers, and then we said, see, don't you want to know if the government is going to help you clean up your roads? And some of them said yes, and some of them said no, no first you play the song. And then we started dictating things a bit. We said, you come and participate in programmes like road governance and all, and then we'll play songs … So now, it's a little better. They don't request only songs* [Interview with Ramesh in August 2006].

At the same time, Ramesh emphasizes the contextual nature of the community radio:

> *The cool thing about it is, I didn't decide that I'm going to do an agricultural programme. The guys who decides are Nagarjuna and Vanita, who are from that village. Now Nagarjuna's dad is a farmer, he owns land, so he knows the problems on the land, like this is a good scheme which will help, and he's saying let's do the programme. I'm completely out of the content part. I'm saying you want to do the programme, I'll give you more avenues, think about the loudspeakers, I'll figure out the loudspeakers for you, but hey you have to tell me what you want. But hey, I'm not telling you what to do, do health, do agriculture* [Interview with Ramesh in August 2006].

Further, when we asked the NGO Maatu at what point participation became an integral part of the project, we were told that it was a four-stage process - first there is awareness-raising on what community radio is about, then participation (considered *"done through the SHGs"*), then *"a sense of ownership"*, and then community management. Management meant leaving the project up to the community, while ensuring support:

> *They are the ones who really have to think about it. Management means … realizing the responsibilities … 80 channels, they'll have to do something about it. On one level it'll be interesting to sit back and see what the management committee does. OK, now you are the management committee for the resource centre and radio station, you have competition, people will not listen on their cable TV and there are 80 channels, who will listen to a purely audio channel? What are you going to do about it?* [Interview with Ramesh in August 2006].

This contradictory attitude to participation seems to echo the examples given by Lohmann (1994); Hildyard et al (2001) and Michener (1998) in Section 4 – the concept of community radio has emerged from outside the community, but the implementation and sustainability is left up to the community.

6.2. Co-optation

Is the community therefore being co-opted into the project, as Michener (1998) suggests in her Burkina Faso case? An interview with Ramesh suggested that local people tell the project implementers what they want to hear (Mosse, 2001 and Dichter,1989):

> *It's hard to know if people are really listening. In a survey, if we interview people and ask them whether they watch TV or listen to us, they say yes. Instead we have to ask, what did you think of the programme last week? The minute they see us, they tell us what we want to hear. They say yes, yes, we listened. They feel guilty, for choosing entertainment over development, like something which is good for them* [Interview with Ramesh in August 2006].

In contrast, the "community" for Ramesh is:

> *Whoever's there in and around the station. Till the people who are listening to the radio. We would be biting off more than we can chew if we say the community is even those who don't listen to our programmes* [Interview with Ramesh in August 2006].

Therefore, the community has been reduced to the listeners of the station, and the self-help groups – in other words, those who support Our Voices. These individuals are different from the rest of the community, but still considered representative of them:

> *We have a few insiders in the village … they come regularly and participate. It's their own people talking…* [Interview with Ramesh in August 2006].

As Michener (1998) argues, each group involved has a different understanding of participation in the Our Voices project. At the policy level, participation is about rhetoric such as "community radio" and "relevant information" – no doubt with a good intention in mind. However, note that of over two hundred people interviewed in Bhairavi, no-one knew the origin of the name "Our Voices" – it was thought to have been given by the NGO Maatu, ironic considered the self-representation implied by the title. At the field level, there are tensions between whether the NGO Jaan (which has been in the area since 1984) represents the people, or the outsiders from the state capital and the international donor agency. For the rest of the community, it is hard to see the value in the initiatives, particularly when the station is facing technical challenges and not broadcasting at full capacity. In terms of the computer training centre, many felt the computer classes were not beneficial (particularly for girls) when the only job opportunities are in the nearest town, 15 km away.

Finally, as Michener (1998) and White (1996) argue, empowering others is a highly contradictory notion. As we have seen above, there are tensions between the policy level and the field level – on the one hand, Maatu wants to *"start dictating things a bit"* but on the other hand they state *"it'll be interesting to sit back and see what the management committee does"*. The donor agency states that *"community media to be specific can only aim and strive to provide people information and a medium that they can use to make informed choices. It cannot make the choice for them. Further still, there is also the debate about whether we can assume we know what is in the community's best interests overlooking their own perceptions regarding this"* (UNESCO, n. d.). On the other hand, we have the comment by the Maatu project manager that the initiative is *"really development, development, development"* and not entertainment, even if that is what the community wants. He

continues "*it's your community, it's your call, and the thing is, we've put in some systems in place, saying that ok, it's your call, but still you can't walk away and do as you please*".

6.3. Lack of resources

For an initiative that was intended to help the marginalized, Our Voices now relies on participation from the SHGs, who are already a more confident, established group of villagers. The remaining villagers have little time to participate. One can therefore ask, how representative are the SHGs of the rest of the community? Ramesh, the project manager, commented that "*the primary participation is from the SHGs, next come the youth, and the farmers come last, because daytime they have to work in the farms, not much time. Any participation is our volunteers going to the farms and recording their programmes*". Our Voices is now working with a second (technology) donor on taking Palm Pilots with information onto farms because (according to Ramesh): "*they don't come to the station, because of timings, maybe because of the distance, because of inhibitions, whatever, whatever … so we thought if they cannot come to the station, let the station come to them*".   This raises another question though – if the content was interesting enough (as is the case of the soap operas, comedies and films on the cable TV networks) wouldn't the audience come?

7. CONCLUSIONS

The case of Our Voices illustrates the challenges in establishing participatory and contextual rural information systems projects. This research is in its initial stages and only raises further questions. These include - who defines what development is? What is "contextual"? To what extent does genuine participation occur in ICT for development projects? Does one group of people have any legitimacy to state what is "good" for another group of people? If it does, what happens when tensions emerge between both groups? Our Voices illustrates that implementing a participatory telecentre for "development" and "empowerment" is no easy task.   Instead, it is full of contradictions and challenges, both theoretical and practical.

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Appendix

Days/ Timings	7.00 to 7.05pm	7.05 to 7.10pm	7.10 to 7.20pm	7.20 to 7.30pm	7.30 to 7.45pm	7.45 to 8pm	8 to 8.30pm
Sun	Jingles and Narration (Events for the day)	Devotional Songs	Market rates and News	Family Values	Awareness Programme (General Issues, e.g water content)	"Home Sweet" (General Family Programme)	Film Songs
Mon	Jingles and Narration	Devotional Songs	Market rates and News	Doctor's Advice and Q&A	SHG News PSA Announcement	Radio Clippings and Kids' Programmes	Film Songs (Tamil)
Tues	Jingles and Narration	Devotional Songs	Market rates and News	"Double Gain" (How to increase your Income)	Beauty Tips and Folk Songs	Discussion and Speech	Film Songs (Request)
Wed	Jingles and Narration	Devotional Songs	Market rates and News	Resource Centre Announcement	"We and the People within" (Awareness of the "Great" Villagers)	Panchayat Programme	Film Songs
Thurs	Jingles and Narration	Devotional Songs	Market rates and News	Legal Advice	Jokes Folk Songs	Poetry presentation	Film Songs (Telegu)
Fri	Jingles and Narration	Devotional Songs	Market rates and News	Resource Centre Announcement	Farmers Discussion Forum	Letter presentation	Hits
Sat	Jingles and Narration	Devotional Songs	Market rates and News	Women's Programmes	Kids' Programmes	"Palace of Cooking"	Film Songs

THE CHALLENGE OF "SUSTAINABILITY" IN ICT4D – IS *BRICOLAGE* THE ANSWER?

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Abstract:

Sustainability is a central concern in a wide variety of "ICT for development" projects – from telecentres to ICT education in schools and universities and health informatics. But what is sustainability and how can it be achieved? In contrast to the ICT for development literature, much IS literature does not emphasize sustainability, but instead has accepted the changing nature of the ICT artifact and unintended consequences of technology. Here we analyze two contrasting "ICT for development" case studies, both which ended in "unsustainability" with regards to their original aims, but which resulted in unintended consequences. We argue that sustainability is an unrealistic concept, which is difficult to operationalize, and that ICT for development literature must be open to the kind of *bricolage* and improvisation that Ciborra suggests. However, we also recognize that since the majority of ICT for development projects still continue to be funded by donor agencies and multinationals, improvisation faces many practical challenges.

Keywords: Sustainability, ICT for development, telecentres, *bricolage*, improvisation, Ciborra, unintended consequences

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CHALLENGING "SUSTAINABILITY" IN ICT4D – IS BRICOLAGE THE ANSWER?

1. INTRODUCTION

It seems apt at a conference entitled "Taking stock of E-development" to review one of the key words in "e-development" or "ICT for development" – that of sustainability. Along with "context" or "community participation", sustainability appears to be a benchmark of a successful ICT for development project. We are now at a stage where deploying information and communication technologies (ICTs) in developing countries to bridge the 'digital divide' has been emphasized (perhaps over-emphasized) by governments and international donor agencies, NGOs and business corporations (UN, 2000; UNCTAD, 2004; Wallsten, 2004; HP, 2005; Madon, 2005; Kuriyan *et al.*, 2006). Whether the end is simply to exist in the information society (Castells, 2001; Heeks, 2002), or to use ICTs as some kind of means to the end of "freedom" (the adaptation of Sen's argument by Madon, 2005), what is clear is that there still continues to be extensive support for the use of ICTs in all sectors of society (Mansell and Wehn, 1998; Madon, 2000; Eggleston *et al.*, 2002; Carmel, 2003; Kuriyan *et al.*, 2006). As a result, a number of ICT for development projects have emerged in many countries, ranging from governmental or NGO encouragement on educational institutions using ICTs (Verdisco and Navarro, 2001; Hepp *et al.*, 2004; FAO Investment Centre, 2005), to rural community ICT kiosks and cottages, often referred to as "multipurpose community telecentres" (UNIDO, 2003)[2]. However, of the multiplicity of ICT for development projects introduced since the height of the euphoria around 2000-2001, the majority of them still face sustainability challenges (Whyte, 1999; Roman and Colle, 2002; Madon, 2005). But what is sustainability? Where has the term arisen from? And are we placing too much emphasis on sustainability? We first start by deconstructing sustainability in Section 2. In Section 3, we provide a contrasting view of sustainability through the literature on *bricolage*, improvisation and unintended consequences of technology. In Section 4, we present two very contrasting case studies – one on the use of the internet for research purposes by Saudi Arabian academics, and the second on a community radio/telecentre in India. Even though the case studies refer to two very different demographics, we see similar threads appearing in both cases and Section 5 analyzes how *bricolage* may be more appropriate as a concept than sustainability. Section 6 concludes.

2. SUSTAINABILITY, SUSTAINABLE DEVELOPMENT and SUSTAINABILITY IN ICT4D

2.1. Sustainability and sustainable development

Although extensively used in both development and ICT for development literature, it is surprisingly difficult to find a definition of sustainability. The Oxford English Dictionary defines *sustain* as "to support the efforts of; to uphold; to keep a person or community; the mind, spirit from failing or giving way; to keep in being, to continue in a certain state, to keep or maintain at

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[2] These centres vary in terms of types of facilities provided, but mainly strive to provide free or subsidized information services to the poor and "digitally excluded" (Whyte, 2000; Proenza et al., 2001; Reilly and Gómez, 2001; WRI 2005).

the proper level or standard; to endure without failing or giving way; to undergo, experience, submit to; to have inflicted upon one or to bear a burden" (Oxford English Dictionary, 2006, pp. 326-327). It defines sustainable as "capable of being borne or endured, supportable, bearable, capable of being defended, maintainable, capable of being maintained at a certain rate or level" (ibid, p. 327). Sustainability is therefore seen as the condition of being sustainable. The origins of the word are from the Latin *sostenere* (to support). As we can see, the main meanings of the word are to do with support, maintenance, to keep something in perpetuation, to avoid failure, to keep alive or regenerate (Fowler, 2000; Reynolds and Stinson 1993).

Sustainable development, on the other hand, is commonly attributed to the Brundtland Report which defines it as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987, p. 43). The aims of the report were subsequently adopted as Agenda 21 (the "Rio Declaration") at the UN's conference on Environment and Development in 1992 (UN, 1992). However, Vehkamäki (2005) traces sustainable development (at least in the Western context) to the seventeenth century in Europe. He argues that sustainability as a concept has always emerged in times of crises, first starting from the large-scale deforestation that occurred in Europe in order to supply the ships for world-wide trade and "Age of Discovery". As a result, the English Navy Board commissioned a book on sustainable forestry in 1661, France followed suit in 1664, and Germany in 1713. According to Vehkamäki, sustainable development again arises after the creation of the Dust Bowl in 1930s USA, and once again towards the end of the twentieth century now with the destruction of "development" becoming apparent.

Whether one agrees with Vehkamäki or not, it is clear that there are two main challenges to sustainability and sustainable development. The first is a conceptual challenge. How can we "keep in being" or ensure something "continues in a certain state"? How can we ensure that we "keep a person a person or community, mind or spirit from failing or giving way", since as Fowler argues, "no condition is permanent or controllable" (2000, p. 8). Sustainability implies stability yet movement – a delicate balance. Fowler asks if this is "a realistic appraisal of human nature and its quest for progress" (p. 9) when the dominant economic system is to generate dissatisfaction – to induce people to purchase "satisfying" goods and services. Equally, it is impossible to define what may be essential for sustainability and what might not. Freeman (1984) gives an example from stakeholder theory. In 1977, a dam was being constructed in Tennessee. A stakeholder analysis had been conducted, and all potential stakeholders consulted and involved. Yet mid-way through construction, an endangered species of a snail-darter fish was discovered and the project had to be halted. How could one have foreseen that the identification of the fish was necessary for the sustainability of the dam? Finally, one could ask - is sustainability contradictory to the life cycle itself, where nothing can be perpetual, "continued in a certain state"… or "endured without failing or giving way"?

The second challenge is that of operationalizing sustainability - perhaps nowhere more apparent than in sustainable development. The latter is an intuitively appealing concept, but harder to put into practice (Holmberg and Sandbrook, 1992; Hargroves and Smith, 2005; Gale and Cordray, 1994). Hemmati (2002) sees sustainable development as "a process of dialogue and ultimately consensus building of all stakeholders as partners who together define the problems, design possible solutions, collaborate to implement them, and monitor and evaluate the outcome" (p. 40) but does not suggest how the dialogue is possible. Fowler (2000) cites Ramirez's definition of sustainability (in the context of an NGO project) as "continuing to answer the question 'how to ensure our relevance'" but neither Fowler nor Ramirez challenge the complexities of who defines 'relevance' or how. Loukola and Kyllonen (2005) ask - what should we sustain? Why should it

be sustained and how can we justify that it should be? And how should it be sustained? Scott and Marshall (2005) comment that although few "authorities" would argue against sustainable development, it is firstly difficult for governments to accept the political consequences (for example, by imposing vehicle congestion charges in cities) and secondly (echoing Loukola and Kyllonen), it is difficult to ensure collective action on the environment, which is a public good. Loukola and Kyllonen (2005) conclude that although sustainable development addresses an environmental issue, sustainability itself is about determining social goals and therefore "essentially an issue of justice, with all its difficulties" (p. 7). Is sustainability ever possible or is it simply a "warmly persuasive" notion like the word community is for Williams (1976)?

2.2. Sustainability in ICT for development

ICT for development literature distinguishes between five main types of sustainability: financial, social, institutional, technological, and ironically, given the origins of the term, probably the least-considered - environmental (Proenza, 2001; Delgadillo *et al.*, 2002; Stoll and Menou, 2003; Kumar, 2005; Oyomno, 1996; Harris *et al.*, 2003; Whyte, 1999; Baark and Heeks, 1998; Colle and Roman, 2003).

Economic or financial sustainability refers to the long-term ability of ICT projects to generate enough income to meet their operational and maintenance costs, in addition to a reasonable surplus for renewing broken and obsolete equipment (Proenza, 2001). Financial sustainability is the greatest challenge for many of the ICT projects which continue to be donor funded for a finite period (Hudson, 1999; Whyte, 2000; Kumar and Best, 2006; Cisler, 2002; Harris *et al.*, 2003). It is especially problematic as many of these projects – such as telecentres – have two opposing objectives: generating sufficient income yet ensuring equal access for those who cannot afford to pay for access (Roman and Colle, 2002; Kumar 2005; Kuriyan *et al.*, 2006).

Technological sustainability is the ability for a technology to exist for a long period of time without major shifts in hardware or software affecting its availability or durability (Misund and Hoiberg, 2003). This ability includes operational simplicity, flexibility, maintainability, robustness and also the availability and capability of technical and managerial personnel (Kiggundu, 1989). Technological sustainability is entwined with financial sustainability as technical equipment usually comprises a large proportion of both capital and recurrent costs, and if the technology is not updated, it may be likely to be (but not necessarily) less user-friendly and therefore less likely to be used.

Social sustainability requires user buy-in and participation, taking into account local traditions, considering differences within communities, empowering marginalized groups, sharing and aligning goals with local people and adapting to evolving community needs (Gómez and Casadiego, 2002; Harris *et al.*, 2003; Stoll and Menou, 2003, Delgadillo, 2004). Social sustainability is about looking beyond equitable access and asking whether the access is actually to something useful (such as a government service) and provides relevant content (Gómez and Martinez, 2000; Harris, 1999; Hudson, 1999; Roman and Colle, 2003; Bhatnagar, 2004). Heeks calls this "utility", where "the project must keep meeting the needs of at least some stakeholders; it must continue to be useful to someone" (2005, p. 1). Social unsustainability results when the tension between those who benefit and those who do not is untenable and results in failure (Kumar and Best, 2006). However, the ability to measure this social impact is problematic (Gómez *et al.* 1999), due to its inherent complexity and lack of appropriate indicators (Mansell

and Wehn, 1998).   Further, much of this literature does not point out how to determine what is "locally relevant" and as Freeman (1984) points out in stakeholder theory, there remains the challenge of predicting who will be the key groups to cause failure or success.

Institutional sustainability is closely related to social sustainability, pointing to the buy-in of key institutional actors (Stoll and Menou, 2003; Madon, 2005; Kumar and Best, 2006; Harris et al., 2003; Colle, 2005; Iyer, 2005).   Implementation of ICT for development projects is a highly political process (Kuriyan *et al.*, 2006) and the ICT artifact needs to become institutionalized and accepted by these political actors (Avgerou, 2000). Once the artifact is accepted as a social fact, it is maintained because of its legitimacy regardless of the evidence of its technical value (Avgerou, 2003).

Finally – and ironically, given the origins of the term sustainability from sustainable development – there is the environmental sustainability of ICT for development projects. For Kumar and Best (2006), this is when a large number of PCs are used "without plans for their eventual disposal or reuse when they reach the end of their effective life" (p. 11). For example, the Jhai Foundation (www.jhai.org) builds battery-powered, environmentally-sensitive PCs.

Reading this wide variety of contributors to sustainability, one realizes it is no wonder Heeks (2002) argues that the vast majority of ICT for development projects fail and Harris *et al*. (2003) agree sustainability is hard to operationalize. One feels compelled to ask – is sustainability actually possible? We now offer *bricolage* as an alternative to sustainability.

3. BRICOLAGE AND UNINTENDED CONSEQUENCES

Several authors rethink the concept of sustainability in terms of the unintended consequences of technology (Markus, 2000), improvisation and *bricolage* (Ciborra, 1994; 1998). Knights *et al.* (1997), argue that managing ICT innovations towards a known set of benefits is an illusion and that innovations are resented by the implementing actors who have vested interests.   Ciborra (1994; 1998) states that instead of resentment, these innovations must be embraced as *bricolage* (from the Latin word *bricola* which means tinkering through the combination of resources at hand (Ciborra, 1994; Ciborra 2002).

To support his argument, Ciborra (1994; 2002) gives four examples of well known innovations developed as a result of *bricolage* - American Hospital Supply (AHS)'s ASAP, McKesson's ECONOMOST, American Airline's SABRE and the French videotext, TELETEL (also known as MINITEL). All four systems highlight the discrepancy between ideal plans for such information systems and the realities of their implementation.   In practice, these systems underwent unintended changes and twists including serendipity, chance, trial and error, tinkering, and even negligence resulting in the eventual artifact. SABRE for example was originally built as a simple inventory-management system addressing an internal inefficiency in the American Airlines's ability to manage its seats and passengers. However, it went on to become the industry standard for seat bookings.

Ciborra calls this process *bricolage*, "…tinkering through the combination of resources at hand. These resources become the tools and they define in situ the heuristic to solve the problem. 'Let the world help you': *bricolage* is about leveraging the world as defined by the situation. With

bricolage, the practices and the situations disclose new uses and applications of the technology …" (Ciborra 2002, p. 49). Bricolage allows people at the local level to apply known tools and routines at hand to solve new problems. Ciborra (1994) writes that "no general scheme or model is available: only local cues from a situation are trusted and exploited in a somewhat blind and reflective way, aiming at obtaining ad hoc solutions by applying heuristics rather than high theory" (p. 16).

These unintended consequences of technology are echoed by many - Markus, 1994, 2000; Nardi *et al.*, 2000; Olson and Olson, 2003 to name a few. The consequences may even cause unintended social impacts that are not advantageous (Orlikowski and Gash, 1994; Orlikowski, 2000; Sarbaugh-Thompson and Feldman, 1998) – presumably this is what is worrying for the implementing agency. What we should do however is to "accept co-existence with the messiness of the worldly routines and surprises without panicking" (Ciborra, 1994, p. 13).

4. CASE STUDIES

4.1. Methodology and methods

Following the invitation within the IS literature for contextual, social approaches in IS research (Pettigrew, 1985; Avgerou and Walsham, 2000; Madon, 1993) this research adapts an interpretive research methodology. The entire premise of our paper is to avoid technological determinism (Avgerou, 1998; Ciborra, 1996) and advocacy of best practices from one situation to another (Mansell, 1999). As seen below, we conducted two case studies – one with Saudi Arabian higher education institutions on the use of the internet for research purposes, and the second with a telecentre/community radio in rural India. Research was conducted in Saudi Arabia in summer 2005, and in India between August 2006-January 2007. In Saudi Arabia, semi-structured interviews were conducted with academics actively involved in research in the fields of Business Studies, Management of Information Systems and/or Technology, and Education, in five of Saudi Arabia's higher education institutions. In India, over 200 interviews were conducted with a wide variety of stakeholders involved in the implementation of the *Our Voices* telecentre, including the donor agency, NGOs involved, government departments and beneficiaries. The overall aim of the Indian research project is an ethnographic study to understand the process of participation in ICT for development projects. Interviews were recorded in both cases.

4.2. ICTs for academic research in Saudi Arabian higher education

While the relationship between academic research and a country's economic, social, environmental, and cultural performance is an important one (Bergman 1990; Jaffe 1998), the participation of many developing countries (DC) in academic research remains limited (Davison *et al.* 2000). The widening gap between research from industrialized countries (IC) and developing countries (Gibbs, 1995; Goldemberg 1998) is attributed to many perceived incompatibilities between cultures and technologies, as well as the problematic issues of ownership, and development of national research capacities (Dunn, 1982; Eisemon and Davis, 1991; Bada *et al.,* 2003; Okunoye *et al.* 2005).

Such issues have made many optimistic of ICTs to empower DC academics in their research, by allowing access to research from both DCs and ICs, unlimited by time, or place. In its quest for development, Saudi Arabia continues to spend vast financial resources on developing different

sectors of its society. Here, we investigated closely the results of its ambitious plan to enhance the quality of higher education by providing ICT-based resources (including computers, internet facilities, access to electronic journals in various disciplines) to help improve the quality as well as quantity of its research output. Having the benefit of economic prosperity, the country has implemented these ICTs at a large scale.

Our empirical study investigated the extent to which access to electronic journals had empowered the Saudi academic community in their research, and if these resources have been sustained. Our findings suggested that in a technologically deterministic manner, the Ministry of Higher Education as well as the management of various institutions promoted expenditure on internet-based academic resources. They sustained them financially and technologically, made them prerequisites for accreditation, and imputed much value to them (political and institutional sustainability). The financial, technological, political, and institutional resources were readily available for sustaining ICTs in these institutions. In addition to the influence of government authorities; academics, management, and other institutional members had very positive attitudes towards the importance of ICTs for developing Saudi academic research. These attitudes, alongside economic prosperity, have helped make these technologies widely available.

However, we found that academics resisted using ICTs for improving their research output. The reasons for low engagement mainly fell into two categories of sustainability – social/cultural (limited motivation, resistance to using technology) and institutional. There was limited motivation to actively produce research due to an absence in the link between promotion and research activity in some institutions, and such systems being unclear or too difficult to pursue. Overload with teaching responsibilities had also limited academics' motivation for online academic research. In resisting the use of electronic resources, academics felt a generation gap between their methods of research and this new ICT-era, which was often overwhelming, or simply considered not legitimate resources of academic research, in addition to limited technical skills in ICT applications generally and especially those related to browsing electronic libraries; and in some instances, language barriers prevailed. However, while academics resisted using the technology for academic research per se, the academic community used the internet for a number of other activities that they perceived as very important. This included e-mail communication not only for administration but also for having closely knit discussion groups. In addition, many of the academics were happy to be involved in an Arab-American dialogue programme for university students. Other uses included reading the news online, browsing for materials to support their current teaching, and online book shopping.

Our study unveiled a number of shared pre-assumptions that were institutionally coherent, including the fact that national politics had a major role in academic promotions to critical positions. Further, many private institutions felt obliged by the Saudi Ministry of Higher Education to make such technologies available for accreditation benefits. However, there still was a tendency to support policies that promoted the use of ICTs, often referring to the fact that this is the method used in the US and the UK, so it is a "good" method. Clearly, therefore, the use of the internet for academic purposes was not contextual or "locally relevant". The ICT resources provided, especially those related to electronic libraries, were abandoned and resisted due to many organizational and cultural constraints, including the shared views about the duties and roles of academics as mainly "teachers" rather than "researchers". They failed to empower academics and to encourage participation (Fors and Moreno, 2002; Gómez and Casadiego, 2002; Stoll and Menou, 2003); they did not make their research more efficient, effective, were largely neglected, and ultimately unsustainable.

4.3. Our Voices

Our Voices is a community radio and IT centre which is part of the Arivu Resource Centre in the village of Bhairavi[3] (population 3000) in south India. The project was initially donor-funded in 2002 but is now being run by two NGOs. Donors other than the original funder are also involved. The centre comprises three rooms – a resource centre downstairs used more as a meeting area and office, a recording studio for the community radio upstairs and the computer room with four networked computers and a printer. The centre has several aims. Firstly, the local dialect is a mix of three languages – that of the state, and of the two neighbouring states, as the district is near the border. A PRA conducted by the two NGOs involved in 1999 showed that villagers were not getting "relevant information" (as defined by one NGO) in this dialect. The PRA found "the community wanted locally relevant information on crops, market prices, and health (particularly women's health)" (UNESCO, n. d.). The aim of the IT centre is to provide computer skills to the local community to enable them access to employment in the nearest town (15 km away) and the state capital (around 100 km away).

Here, we will focus on the community radio (rather than IT centre) aspect of the telecentre. At first glance, the radio is very community-led and open to *bricolage*. The title, "Our Voices", implies ownership and self-representation by the villagers. Programme information is contextual, because, according to UNESCO "the villages of India are reduced to being hapless consumers of media that is irrelevant to them". The nearest All India Radio station was broadcasting from the state capital, disseminating "city-based" information in the mainstream state language. The project implementers stated that "by providing information about employment, better farming techniques and health we hoped for new sustainable job opportunities, improved farming knowledge and healthier life" (UNESCO, n. d.). *Our Voices* aimed to broadcast daily, from 7pm – 8.30pm, as most people are at home at this time and power is available. Jingles and programmes are recorded by children and local people and the centre is managed by a committee drawn from local self-help group leaders. Most programmes are in the form of plays, interspersed with public service announcements (e.g. to boil water before drinking). Programme topics include the medicinal value of local plants; road governance, sanitation and women's health. The table in the Appendix illustrates the original weekly programming content for Our Voices.

Due to the Indian Telegraph Act of 1885, community radio is considered illegal in India (although this is currently in the process of amendment). This meant that the radio station was relying on a number of "roundabout" methods to reach its audience – broadcasting through cable TV, through loudspeakers, and playing the same content at weekly meetings organized by groups of women (called self-help groups). During the research conducted between August 2006-January 2007, the loudspeaker cables had become frayed and the loudspeakers themselves had gone missing. The cable TV operator from the nearest town had taken over the village cabling and ostensibly could not carry the channel because of technical difficulties. Instead, the village now receives 80 TV channels, rather than the previous seven when the radio first started in 2002.

In reality, once trust was gained with interviewees, we learnt other reasons for unsustainability. Firstly, there was a discrepancy between the content the donor and NGOs wanted to provide

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[3] All names have been changed, including those of people, the NGOs and villages.

("development" related information) and what the listeners actually wanted – entertainment. Consider this from the project manager:

> "*First few months, took a lot of energy and effort co-ordinating the project. These guys, you have to keep telling them that programming should be in a certain direction. Because it's really development, development, development. We can either approach community radio as what the community wants. If you make it that way, it will be music only. But at [the donor agency] we can't justify all this equipment to play music all day. There has to be a development angle. So you kind of need to keep pushing programming in a certain direction* [Interview with Ramesh in December 2004].

Many of those interviewed stated that "*we don't like the people who work at the station … they are snobbish*" or "*the information was not interesting for us, it is what we know*". One listener reported that one member of staff from the station came to her house with a piece of paper and asked her to say "in her own words" what the piece of paper said (a statement on street hygiene) – an action which raises the question – who is the "our" in "Our Voices" – the station staff or the listeners? Most said they preferred the several soaps and films that were on at the same time in the evening, but they would be likely to listen if the station dealt with interesting topics such as the State Day, biographies of actors and actresses, more quizzes and live shows. However, the project implementers repeatedly stated that the aim of the project was development, not entertainment. Entertainment was merely to make the development information palatable. According to the local government official (the District Commissioner), this is a common tactic in development:

> *Suppose you're showing some film and in between something is told about the message, definitely they will know the movie is going to come again after ten minutes. So, little bribe* [Interview with Ankit Patel, December 2006].

As ethnographic research progressed, we discovered that the loudspeakers had in fact been disconnected by the community because they were too annoying. One set of loudspeakers had been used to broadcast for a major festival (certainly *bricolage*!) but considered vandalism by the project implementers, who then did not re-connect the speakers in that village, stating that they did not appreciate the initiative. However, the NGO continued to believe that such "*disenchantment merely conforms that there is a disconnect between state and civil society*" [Interview with Arjun Seth].

> *[It's] neither utopian, nor can we expect results overnight … let's face facts, we started cable casting in 2003, but value for information it's taken time, but the challenge is once you start getting small victories, then people will actually see efficacies in this.* [Interview with Arjun Seth].

5. ANALYSIS: FROM SUSTAINABILITY TO BRICOLAGE?

Our two case studies differ widely in terms of context, yet they both demonstrate the tension between "sustainability" and *bricolage*. It would be easy to replicate much of the ICT and development literature cited earlier and assign different types of sustainability failures to the above cases. In the case of Saudi Arabia, it is clearly a lack of social/cultural and political/institutional sustainability. In *Our Voices*, it initially appears to be a lack of technical sustainability, but on deeper investigation proves more social. The sustainability literature would address this by advocating partnerships between key stakeholders (Hemmati et al, 2002; Madon, 2005). Further there is a tendency to call for 'performance criteria' and 'evaluation frameworks' to assess impact (Whyte, 1998; Whyte, 2000; Madon, 2005).

Clearly, the internet is not seen as relevant by the Saudi academics, especially not in ways that overlap with the goals of the Saudi government or their academic institutions (i.e. in terms of academic research development). Equally, *Our Voices* suffers from a tension of making a project focused on "development" information sustainable when the audience are saturated with this. In addition, a number of events that occurred in *Our Voices* illustrate how difficult it is to carefully address "each individual component of sustainability…" as organizations such as UNIDO (2003) state. During the course of the project, a camera was stolen, a key member of staff resigned and bad feeling evolved around the project. As Freeman (1984) commented, it is well-nigh impossible to anticipate what factors would make a project unsustainable. Instead, as Ciborra (1994; 1998; 2002) and Markus (2000) argue, these twists and turns should be welcome and incorporated rather than feared as a threat to the project. Unintended consequences may make a project more sustainable (to the extent that sustainability is possible) in the long term. For example, Rangaswaamy (2006) finds her sample of Indian kiosk owners use the infrastructure for creative businesses such as the repair of mobile phone handsets, digital photography and wedding videography. We argue that in such situations, those affected by "ICT for development" initiatives should be allowed to be *bricoleurs*.

In the Saudi Arabian case, it would be interesting to see how the use of the internet for other purposes than academic research will evolve amongst the Saudi academic community. At the time of empirical research, ICTs had helped them communicate better with the internal as well as external environment of their institutions, it revolutionized the manner and speed of paper work in many of the institutions, and was seen so far as an efficient tool for better organizing of academic-related activities. More interestingly however, was the emergence of an unexpected use of electronic mail. When we evaluated the content of communication messages over a period of time, it was found that a large proportion of e-mails were comprised of forwards that ignited socio-political debates about local problems like women's right to drive, regional politics like the Sunni-Shiaa tensions in the eastern province of Saudi, regional politics including the infamous debate of the Israeli-Palestinian conflict, and broader international issues like global warming and 9/11. This method of discussion was favoured specifically because it was "off-the-record" and was only circulated between a trusted community. However, the management do consider this large engagement in e-mail activity a waste of valuable faculty time, and discourage it to a certain extent, sometimes referring to the 'original' objective of the internet – increasing high-quality academic research.

In addition, Saudi academics showed evidence of combining and applying their known tools and routines to deal with an emergent and new concern at hand. The event of September the 11, 2001 had caused much pressure within the country to meet international demands for justifying that the country was not a seedbed for terrorism. Orders were given to review the educational curriculum at all school levels, and many changes were proposed to the religious studies curriculum in particular. One of the institutions involved in our research was eager to deal with these international pressures. Academics in this institution were happier to engage in this issue than to

use the internet for its intended benefit (academic research). They were intensely involved in using the internet in a US-led programme entitled 'Soliya' (http://www.soliya.net/), which utilises web-based videoconferencing technology to engage small groups of university students in "…intensive dialogue about the relationship between the US and the Arab and Muslim World, with a particular emphasis on the role of the media in shaping perceptions of the "other"…" (Soliya, 2007). The programme further aims at promoting and facilitating youth understanding and tolerance across cultures of the West and the East. The extensive involvement of academics in this initiative, and their voluntary work to aid and promote it amongst students of their institutions was an example of " … looking within the organization, to discover those unique attributes that can be leveraged by IT" (Feeny and Ives, 1989, p. 37), thus allowing for instances of tinkering and *bricolage,* and resulting in unintended consequence of ICT implementation and use.

Contrary to Korpela *et al*'s (2000) call to identify and manage risks, Stahl (2005) comments that strategy fails because it is no objective yardstick. "One important reason why we can never assume strategy will be successful is that all actions have non-intended side-effects which preclude the possibility of planning the future comprehensively" (p. 489). Having said this, however, is it likely that the implementing agencies for ICT for development projects would allow for *bricolage*? There is enormous expense invested in these projects. Consider Mission 2007 (or as it is now renamed simply Mission), an attempt to introduce 100,000 rural kiosks in India, with an investmend of around $1.2 billion[4]. "Tinkering" could result in a tremendous waste of financial and human resources. As Wellenius (2003) argues, the opportunity cost of development money is extortionate, and ICT-projects that fail to finance themselves overtime run the risk of draining public resources. This is arguably ethically worse if ICTs are prioritized over issues such as water, food, land and shelter as Heeks (1999) argues. Secondly, development agencies have clear aims and definitions of what they consider "development" as illustrated by Ramesh's comment above that *Our Voices* is about "development, development, development" and not entertainment.

Similarly, the ICT for development field needs to differentiate more clearly between the sustainability of a concept and sustainability of the artifact. As Orlikowski and Iacono (2001) and Sein and Harindranath (2004) argue, ICT is not a black box but multi-faceted, multi-purpose and constantly changing. Let us take the concept of communicating over space and time. This has been sustainable over years, and presumably will be "for the indefinite future". But the *artifact* for communication has changed innumerably – from the letter, to telegraph, to phones, mobiles, email, software such as Skype and so on. And we repeat Fowler (2000) here that the challenge of sustainability is that it tries to achieve a tenuous balance between progress and stability, satisfaction and dissatisfaction of the artifact.

6. CONCLUSION

Our paper began with a review of sustainability, and sustainability in ICT for development literature. Most commonly, sustainability tends to be divided into five types: economic/financial, social/cultural, political/institutional, technological and environmental. Yet, much of this literature also summarizes unsustainable ICT projects as having suffered in one or more of these areas. Still others (such as Heeks, 2003) state that the majority of ICT for development projects fail because of the design-reality gap. We would like to reduce this gap by calling for less

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[4] Meeting with Basheerhamad Shadrach, one of the key champions behind Mission, on 10th November 2006 at Microsoft Research India.

emphasis on the term sustainability in ICT for development projects. Nothing has ever been sustainable, and nothing will ever be. Change is inevitable, and ICT for development project practitioners and theorists must be open to the fact that they are living in a fast-moving world. Like stakeholder analyses, sustainability models and frameworks will not predict the future or guarantee a sustainable project. We therefore offer *bricolage* as a potential answer to the sustainability challenge. As Stahl (2005) concludes, "in a modern society, risks abound and the very attempt to overcome them is likely to create more risks" (p. 489).

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APPENDIX: WEEKLY PROGRAMMING SCHEDULE FOR *OUR VOICES*

Days/ Timings	7.00 to 7.05pm	7.05 to 7.10pm	7.10 to 7.20pm	7.20 to 7.30pm	7.30 to 7.45pm	7.45 to 8pm	8 to 8.30pm
Sun	Jingles and Narration (Events for the day)	Devotional Songs	Market rates and News	Family Values	Awareness Programme (General Issues, e.g water content)	"Home Sweet" (General Family Programme)	Film Songs
Mon	Jingles and Narration	Devotional Songs	Market rates and News	Doctor's Advice and Q&A	SHG News PSA Announcement	Radio Clippings and Kids' Programmes	Film Songs (Tamil)
Tues	Jingles and Narration	Devotional Songs	Market rates and News	"Double Gain" (How to increase your Income)	Beauty Tips and Folk Songs	Discussion and Speech	Film Songs (Request)
Wed	Jingles and Narration	Devotional Songs	Market rates and News	Resource Centre Announcement	"We and the People within" (Awareness of the "Great" Villagers)	Panchayat Programme	Film Songs
Thurs	Jingles and Narration	Devotional Songs	Market rates and News	Legal Advice	Jokes Folk Songs	Poetry presentation	Film Songs (Telegu)
Fri	Jingles and Narration	Devotional Songs	Market rates and News	Resource Centre Announcement	Farmers Discussion Forum	Letter presentation	Hits
Sat	Jingles and Narration	Devotional Songs	Market rates and News	Women's Programmes	Kids' Programmes	"Palace of Cooking"	Film Songs

OPTIMIZING CULTURAL AND ECONOMIC SECURITY

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Abstract: The People and Practices Research group at Intel Corporation has since its inception been keen on making sure that new technologies fit with the people for whom they were designed. Like some other large technology firms, Intel has recently shifted some of their focus to understanding emerging economies as new places for technology uptake. Honing this focus, the PaPR group is currently researching why some ICT4D projects are so successful and self-sustaining while others appear to collapse after a very short time. Piggybacking to various degrees on other projects in 20 plus different locations, we are hoping to produce a richer understanding and a clearer blueprint for truly bringing the benefits of ICTs to communities as a tool for development as first envisioned by so many a little over a decade ago.

We propose that many of the problems and unevenness in results with technology transfer (ICT4D) stem from the lack of understanding of what a community already possesses in its day-to-day portfolio of skills. Because the already existent cultural motifs of healthcare, formal/informal economies and social networks in a community afford people a type of security, it is critical to not disrupt this security with the introduction of new technologies.

It is commonly thought that low-infrastructure communities will blossom more fully if a good technological "cocktail" is served by a willing government or NGO. What this project is discovering, and what is addressed in this report, is that communities already have many capabilities and those must be first understood and then built upon – not destroyed – in order for ICT to be adopted and sustained. ICT4D must follow a formula of "development from below" in order to maximize successful technology adoption.

Keywords: ICT4D, Economic Security, Low Infrastructure Communities, Sustainable Development

OPTIMIZING CULTURAL AND ECONOMIC SECURITY IN THE IMPLEMENTATION OF DIGITAL DEVELOPMENT: THE CASE OF PENALOLEN, CHILE.

1. INTRODUCTION

> The administrator of a program of technological change carries a heavier responsibility [than a surgeon]. Whenever he seeks to alter a people's way of life, he is dealing not with one individual, but with the well-being and happiness of generations of men and women. If his skill is poor and his judgment bad, he can destroy cooperative human relations and create hatreds that will affect uncountable number of people. If on the other hand, his skill is equal to the task, the possibility is open for creating cooperation where it did not exist and for bettering the lives of generations. (Spicer 1952:13).

The challenges facing the creation of sustainable economic development for the majority of the world's population is not a new challenge. Its roots are long, although often re-invented by new-comers to the process. One of our current research projects in the People and Practices Group at Intel Corporation – Community Based Technology Adoption – delves deeply into the question of why some ICT4D projects have been by all measures deemed successful, and why others are still struggling to survive, or have ceased to exist altogether. This paper presents some of our preliminary findings as of the end of 2006; our full results will be out in the early fall of 2007.

According to various reports, there are now over one billion internet users in the world today, and there will be 2 billion somewhere close to the year 2011 (Computer Industry Almanac, Jan. 2006). However, as everyone here knows, the vast majority of these users are located in less than fifteen countries but make up 70 percent of the users. Still, organizations such as the World Bank, the United Nations, national governmental organizations, and private donor foundations continue to energetically promote ICTs as being a powerful tool to lift many communities worldwide out of poverty. Much time, effort and money have been dedicated to these efforts, and there have been successes. Success can be defined in many ways depending on how one asks the questions: Did the hardware arrive safely? Is there a reliable electricity supply to power the technology? Is there cable for connecting to the internet, or cell phone coverage for mobile phones? Are there people with understanding of the newer technologies to maintain and sustain them? Sometimes if those questions are answered in the affirmative, then the project is deemed a success. And sometimes at that point the donor foundations and NGOs move along, rarely returning to conduct further evaluations since their budgets are tight enough as it is.

Our research is showing very clearly that it is not enough to have connectivity, nor is it enough to have affordable technology. In order for ICTs to take root in a community, the technology and all its related parts must also be sustainable and thus self-perpetuating in order for social and economic benefits to be felt and embedded. Such embedding only comes when those who design the project see the target community for the things it already has, not only for what it lacks.

> The conclusions concerning the achievement of acceptable cultural change can be reasonably summarized: find out what the people want; start from where they are; consult local leaders but be sure you reach the right ones; get the participation of the people themselves; carry on with good will and avoid what has been aptly labeled elsewhere as "preconceited" behavior. (Provinse, John H. 1953.)

What we have come to refer to as "seeing the hole, not the doughnut" is a way of describing what many development projects do – they see the things that a community does not have, and they often miss what the community already has, things like the social structures, informal economies, traditional herbal healers, and the wealth of local knowledge, from boat building to cooking tamales. Oftentimes, the project only sees, for example, that there is no internet connection, but not how people succeed in communicating and renewing their community in everyday practices.   We propose that by understanding these everyday practices, new technologies can better fit the people they are to serve, thus becoming integral parts of their lives, and so will be in themselves sustainable development.

Development is a teleological concept of change, that is, the concept of development suggests some purpose/goal toward which this change drives. ICT4D frequently assumes that this purpose is and should be economic development. While we will not argue that economic development should not be the purpose of ICT4D, we will suggest that the conflicting (or even antagonistic) worldviews of the various peoples affected by such programs need to be reconciled before successful ICT4D can be effected. In particular, ICT4D needs to take into account the existing economic activities of these communities, which are composed of what can be described as portfolio entrepreneurs, that is, people taking part in varied economic endeavors to make ends meet.

2. METHODS

Our work involves ethnographic studies of geographic communities in the midst of programs to deploy IP-based technologies. Our field work piggy-backs off the efforts of development agencies and non-governmental organizations that are bringing ICTs into communities for the purpose of mostly economic development. In many cases, we are not so much evaluating as collaborating. By working closely with community members, we can help development agencies to better deliver services. This work will focus on six communities, with many more communities providing additional or confirmatory material. Most of our work thus far has been in Peñalolén, Chile; Huangbaiyu, China; Theni, India; Soweto, South Africa; and North Lawndale, USA.

The primary aim of our research is to better understand the ways in which communities make decisions to adopt (or not) new technologies that have the power to change their lives. This research has involved working with various constituencies in ICT4D projects around the globe. We have observed lives and the contexts in which they are lived. We have observed and interacted with both the "objects" of the development programs and the "subjects": the communities to receive the ICTs and the organizations delivering them, respectively. We have visited with community members in their homes and places of work, primarily to discuss their communities and the lives they live within them. We have talked about friendships, work, leisure, and goals for the future. Only secondarily did we talk about the technology

plans (community members were, in many cases, not even aware of the ICT4D project). Among the community members who have known about the plans, we have met with community activists and community leaders. We also have met with the delivery organizations in their offices and various public meetings to discuss the "how and whys" of their plans. We are analyzing the various documents created in support of these endeavors. This work is conceptualized as action research, and although our goal is to understand community change, we have also attempted to assist the development agencies in crafting more appropriate technologies and services.

3. RESULTS

3.1. A Model for Success: Peñalolén, Santiago, Chile

One community that appears to be enjoying success with the deployment of a long-term ICT4D project is the municipality of Peñalolén, Chile. Peñalolén is one of some 30 municipalities that make of the greater Santiago metropolitan area. Created as a political entity 22 years ago, it is one of the poorer municipalities in the city of almost 6 million, and one of the most ethnically diverse also. The population totals approximately 260,000 persons, the average income for Peñalolénos is about $300 US monthly and until 2005 has one of the largest "tomas," or squatter settlements, in the country.

In 1998, two computers were placed in a church basement with the objective of bringing ICTs to Peñalolén. This was the beginning of the drive to make Peñalolén a "digital community" through the use of ICTs, and was promulgated by the now-mayor of the municipality, Claudio Orrego Larrain. Helped by national initiatives to make a place for Chile in the digital world, primarily through supporting ICTs in public schools throughout the country, Orrego took on the founding of the Corporation El Encuentro (The Meeting Corporation), a non-profit organization with the mission of providing ICTs for the poor. From this beginning has blossomed some strong and so far sustainable developments in the camp of ICT4D.

Telecentres for the Community: Beginning with the telecentre at El Encuentro, there are now five additional telecentres being brought online in Peñalolén. These are being developed through the local neighborhood organizations (Juntos Vecinales), and were chosen from proposals put forth by the same neighborhood organizations. Each new telecentre will be supported through municipal funds (and other indirect private enterprise support, such as the donation of PCs) for the first year of their existence; after one year each telecentre must have in place a method of self-support. It is imagined that the telecentres will be able to offer and charge minimal amounts for classes in computing and digital literacy and other related services in order to become self-sustaining.

Digital Schools: With the cooperation of the national program Enlaces (Linkages – a program that helps develop locally relevant educational materials and curriculum for Chiles public school system in partnership with national universities), there is a grand push to 1) have the elementary schools be online and fully access the benefits of ICTs, and 2) serve secondarily as community telecentres in the evenings. One elementary school, serving the poorest children in Peñalolén, serves as a model for the others. Having a fully equipped computer lab, the school now has a WiMAX tower to power internet access, and continues to train students and community members in computer usage. Another school, this one a high school, is getting ready to launch an internet radio station to be run by the students and will broadcast not only music but other content relevant to the community of Peñalolén.

Community Radio: Linked to the oldest telecentre is Radio El Encuentro, a community radio station that broadcasts both on the FM band and on the internet to the community of Peñalolén. The broadcast content is a mix of music and talk radio that discusses issues of relevance to those in the community, and also includes a "job board" and a question and answer time, where the answers are often looked for on the internet and then rebroadcast.

Digital Employment Office Yunus: Opened in 2005, the Oficina Yunus is driving a threefold mission: to act as an employment office by accessing jobs online on a national and local level; offering coursework in computing and general job skills assessment and training; and serving as the center for microfinance for those in the community of Peñalolén who want to start a small business. One innovative service that has been created is the Contract a Peñaloléno program, where community members searching for work can post their resumes online and others in the community can browse the database and find workers.

Digital Libraries: Linked to the national program to digitize Chile's libraries, BiblioRed, there is now one library that has 20 PCs that will all eventually be linked to the internet and thus serve as both an info-center and a telecentre for the community.

E-government: Shortly after Mayor Orrego took office, he began to form a group within the municipality's offices known as the Digital Community Group. This group of about six to seven people has been tasked with bringing the government offices and services completely online as quickly as possible. They have created a web page for the government complete with local content and links, and have brought the municipal offices online. A Peñaloléno can access the page and pay their trash collection charges, get business permits, pay business taxes, and access a host of other information both about their community, and give feedback to government officials.   Both the municipal government and now two neighborhood associations maintain blogs to keep community and organization members informed and to broadcast their events to the community at large.

4. CONCLUSIONS

It appears that the community of Peñalolén is moving strongly towards a digital future, taking advantage of the social and economic benefits that ICT4D can offer. Why this community is succeeding while others might flounder will now be discussed, along with some of the negative issues that must still be surmounted.

In the opening introduction, it was stated that successful development projects must start from "below," from the community itself, and not be imposed from "above" without understanding that same community. Development "from above" has always faced challenges, as this way of thinking is both patronizing (outsiders knowing what is best for someone else) and very often programs are lacking in local relevance. The first question that a project should ask is what does the community want, and not necessarily assume what the community needs. One needs to see the doughnut, not the hole.

In Peñalolén, efforts to bring ICT4D were indigenous to the community. The first digital project grew out of a local church and grew with the efforts of community members working

as volunteers to bring forth what they saw as valuable for their local needs. As the political climate in the country grew more favorable for the support of ICTs, and in particular for ICT4D, Peñalolén's projects could be expanded. Finally, when the municipality elected a mayor who champions the community benefits of ICTs, true flourishing is occurring. Another side benefit is that with stronger demand for computing services, three new privately run telecentres have opened, providing both jobs and internet access and other services to more people in Peñalolén. But all these events have been almost ten years in the making. And the innovations are not without their detractors and problems.

Success for some parts of Peñalolén has not been complete. The average incomes are still too low to allow for computers to be easily obtained, and the costs of internet access are still high. Poverty in general is still a great challenge, and using a computer or looking for work on the internet will not solve this problem alone. It is difficult enough for most in Peñalolén to pay for electricity, water and food. Drug use is still common, as is alcoholism. Health care is available to all but is sub-standard. Permanent housing is still scarce. Related to ICTs, the computers at the Digital Library must wait to get online because someone stole the wireless access cards from the machines. The Employment Office Yunus needs many more teachers to prepare job searchers for new employment and for teaching basic computer use. The new telecentres are still waiting for the internet connection. While one elementary school has a new beautiful and well-used computer lab, 17 other schools have a ratio of about 100 students per one computer. And there are many in Peñalolén that are not convinced of the benefits of ICTs nor of the role of the municipality in supporting this program.

Taken together, however, it is our conviction that so far the ICT4D projects in Peñalolén have been successful, and will continue to be so in the future. We offer, in conclusion, five observations that may better other projects attempting to have the same positive outcomes:

1. ICT4D projects need time to grow and prove themselves. There must be a dedicated long-term commitment to ICTs.

2. Strong community support is needed in general, as well as more directed backing, for example, by neighborhood organizations.

3. Schools need to have a strong role so that future generations have a stake in the process.

4. Capacity building classes must be taught so that community members can both understand computing and maintain the networks.

5. The thrust of projects must be geared to local needs and local content; otherwise ICTs will never be seen as essential.

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STRUCTURE, AGENCY, AND CAUSALITY: THREE CENTRAL ASSUMPTIONS IN ITD RESEARCH

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Abstract: The intention of this paper is to highlight and demonstrate the importance of three ontological assumptions in information technology for development (ITD) research; structure, agency, and causality. We argue that these three assumptions are 1) inherent in all social theory, and thus in ITD research, and 2) underdetermined by the current dominant philosophical approaches to research. Therefore, irrespective of one's adopted philosophical approach we argue that researchers need to reflect on these assumptions. To expedite this reflection, we present a model of the relationships among philosophy, social theory, and research methodology that illustrates the centrality of these three assumptions in the process of research and theorizing. Then, this essay engages in a retrospective analysis of an ongoing longitudinal interpretive research study in India to consider the relevance of these assumptions and show how they are implicated in research and the development of theory.

Keywords: philosophical assumptions, social theory, structure, agency, causality, India, rural development.

STRUCTURE, AGENCY, AND CAUSALITY: THREE CENTRAL ASSUMPTOINS IN ITD RESEARCH

1. INTRODUCTION

This paper reflects on the relationship between academic researchers in the field of information technology for development (ITD) and the underlying assumptions they employ to underpin their research. We argue that to strengthen the theoretical base of ITD, we need to encourage greater reflection on these philosophical and theoretical assumptions. Impetus for this inquiry comes from recent recognition that immersion into insights from philosophy and social theory can provide us with new insights into our research in the empirical world (Hollis, 1994; A. Lee, 2004, p. 2; Walsham, 1995). If we wish to engage in research that has a chance of reaching valid findings, having clear sight of these assumptions is essential.

ITD researchers are often captives of the debate at the philosophy of science level – we find ourselves obliged to work within the existing paradigms of research such as positivism, interpretivism, (A. Lee, 1991; Orlikowski & Baroudi, 1991; Weber, 2004), and the more recent entry of critical realism (Dobson, 2002; Mingers, 2004a, 2004b; Smith, 2005, 2006; Tsoukas, 1989). Variations on this debate have been conducted at the level of the philosophy of social science and has been evolving for many years now (Bhaskar, 1998b; Kincaid, 1996; Latour, 1999; Lauden, 1990). These philosophies are adopted and debated, along essentially the same lines of argumentation, by researchers across the social science spectrum. This is possible because the purpose of every social science study is the same: to understand human behavior in social situations.

These philosophical paradigms are both a blessing and a curse. They have proven very helpful in the structuring and communication of research through the provision of a set of common guiding assumptions (e.g. George & Bennett, 2005, p. 128). However, sometimes they obscure as much as they clarify, presenting simplifications of more nuanced positions (Weber, 2004). Indeed under the umbrella of each approach there is a wide degree of latitude to choose amongst different assumptions within that framework. For example, there are a plethora of research designs and methodologies that fall within the paradigmatic research approaches. Consider Heller's (2001) listing of a series of approaches in contemporary research: constructionism, constructivism, critical enquiry, deconstruction, discourse analysis, essentialism, ethnography, ethnomethodology, existentialism, foundationalism, Frankfurt School, hermeneutics, and the list goes on (2001, p. 51). Also illustrative is the fact that interpretivism, for example, can arguably be underpinned by the philosophies of critical realism, hermeneutics, or phenomenology (Walsham, 2006), with strains open to hypothesis testing and more stringent methodologies (e.g. A. Lee & Baskerville, 2003) and another strain that argues that methods are more problematic and reject the possibility of hypothesis testing (Avgerou, Ciborra, & Land, 2004; Avgerou & Walsham, 2000; Myers, 2004; Walsham, 2001).

In particular, this article identifies three ontological assumptions that are underdetermined within the frameworks of positivism and interpretivism; social structure, agency (models of individual action), and casualty. Importantly, all three of these assumptions are inherent in all social theory, and consequently, all ITD theory. Therefore, regardless of the object of research or research approach, these assumptions warrant explicit consideration. To facilitate this reflection, we propose a simple model of the relationship between philosophy, social theory, and research methodology that highlights the central role of these three components.

This article proceeds as follows. The following section presents and discusses a model of the three assumptions, and shows how they are underdetermined within positivism and interpretivism. With these three assumptions in mind, section three is a retrospective analysis of a longitudinal interpretive research study in India. The goal is to consider the relevance of these assumptions in ITD research and show how this benefits the goals of theorization and generalization. Finally, we conclude.

2. THE MODEL: THE THREE ASSUMPTIONS OF SOCIAL THEORY

This section presents a simple model of the relationship between aspects of the philosophy of social science and research as a starting point for researchers to reflexively engage with philosophy and social theory. The foundation of this model is ontology, the study of what exists. The metaphysical and scientific concepts that constitute one's ontology are our linguistic representations of this reality. When a researcher engages in research he/she necessarily makes ontological claims about what he/she believe exists in the world. The hope is that these claims refer to what actually is in the world. Stemming from ones' ontology other research considerations naturally flow. It should be stated that such a position in no way downgrades the crucial role of epistemology in research, but rather, it should be seen as promoting the often neglected role of ontology (e.g. Crotty, 1998).

We can usefully split this ontology into two domains, the ontology of the natural world and the social world[1]. It is the postulated differences in these two domains that results in the schism between the natural and social sciences (cf. Taylor, 1994). While the extent of differences between natural and social world ontologies is debatable (Kincaid, 1996; Martin, 1994), the belief that the social world emerges from the natural world is a view more commonly held, and provides a basis for understanding social ontology (Berger & Luckman, 1967; Searle, 1995).

When a researcher is formulating a theoretical understanding of a particular object of study, he/she will be greatly influenced by his/her assumptions regarding the ontology of the natural and social world. Clarifying this object requires a researcher to make specific assumptions regarding the nature of structure, man, and causality (natural and social). Depending upon these assumptions, the researcher is constrained with respects to his/her epistemology and provides guidance for the consequent research methodology that is deemed to be best suited to study this particular object.[2] While there are many other assumptions that must be made, our argument is that these three are both a) basic to all social theory and b) left unresolved under the banners of interpretivism or positivism[3].

The model of reflexivity proposed in this article has two movements (see Figure 1). First, it begins with meta-theoretical reflection and clarification of the assumptions that underpin the ontology of the natural and social world, specifically with respects to the nature of structure,

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[1] Orlikowski and Baroudi (1991) characterize the two types of ontology as "beliefs about physical and social reality" (p. 7).

[2] Of course, one can engage in grounded-theory approaches where there is ideally no specific starting theory. Such an approach, however, does not exclude the necessity of having specific ideas as to the nature of the natural and social world upon which any theory can be built.

[3] In contrast to positivism and interpretivism, critical realism, as a singularly developed philosophy of the natural and social sciences, does takes a clear position on two of these issues; social structure and causality (Bhaskar, 1978, 1998a). Archer, working in the critical realist tradition has been developing a critical realist compatible model of man (see: Archer, 2000, 2002).

man (agency), and causality. This includes, as much as possible, an ontological elaboration of the object of study. That is, what is it exactly that we would like to know? What type of object (natural and social) is it and what types of empirical effects can we expect to see? Second, the researcher moves towards the construction of the appropriate epistemology to tackle that object of study[4]. The rest of this section clarifies the three components.
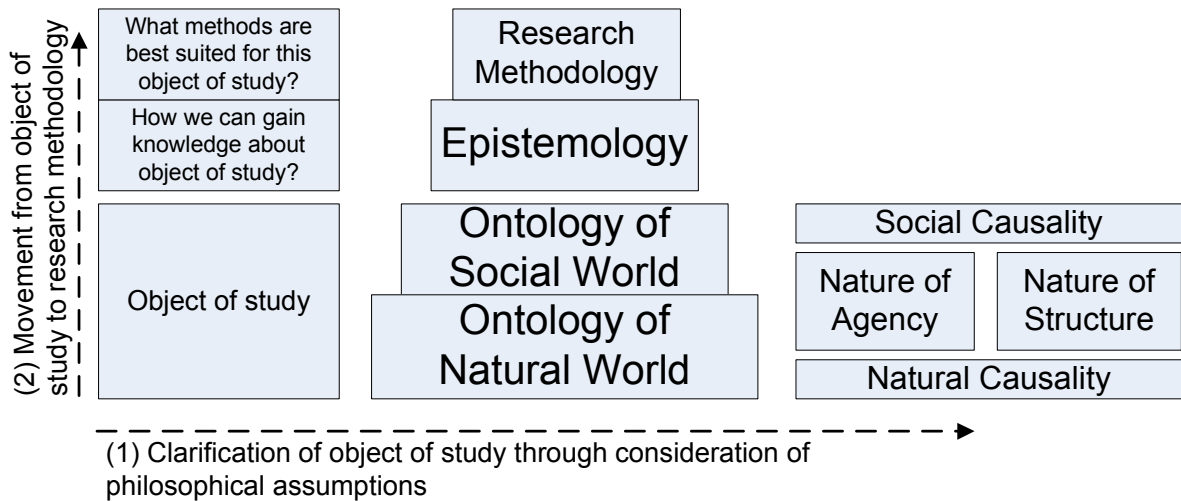

Figure 1. A reflexive researcher does the following: (1) Clarifies the object of study as much as possible with a consideration of the underlying philosophical assumptions involved and (2) Moves from this towards the epistemological and methodological questions that will ultimately define the research methodology.

2.1. The nature of structure

In modern sociology the debate over the nature of the social world has classically been between two positions; individualistic and holistic (Hollis, 1994). Individualists believe that all action and change is based upon the behavior of individuals. The end result is methodological individualism where all social theories are reducible to individualistic theories.[5] Holistic accounts, on the other hand, hold that individual behavior and social change is the product of macro social forces such that individuals are essentially puppets reacting to these forces (Porpora, 1989).

Two other perspectives argue that structure and agency interact; structurational and relational (Porpora, 1998). Structuration theory was an attempt to develop a middle way between the two traditions of sociology defined above (Jones, Orlikowski, & Munir, 2004)[6]. The result is the "duality" of agency and structure where the "two are dependent upon each other and recursively related", with the main focus on social practices (Rose, 1998). Structure, then, is

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[4] This model presents a static picture of the research process. A more accurate model would show how, through the process of science, further engagement with theory and the activity of gathering empirical data would might bring about an adjustment or changes to these underlying assumptions. The model suffices for the argument here which is to highlight the importance of these three assumptions at the beginning of the research process.

[5] There are arguably many different subtle variations on methodological individualism, with increasing focus on the significance of the role of individualist theories (Kincaid, 1994).

[6] Structuration theory has underpinned a lot of IS and ITD research (e.g. Heeks, 2001; Jones et al., 2004; Kouroubali, 2002; Orlikowski, 1992; Orlikowski, 2000; Walsham & Sahay, 1999).

activity-dependent with only a transitory character, as opposed to the holistic conception above. Stemming from Marx and adapted by critical realists (Archer, 1996; Bhaskar, 1998b; Porpora, 1998), a relational sociology holds that structure and agency are linked through a series of relations, where these relations are both necessary and relatively enduring, at least enough that we can set out to study them (Archer, 1995, p. 166). Structure and agency are dependent upon each other for existence; they also operate to a degree autonomous and independent of each other. Consequently, it is possible to trace the interaction of structure and agency through time, something that is difficult for structuration theory that reduces structure and agency into activity (Archer, 1995; Rose, 1998).

The different philosophical approaches of interpretivism and positivism do not necessarily advocate a particular ontological conception of social structure. Social scientists within the positivist paradigm have taken both a holistic perspective (e.g. Durkheim, 1994) as well as an individualist perspective such as assumed by the deductive mathematical modeling at the heart of modern economics (Lawson, 2006). Interpretivists also have some latitude in terms of their adopted vision of structure. Subjectivists are generally considered individualists, focusing on the activities of individuals (King, 1999), whereas those interpretivists who take a critical perspective look to relational structures of power and inequity for their explanations (e.g. Walsham, 2003, p. 85).[7]

Ultimately, one's conception of social structure is crucial as it determines the level of description necessary for the explanation of social events; should the focus be on the individual, the collective, the activity, social relations, or some combination thereof? The choice has significant ramifications. Consider, for example, a critical researcher examining issues of poverty and social inequities. This research takes on a very different focus if power is seen as relational as opposed to an individualistic conception, with significantly different policy outcomes. To better understand and evaluate these recommendations, therefore, we must understand the researchers' underlying conception of structure.

2.2. Agency: an individual-level theory of action

> "Any theory of action requires a theory of the elementary actor. The elementary actor is the wellspring of action, no matter how complex are the structures through which action takes place" (Coleman, 1994, p. 503).

As Coleman's statement makes clear, any explanation of a social phenomenon without some reference to the mechanisms prompting human behavior at the level of the individual is most likely incomplete (Coleman, 1994; Kincaid, 1994, p. 511; Little, 1998). Complete social explanation "reaches down to individual reasoning and up to collective resources on offer" (Pawson & Tilley, 1997, p. 60). These are psychological and socio-psychological mechanisms that combine individual desires, beliefs, and opportunities to result in human behavior (Hedström & Swedberg, 1998, p. 23). Consequently, all social theories necessarily include an

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[7] One implication here is that the division sometimes made between positivism, interpretivism, and critical theory (e.g. Orlikowski & Baroudi, 1991) is not comparing likes with likes. Critical theory starts from specific ontological beliefs about the nature of social structure with its inherent conflict and contradiction. Such a position is predicated on its notion of totality that implies a relational perspective of society, generally attributed to Marx. If this is the case, there is no reason that a position of criticality can not be accommodated within general positivist and interpretivist paradigms, provided that they adopt the same perspective of social structure. As a concluding piece of evidence for this argument, we refer you to McGrath (2005) who, after analyzing two critical IS works concluded that "when critical research report on their field studies, their descriptions of methodology (where these are provided at all) show few, if any, distinguishing traits from those of interpretive or positivist researchers" (p. 97).

individual-level theory of action, whether they are in individuals or groups.[8] Such a theory is implied by most social theorists and is the "dominant model of action we apply when we say we understand the action of another person" (Coleman, 1994, p. 13).

Fortunately, for the purposes of singular social theories, it is not necessary to include a complete model of human behavior. Not every belief, desire, or understanding needs to be identified to explain how a particular theory reaches down through the head of people and motivates action. Each theory will have its particular individual-level theory of action correlate. Consider incentives in economics. Incentives are understood as influential because economics conceives of humans as ultimately self-interest maximizers. Consequently, when presented with incentives, people interpret them according to the desire to maximize their own interest. Of course, self-interest is just one individual level theory of action of human behavior. Just as economics has expanded to bring in behavioral economics, for example, so have ITD researchers argued that there are other rationalities beyond this particular economic approach (Avgerou, 2000). For many people, self-interest is outweighed by other beliefs or desires such as feelings of moral obligations.[9] Clearly explicating the individual level theory of action plays has two important benefits. First it allows for an easy identification of when and why a theory may be limited or wrong. Many critiques of the economic model of man have led to an expansion of the models and consequent improvement of economic theory. Second it provides the crucial linking macro-level theories with individual level action.

2.3. Causality: the link

Causality is intimately related to the nature of explanation (Gregor, 2006, p. 618). If you believe in the power of social objects to structure human activity, exactly how does this happen? Is it deterministic, and if not, how can we know if something is causally related? When we make assertions about the crucial success factors of an ITD project, for example, can we say exactly *how* and *why* this success factor contributed to the success?

Despite the relationship between causality and explanation, the topic of causality itself receives little direct treatment in the IS or ITD literature, with a few exceptions (Gregor, 2002, 2006; B. Lee, Barua, & Whinston, 1997; Markus & Robey, 1988; Smith, 2006). This lack of coverage may be due to the inherent philosophical complexities that have resulted in so many competing conceptions of causality. Gregor (2006) lists four approaches to the analysis of event causation; regularity, counterfactual, probabilistic causal, and manipulation analysis (p. 617). Indeed, there may be many different types of causality and that "competing" conceptions may prove appropriate in different situations (Cartwright, 2003, p. vii; 2004). Unfortunately, there is not the space to delve into the varieties of causality, or their implications. It suffices to say for the argument here that its tight connection with explanation makes it a necessary component for reflection for all researchers.

3. REFLECTING ON RESEARCH: AN EXAMPLE

In this section, we draw on ongoing longitudinal research carried out by one of the authors in India. This research was initially conducted using an interpretivist lens where the goal was to describe and gain understanding, rather than to explain. We now revisit the case reflecting upon the three assumptions of social theory presented in this paper. The case we present is

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[8] For example, Avgerou and Madon (2004) argue that to account for actors behavior in a particular information system implementation, one must bring in layers of context to allow for researchers to "draw on a frame of reference and meaning: Who are the actors? What understanding and emotional attitudes drive their actions? Where do these stem from" (p. 169)?

[9] Consider the plight of the low-paid or volunteer NGO worker, who receives less monetary remuneration for the belief that she is going some good in the world.

that of introducing information technology for promoting rural development in the state of Gujarat, India from 1989 to 2006. Rather that discussing specific details of the findings, our aim in the next section is to briefly abstract some key aspects of this effort.

3.1. Abstracting key aspects of the IT for rural development effort, Gujarat, 1989-2006

A strong enabling factor in the effort to introduce IT for rural development in Gujarat was the political leadership in the mid-1980s. Following several decades of failed attempts at decentralization, there was a strong policy drive time to introduce computers in order that relevant local information about the implementation of rural development programmes could be made more readily available for planning and monitoring at the district level.

However, despite this vision, various institutions intrinsic to Indian society were seen to play an influence on this policy drive. Here, we focus on three such institutions: the bureaucracy, caste, and the village. First, the top-down nature of the Indian bureaucracy continued to create stiff resistance to efforts made towards decentralization. So strong was the strength of administrative hierarchy that although the slogan of the computerization project was 'decentralisation', the system was eventually designed and implemented completely from the top and imposed as a menu-driven rural development programme information system onto district development agencies. Indeed, the entire planning processes acted as a powerful centralizing force reducing the task of rural development to an impersonal and mechanical exercise that resulted in feelings of apathy among staff at the district level.

A second and related institution of Indian life which imposed itself on the computerization efforts during the first few years of implementation is caste. The administration with its strict division of hierarchy bears semblance to the caste system in India, with its roots in religious beliefs and practices. According to this system, the Indian bureaucracy has a distinct character in which work practices have come to be elaborately differentiated. For example, within each district, senior civil servants have certain prerogatives over the lives of people in subordinate positions – to fire, promote, and determine pay and workload. Under this type of work situation, it is rare to find much collaboration of teamwork taking place between workers at different echelons of the administrative hierarchy with the typical scenario of the lowest clerical rank of officers hardly coming into any direct contact with the highest rank of officers from the Indian Administrative Service.

The two institutions of bureaucracy and caste which tended to reinforce each other exerted a strong influence on the implementation of computerization for rural development in Gujarat during the period 1989 to 1993 and were instrumental in the non take-up of the technology. District-level staff refused to use the system because they perceived it to be irrelevant for the task of rural development. This action gained endorsement from the state government which supported non-usage of the initial menu-driven system but which at the same time encouraged district-level staff to use computers in ways that they found relevant for their own local planning and monitoring tasks. From the mid-1990s, this encouragement provided district officers with an impetus to understand the nature of rural poverty elevating the importance of a third key institution in Indian life – the village. Contrary to the literary image of the Indian village as a peaceful and harmonious self-sufficient community, rural development officers were cognizant of the fact that division and hierarchy arising from income inequalities in the ownership, control and use of land figured prominently in village life. Earlier, they had little opportunity to obtain information other than what was required by higher echelons of the bureaucracy for resource allocation – typically financial outlay and physical numbers of households assisted under rural development schemes.

District officers saw many ways in which computers could directly help them in their work. First, automating the preparation of routine reports and programme plans saved time. Second, sorting data in different ways revealed patterns in the different aspects of the village such as on its demographic composition, on income and other surrogates of poverty, and on inequality and social deprivation. Such data was perceived by them as useful for rural development planning. Third, they gained more confidence in their ability as planners to report to higher authorities about the functioning of rural development programmes and in their ability to make a difference to the communities they were serving. This led to a period of experimental IT usage at the district level in Gujarat. Although there was some degree of synergy in terms of improvements in levels of usage across the districts of Gujarat, individual district rural development agencies were also creating applications specific to their socio-economic and environmental context.

But this local movement to embrace information technology for rural development was short-lived and never really got a chance to transform into some kind of collective outcome. By 2000, a new ideology of governance reform began to intrude into Indian society and the Gujarat state government was influenced by this ideological stance coming from international agencies. This new ideology led to a switch from faith in state control of rural development to faith in markets and other civil society players – for example, non-governmental organizations. A suite of 'good governance' prescriptions followed which focused on improving efficiency, increasing civil society participation, and accelerating the marketization of governance activity by involving private entrepreneurs. In terms of computerization activity, the new mandate favored a portfolio of front-end applications such as web portals and e-service delivery over the erstwhile objective of improving the back-end processing of large economic development programs through improved qualitative data. Consequently, by 2003, all earlier progress had been eroded and hardly any examples of local usage and management remained. On the contrary, new players had entered the scene in governance activity. Apart from the bureaucracy, the presence of private players, non-governmental agencies, and community self-help groups was increasing. So far, however, there is little interaction or information exchange taking place between these disparate groups directed towards the common cause of improving rural development.

3.2. Drawing theoretical conclusions

In this section, we attempt to reflect on the relevance of the three assumptions of social theory for this ongoing research. We start with the observation that over the 17-year period of research, there were three main phases in terms of IT usage outcomes. Underlying the descriptions of each phase is a causal explanation which has so far been implicit but which we now explicitly emphasize. In the first phase of research, technology offered the possibility to improve the rural development effort via decentralization. However, the social relations that determined the realization of this possibility were not in place. On the contrary, despite policy prescriptions promoting decentralization to local political and administrative bodies, the style of planning was still very much 'top-down' operating within a strict hierarchy of rules and control. The way in which the initial suite of IT applications was launched by the central government (as a menu-driven system designed and developed by a team of programmers in New Delhi in all 436 districts of the country) only served to endorse this attitude thereby de-motivating district-level staff from engaging with the technology. During this phase, IT did not improve the effectiveness of rural development and its non take-up by district-level staff was symptomatic of the individual level reasoning of staff members. The application meant little to them because (1) it was an alien artifact for them and they could not understand its potential, (2) the application did not correspond to their daily reporting formats causing them to spend more time, rather than less, and (3) they felt disheartened because the application did

not allow them to use discretion in the collection of data and the taking of decisions regarding poverty alleviation.

In the next main phase of research during the mid-1990s, our findings show that IT offered the possibility of improving the rural development effort but that this time a new context of social relations enabled this to come about. The hegemony of the central government and the long-standing relationship of hostility this caused with the state government resulted in the latter defying the central government and encouraging district-level staff to experiment with the technology. A strong bond surfaced between the state administration and the district agencies and this relationship appeared to be relatively stable over a period of years providing district officers the opportunity to implement their own theories about poverty alleviation. Many of these theories drew on years of experience of working in the field and a wealth of mental models about Indian village life. Earlier, these theories lay dormant in the minds of the district officers who were unable to exercise any discretion in their work due to the top-down target-driven planning orientation. The individual reasoning and beliefs of district officers now found expression because the new relationship with the state administration effectively neutralized the repressive control mechanisms of the central government.

While there was a period of 'making a difference', this was short-lived and was not transformed into some kind of collective action at the state level. In fact, by the late 1990s, there was a new dominant ideology regarding how IT could transform governance activity coming from the international development community based on the idea of 'rolling back the state' and involving a variety of civil society organizations in development planning activity – for example, non-governmental agencies increasingly working with the rural poor. Huge investments have been made to establish e-services applications to improve the interface between citizens and government by providing a range of IT-enabled services such as application forms for government-run rural development schemes. However, the current set of social relations once again discourages, rather than encourages district level officers to improve rural development planning and monitoring systems. These relations now involve more than government alone. There are new players which have their own systems of hierarchy in place – for example, rural development programmes now involve the input of local NGOs which have their own structures of reporting and information systems. Similarly, there is a policy thrust towards the marketization of government services resulting in fragmentation of government information and services. For example, a citizen can obtain an application form for a government scheme from a privately-owned telecenter (such as an application form for obtaining assistance under rural development programmes) but the processing of that application and the monitoring of the assistance is still done by the government rural development agency responsible.

To date, however, there is little understanding of how the activities of the telecentre operator and the back-end development agency will coordinate their activities to achieve desired development objectives of providing assistance to citizens in order to help them generate income. Until such time as this coordination is addressed, district rural development agencies have sadly regressed in time to the earlier situation in which they had little input into local planning processes and little individual motivation to think beyond the routine implementation of targets set by higher authorities for a task as important to India as rural development.

The purpose of our brief analysis presented in this section has been to show how a consideration of the three assumptions: the nature of structure, individual level theories of action, and causality can potentially improve theorizing. A main hypothesis derived from earlier analysis was as follows: 'acceptance and usage of new technology derives from local administrators having the flexibility to direct technology according to their own needs'.

However this didn't tell us about the relationship that supported this flexibility, how the relationship had changed from earlier, and what aspect of the new relationship enabled increased flexibility. The adoption of our proposed model helps to explain what is going on and prompts us to focus on particular directions in future research. This has occurred by making explicit the identification of causal processes, the relationships which enable or constrain those processes, and the individual behavioral patterns that build those relationships. The origin of any of the outcomes observed is dependent on the formation and dynamics of relations between players. For example, at the beginning of the research, structural factors were overwhelmingly shaping the behavior of individuals. The central government wielded considerable power over the state government at the beginning of the research in the way it imposed the technology on the district administration. This imposition was short-lived because later on, the explanation of IT usage was driven to a greater extent by individual decision making within a social context that was conducive to individual experimentation and flexibility. There was a change in the behavior of the state administration and the consequent increase in empowerment of the district officers. Towards the third phase of the research, however, external influences on both central and state government have resulted in a high degree of mistrust between the district administration, private entrepreneurs, and NGOS. New channels of communication need to be established to help build relationships at this level.

Assumptions with respects to the three aspects of social theory we propose are implicit in all ongoing interpretive research in the ITD field. However, we argue that extracting out causal theories from the explanation is a useful process because this process has the potential to be applicable to other contexts. For example, our analysis enables us to provide two broad theories about the 'IT for rural development' effort ongoing in many developing countries. First, improvements in rural development through IT can only come about if local domain experts have the inclination to develop useful applications. Second, this inclination arises and survives over the long term when these officer experts have the requisite flexibility and support from the government.

In this paper, we have proposed a model for analysis which operates both at the wider societal level and at the level of individual human behavior. Such analyses are important and are made possible through efforts at studying ITD initiatives over the passage of time as recently identified by Walsham & Sahay (2006). They argue that while ITD analyses have typically focused on the wider context of the organization or society, issues of identity and individual behavior have so far been neglected. The purpose of our paper has therefore been to bridge this gap by recommending that for strengthening theoretical reflection in ITD research, the level and focus of analysis should be both multi-level and longitudinal.

4. Conclusion

There is a tendency for ITD research to be pigeon-holed into positivist or interpretivist camps. While these philosophical positions arguably represent different world views about the nature of reality, they also do not fully specify the nature of ontological assumptions about the world. The authors believe that a significant way to improve the quality and output of research is for a researcher to at least reflect on the three assumptions that are implicit in all social theory; structure, agency, and causality. Our case shows how structure can be constraining at one point in time, but that that this constraining influence can be enabling at a later point in time depending on the model of individual behavior and motivation. The causality we propose through this model is not a simplistic one based on empirical observation, but one which is based on an in-depth and long-term study of the underlying processes which prevail.

Such reflexivity has benefits. It helps clarify the object of research potentially improving the connection between the object of study and research methodology. It also has the ability to improve the communication of research across different paradigms. Grounding theories in essential ontological components of the world gives them a status that can be assessed from across the epistemological spectrum, as well as compared to other competing theories (Psillos, 1999).[10] Thus, despite working from within different paradigms, researchers may find common theoretical ground based upon a clarification of the nature of these three assumptions at work in any theory. In this way, through the explicit consideration of these assumptions, we may be able to break away from pigeon-holing our research into philosophical silos.

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[10] This does make the assumption that social science theories do correspond to (refer to) an existing reality in the world, and thus comparison across theories is possible through empirical testing and adjudication.

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E-GOVERNANCE SERVICES THROUGH MULTIPURPOSE TELECENTRES - MULTIPURPOSE FOR WHOM?

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Abstract: The last few years have seen the emergence of telecentres as a popular phenomenon in global development affairs. Given the context of governance reforms and the idea of outreach posts for service delivery and to bridge digital divide, telecentres have been seen as the ideal solution to bring together all these idea. Central to the concept of telecentres is its multipurpose nature. It is believed that since the technology is capable of delivering/providing multiple services, telecentres could be multipurpose service delivery centres. In the context of e-governance services, this offers the possibility of providing all e-governance services through one location. However, this simplistic technologically deterministic argument fails to see the complex nature of every service and the issues involved in integrating these services and delivering it over telecentres. The paper tries to highlight the issues involved in this assumption based on an empirical study of Akshaya telecentre project in Kerala.

Keywords: telecentre, multipurpose, integrated, e-governance, services

E-GOVERNANCE SERVICES THROUGH MULTIPURPOSE TELECENTRES - MULTIPURPOSE FOR WHOM?

1. INTRODUCTION

Telecentres are today considered as a phenomenon in international development efforts. They are often referred to as multi-purpose community ICT access centres offering e-governance, e-commerce and other ICT services. The multipurpose nature of telecentres is ascribed more in terms of the 'objectified' nature of technology rather than a deeper understanding about the various dimensions of it. Moreover, the possibility that non-state actor owned telecentres can offer a range of e-governance services in an integrated manner fascinates many governments. The fascination needs to be viewed in the context of the neo-liberal reform programmes being attempted in most of the developing countries.

The paper hence takes a broader look at issues pertaining to governance and e-governance in the context of telecentres. The paper specifically discusses the problematic nature of service integration that is fundamental to the idea of multipurpose nature. The findings are based on a case study of Akshaya telecentre project in the south Indian state of Kerala.

The next section discusses some of the key ideas in the literature on governance, e-governance, and telecentres. The section that follows will highlight the details of the case study. This will be followed by analysis and discussion sections.

2. GOVERNANCE

Discussions on public governance in the past two centuries have centred primarily on the nation state and the government. Public administration in modern states was bureaucratised with a view to provide multiple and varied governmental services. The bureaucratic form of organisation is both the outcome of the wider social and cultural orientations of modernity as well as a major agent for institutionally embedding these orientations (Luhmann 1982, 1995; Gellner 1983, 1996; Sayer 1991; Kallinikos 2004). Weber (1922, 1968) considered bureaucracy as a technology of control that acted through its structuring of information into cases and channels, its strict reliance on impersonal relations, and inevitable tendency towards rationalisation. He described the characteristics of bureaucracy as hierarchy of authority, impersonality, written rules of conduct, promotion based on achievement and specialised division of labour and efficiency. Weber considered the development of bureaucracy as a response to needs of the industrial revolution for operation and expansion of large-scale enterprises in both the public and private sectors of modern societies (Aron 1970; Coser 1977). The institutionalisation of expectations and action patterns coinciding with rule-bound behaviour were seen as an essential means for avoiding haphazard initiatives and opportunism, and improving the performance of public organisations (Kallinikos 2004).

However, the bureaucratic model of state in practice was seen by many as a system that was static and unable to adapt to the dynamic changes in the environment. It was attacked for inefficiency, corruption, concentration of power, misuse of power, poor decision-making, political interference, job dissatisfaction, organisational conflict, difficulty in measuring performance & holding public officials accountable (Thompson 1965; Rossel 1971; Sorensen & Sorensen 1974; Perry & Kraemer 1983; Boisot and Child 1988; Hood 1991; Mitchell & Simmons 1994; Gregory 1999). The underlying argument is that, like many other institutions, structures and processes are often maintained and sustained by powerful myths and ceremonies, without necessarily evaluating the results of their action (Meyer & Rowan 1991). However, as Kallinikos (2006) points out, the aura of negative predispositions that has

engulfed bureaucratic regulations is despite the crucial and inescapable implications of bureaucracy in modern life and its contribution to the predictable and accountable ways underlying the operations of political and economic institutions in modernity.

In the last century, it was considered as a great achievement that the machinery of government could be organised in several different ways according to the functions that are required to deliver services; broad groups of clients at which services are aimed or geographical areas in which they are delivered (Haldane 1918; Self 1977). However, it is to this fundamental and cherished characteristic that many of the ills are now being ascribed (Bellamy 1999). One of the major arguments by opponents of the bureaucratic form is that governments are neither horizontally (departmentalism) nor vertically (multiple service delivery points) integrated or 'joined-up' (Bellamy 1999).

The decades of the 1980s and 1990s witnessed the decline of the Weberian bureaucratic model as the dominant model of state and the systematic introduction of a series of administrative reforms in western governments. These reforms were brought under the neo-liberalist ideology of New Public Management (NPM) incorporating concepts such as efficiency, marketisation, accountability and decentralisation (Weiss & Barton 1976; Flynn & Strehl 1996; Hodge 1996). Administrative reforms programmes under the same framework were later attempted in most developing countries. In fact, public administration in most developing countries has always been imitative rather than indigenous (Avgerou 1990).

The reforms gave an increased opportunity for many non-state actors to play a major role in the governance of a region. The increasing participation of non-state actors have been acknowledged by a new concept called 'governance network' - a network that consists of the public sector (state), private sector and civil society, undertaking the tasks of coordination, competition and cooperation respectively (Pierre & Peters 2000; UNCHS 2001; Robinson et. al. 2000). The forces of globalization and ICT, especially Internet, is said to have facilitated the formation of coalitions and networks from the bottom up, thereby linking the global and local processes and effectively blurring the traditional assignment of roles (UNCHS 2001). Researchers have used the term "hollow state" to denote that government increasingly takes place in the private and non-profit sectors (Fountain 2001; Milward 1996; Milward & Provan 1993).

3. E-GOVERNANCE AND INTEGRATION

Governance reforms are currently attempted through the introduction of e-governance projects with the stated aim of improving the efficiency and effectiveness of public services (Ciborra 2003). E-governance is hence generally discussed in the background of the good governance[1] argument associated with the principles of NPM (Heeks 2001). Considering the 'constraints' of the bureaucratic state and the 'possibilities' of the new technology, it was felt that the new technology will enable governments to break down departmental silos, streamline bureaucracy and integrate services – "that it will create public services that work better and cost less" (Gore 1993). The assumption that ICTs could be harnessed to these ends derives from an approach to IT-led business strategy put forward in the closely related literatures on value adding supply chains and business process reengineering (Bellamy 1999). E-governance, initially in developed countries and later in many developing countries were hence often attempted through introduction of models and practices from business

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[1] According to Okot-Uma (2003), good governance can be defined as comprising the processes and structures that guide political and socio-economic relationships, with particular reference to 'commitment to democratic values, norms and practices; trusted services; and to just and honest business'

management (Fountain 2001; Heeks 1999). The conceptual shift whereby citizens are increasingly treated as customers[2] should be seen in this light (Ciborra 2003;Fountain 2001).

It is today seen as a major achievement of governments if the citizen services in the country/region have a high degree of customer orientation. Lee, Tan, & Trimi (2005) takes the view that e-governance categories have direct *counterparts* in the business world, as shown in table 1.

E-government category	Business metaphor	Description	Sub-category	Example practice
Government to citizens (G2C)	Customer Relationship Management (CRM)	Providing opportunities for greater citizen access to and interaction with the government	Managerial interaction	Government's informational Web sites
			Consultative interaction	E-voting, instant opinion polling
Government to businesses (G2B)		Seeking to more effectively work with businesses	Businesses as suppliers of goods or services	Government's e-procurement
			Businesses as regulated economic sectors	Electronic filing with various government agencies
Government to government (G2G)	Supply Chain Management (SCM)	Enabling government agencies at different levels to work more easily together	Vertical integration	Sharing a database among agencies within the similar functional walls but across different levels of government
			Horizontal integration	Sharing a database among agencies at the similar levels of government but across different functions
Government internal efficiency and effectiveness (IEE)	Enterprise Resource Planning (ERP)	Focusing on internal efficiency and effectiveness	Government to employee	Web-based payroll/health benefits system
			Integrating internal systems	Implementing ERP-like systems to integrate different functions within a single agency
Overarching infrastructure (Cross-cutting)	Enterprise Application Integration (E AI)	Facilitating the interoperability across different practices	Hardware and software interoperability	Public-key Infrastructure interoperability
			Authentication	e-Authentication across different e-government initiatives

Source: Adapted from Lee, Tan, & Trimi (2005)

Table 1. E-government practice categories.

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[2] For problems associated with this, please see Ciborra (2003)

The concept of integration of service could also be traced back to the literature on business process reengineering and the growing focus on the client service interface. The basic business logic employed is that formal organisational boundaries should be regarded as increasingly permeable as information begins to flow more freely between services, their suppliers and their clients (Davidow & Malone 1992; Lipnack & Stamps 1993). This idea is further highlighted by writers like Venkatramen (1991:141) & Srivatsan (2004) who believe that the organisations of the future will be virtual organisations that embrace tasks both within and outside the formal boundaries of the focal organisation.

Some writers (Ranerup 1999; Heeks 2001) have ascribed a particular logic according to which ICT is first used for e-administration (using ICT to improve administrative efficiency along the lines of neo-liberal NPM ideology) and e-services (using ICT to improve the delivery of routine services to citizens) and finally for e-democracy/e-society (using ICT to promote socio-economic activity). A similar evolutionary concept, with focus on integration was developed by Layne & Lee (2001), which consists of four stages cataloging, transaction, vertical integration, and horizontal integration (Figure 1). The idea of horizontal integration (cross-departmental) and vertical integration (supply chain) are borrowed from the business domain where such integration is expected to provide value added services to clients (Bellamy 1999).
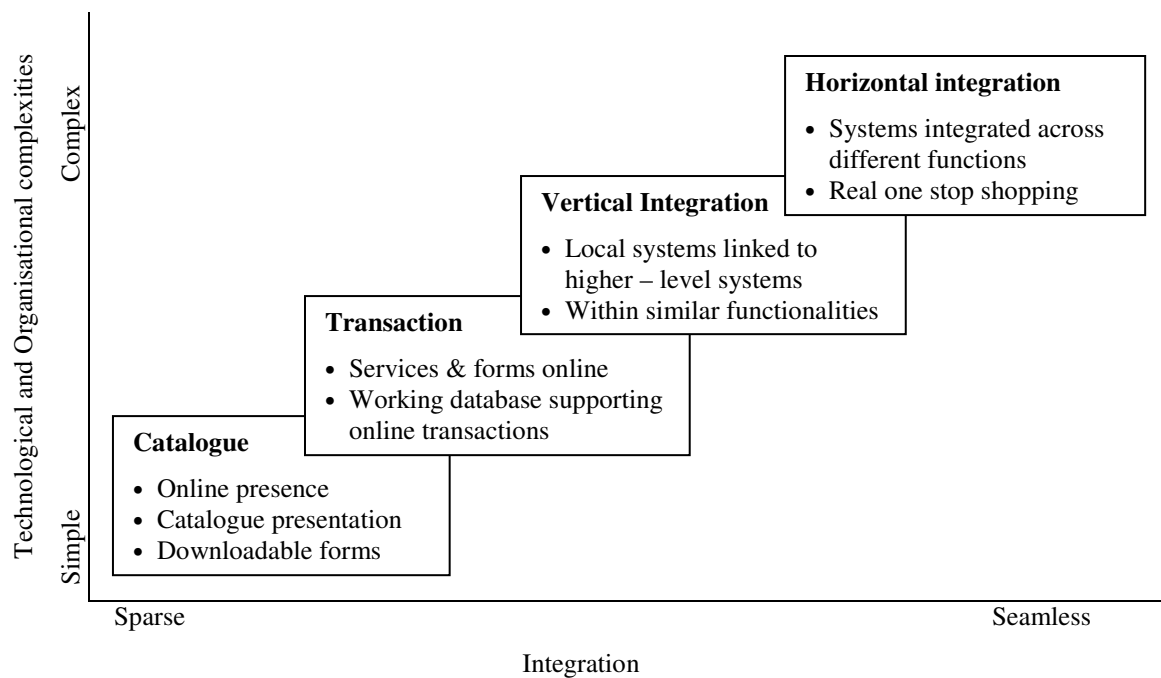
Source: Adapted from Layne & Lee (2001).

Figure 1. Dimensions and stages of e-government development

E-government progress, however, does not necessarily follow such a linear path (Lee, Tan, & Trimi 2005). One important outcome of the marriage of IS implementation in government, principles of NPM and the large expectations about ICT is that there is an increasing emphasis on integrated e-governance service delivery over an ICT front-end even before any meaningful activity is undertaken in the backend (Heeks 2001; Madon & Kiran 2002). These front-end initiatives themselves do not reduce the lack of interoperability in the back-end, in spite of the fact that a few of them are citizen friendly (Westholm 2005).

Given the context of NPM and the nature of technology, it became possible to locate service centres closer to citizens/business as well as partnering with non-state actors for service delivery. The service centres could consist of an unattended kiosk in a government agency, a service kiosk located close to the citizen, or the use of a personal computer in the home or office (World Bank website[3]). The emphases on integrated service delivery lead many governments to create integrated citizen service portals (e.g. Singapore government[4], UK government[5], US government[6], etc.). However, in the context of most developing countries, governments do not provide such centres in large numbers and there also exits a disparity in the diffusion and use of ICT, referred to as the 'digital divide[7.] By providing access to Internet and a range of services including government services, telecentres are supposed to bridge this digital divide and play a role in the governance and development of the region.

Though the success and effectiveness of e-governance and such interventions in developing countries is debatable (Polidano 1999; Avgerou & Walsham 2000), most developing countries have prioritised the use of ICT in different sectors and especially in government also in the light of the argument that ICT offers lower-income countries the chance to "leapfrog" stages of traditional development through technological advancements and that it will lead to the achievement of good governance goals (World Bank 1999; Eggleston et al. 2002, Heeks 2001; Okot-Uma 2003; Prattipathi 2003). Studies have revealed that the development of computer based information systems in developing countries are hindered by organisational, cultural and other institutional factors in most developing countries (Avgerou 1990). Madon (1993) also point to the importance of the social, political, cultural and organisational factors that prevail in the environment and the way in which these factors interact with the process of technology adoption. It can be inferred at this stage that availing e-governance services from 'one-stop shop' is inherently problematic in the case of developing countries.

Many writers argue that citizen adoption of online government services has not yet completely materialised even in developed countries and that it has fallen short of its potential to transform service delivery (Warkentin et.al 2002; West 2004). Studies by Carter & Belanger (2005), Kiran (2006) and Warkentin et. al (2002) reveal that trustworthiness is a significant indicators of citizens' intention to use web based e-governance services and that this varies across different services. The issue of trust and trustworthiness adds another level of difficulty to the use of integrated e-governance services apart from the issue of institutions pointed out by Bellamy(1999).

4. TELECENTRES

It is no surprise that telecentres have suddenly become a phenomenon in international development efforts and occupy centre-stage in much of the current ICT4D policy and

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[3] Please see http://www1.worldbank.org/publicsector/egov/definition.htm

[4] Please see http://www.ecitizen.gov.sg/

[5] Please see http://www.direct.gov.uk/

[6] Please see http://www.fedworld.gov/

[7] Digital divide refers to the vast difference in terms of access to ICT facilities that exist between various groups of people. Access not only means physical access but also refers to other factors that facilitate access like affordability, content, gender, socio-political situations, etc. For example, DiMaggio & Hargittai (2001) suggests five dimensions along which divides may exist: (1) technical means (software, hardware, connectivity quality); (2) autonomy of use (location of access, freedom to use the medium for one's preferred activities); (3) use patterns (types of uses of the Internet); (4) social support networks (availability of others one can turn to for assistance with use, size of networks to encourage use); and, (5) skill (one's ability to use the medium effectively).

academic discourses regarding their developmental potential (Madon 2005). One could argue that telecentres have its theoretical strands in the new ideas of development, networked governance, NPM and its business process reengineering/integration concepts and in the deterministic stand about the role of ICT in development. The global enthusiasm for telecentres is best captured in the European parliament's document on developing countries and the ICT revolution (Final Study working document for the STOA Panel 2001).

The document says "Telecentres are today considered one of the most successful means to promote ICT diffusion in the developing countries. They increase the access of people to ICT, particularly the poor and people living in remote rural areas. The telecentres help local communities improve their business performance: they allow the local enterprises (agricultural co-operatives, handicraft industries, artisans, shops, garages and tourist facilities) to access to accurate market and pricing information. Through the Internet and other information transmission systems they can become aware of new market opportunities and also benefit from the training and access to the knowledge network provided by the telecentres. Farmers can also access current meteorological reports, information about the spread of animal and plant diseases, pests and their control. In the low-income areas the shared cost solution of a telecentre is probably the only viable option to provide diffused ICT access. Moreover, telecentres are maybe the best resource to involve the local private sector and induce people to invest in ICT development".

Considering the multi-tasking characteristics as well as the integrated services possibilities of the technology, telecentres are generally believed to operate as multi-purpose community ICT access centres which offer a set of services including e-governance services, e-commerce and other ICT services (Proenza et al. 2001). The 'business models' behind the telecentres were built on the assumption that every identified service will be a revenue source and that total revenue will make the centres financially viable.

What has, however, emerged from various telecentre studies is that the sustainability of telecentres, in general and specific services in particular are heavily dependent on many factors associated with the context (IDRC 2003; Kyabwe & Kibombo 1999; Baron 1999; Benjamin & Dahms 1999; MSSRF 2003, Proenza 2002). Studies undertaken in various parts of the world have shown that the socio- economic, political and governance issues affect the operation of telecentres. Important studies in this regard include the studies undertaken by Roman & Colle (2002), IDRC between 2000 and 2001, reported in the Acacia conference report (IDRC 2003), M S Swaminathan foundation in India (MSSRF 2003), Baron (1999) in Bogota, Kyabwe & Kibombo (1999) in Uganda,. Latin America's Somos@Telecentros Network[8], Batchelor S et al (2003), based on 12 detailed case studies undertaken in El Salvador, Caribbean Islands, Uganda, South Africa, India, Kenya, Ghana, China, Cambodia and Honduras, Suzuki & Chamala (1998) in Australia, Pigato (2001) in sub-saharan Africa and South Asia, Kenny (2002) in South Africa, Robinson (2000) in Mexico. According to a United Nations Development Program document (UNDP 2001), numerous telecentre studies report non-use of services by the targeted local population due to the lack of understandable and relevant content.

The issues identified include finance related issues, skill related issues, content related issues, technical/connectivity related issues, etc. One important issue pertains to the issue of trust.

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[8] Please see http://www.tele-centros.org/

Kiran (2006) points to the numerous layers of trust coming between the user and the technology. Drawing on Giddens's (1990) notion of 'abstract systems', it is argued that social institutions, and more particularly trust between citizens and intermediaries are extremely important in the realization of e-governance services through telecentres. This argument highlights the difficulty in integrating services telecentres.

What most telecentre studies reveal is that while the 'technology' is seen to have the potential of integration both in the back-end as well as front-end delivery, it is the context that determines what services are feasible. The provision of multiple services through a single site to attract a large rural clientele and enhance financial viability has been a cornerstone of ITU's idea of Multipurpose Community Telecenters (Ernberg1998). The financial viability in this way has proven elusive in practice (Proenza 2002). In fact, even in those cases where such centers seem to sustaining, it is observed that these centers survive on account of one core service or a dominant service and not on account of multiple services (Parthasarathy, Kiran et. al. 2006).

5. METHODOLOGY

Case study of a large telecentre project was undertaken to understand the issue of integration affecting e-governance services. Akshaya telecentre project is a project undertaken with direct involvement of a state government and had the idea of integrated e-governance services delivery as one of its major objectives. The project was implemented in the south Indian state of Kerala, which is treated in international development literature as a unique case in terms of its development achievements. The study adopted an explanatory single-case embedded design (Yin (2003), considering the overall uniqueness of the case. Multiple data collection methods were employed for the study (Yin 2003; Benbasat et. al. 1987). The data sources included documents, archival records, interviews, direct observations, and participant-observations.

Interviews were the most important source of information for the study. Guided conversations taking the form of semi-structured interviews were conducted. The researcher has had direct association with the project and this helped in terms of gaining access to the project team and compiling a list of people to be interviewed. Interviews were held with political leaders and bureaucrats at the state and district levels, entrepreneurs, people under the 'foot print' of telecentres, elected representatives of local bodies, officers of the Kerala State IT Mission (KSITM) which is the agency under the state Information Technology Department, government officers attached to utility departments and government officers attached to e-governance services delivery projects and users of the other selected e-governance projects. Table 2 gives the details of the number of interviews conducted in the field.

No.	Category of people interviewed	Number
1.	Political leaders at state level	4
2.	Political leaders at district level	3
3.	Bureaucrats at the state level	7
4.	Bureaucrats at the district level	2
5.	Akshaya Entrepreneurs	83
6.	People under the 'foot print' of telecentres	64
7.	Elected representatives of local bodies	26
8.	Officers of KSITM	

	Trivandrum Office	10
	Project Office	5
9.	Government officers attached to e-governance services delivery projects.	15
	Total	219

Table 2. Interview list

The interviews ranged in its conduct from adhering to relatively formal semi-structured interviews to ad-hoc ones. While most of the formal interviews took an average of about 75 minutes, the less formal/ad-hoc interviews were done over a few minutes, mostly between other activities. Interviews with the District Collector; Secretary (Information Technology); Vice-president, district panchayath; District Coordinator and 12 entrepreneurs were held more than once, basically with a view to corroborate the evidence collected. The data collection was guided by Yin's idea of 'levels of questions' (Yin 2003:74-75). Hence occasionally, statements were made to trigger a conversation and let the interviewee speak for themselves, but with the idea that the verbal line of enquiry is different from the mental line of enquiry. All the interviews were made face to face though follow up interviews were made using telephone and e-mail. Case notes were taken at the time or written immediately afterwards. Special care was taken to further regroup the ideas that emerged from the interviews to reflect upon them and to use them for guiding and examining further evidence. A total of 208 telecentres were visited during the course of the study.

6. CASE STUDY

As mentioned earlier, Akshaya is a unique telecentre project implemented in Malappuram district of Kerala (see Kiran 2005; 2006 for a detailed case study). Launched in November 2002, this project was conceived with the idea of bridging the digital divide by simultaneously addressing issues of ICT access, skill and content. The project is a key component in the e-governance roadmap of the state. In the initial phase, one person from every family in the district was targeted to receive functional ICT skills. 630 centres (kiosks) owned and run by entrepreneurs were started in the district as part of the project. Digital content pertaining to healthcare, agriculture, education and legal issues was created in the local language for the project. The project has one of the largest wireless IP based external networks in the world.

Originating from a proposal of the district panchayath (district level local body) of Malappuram for 100% district wide e-literacy training, the project was converted into a comprehensive telecentre project by KSITM. Kerala was attempting to 'modernize' the government9 in line with the philosophy of NPM, with financial support from the Asian Development. It was also undertaking a series of e-governance activities (Madon 2005). It was felt that the telecentres with private ownership can be a very viable outreach post for the e-governance services. The project is viewed both as the key front-end e-governance infrastructure that is to be integrated with the ongoing backend e-governance projects and also as the data capture points for the government's management information system. Based on earlier experiences within the state, and that of similar projects elsewhere officers in KSITM felt that, apart from functional ICT literacy, cheaper accessibility options and availability of local content were essential for the long-term sustainability of such a project. Moreover, the project team felt that demand (usage) and supply (content) markets functioned sub-optimally,

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[9] Modernizing Government Programme (MGP) - www.keralamgp.org

and that the state had to intervene to create critical mass of users and content so that markets can operate in the long run. This was attempted by creating a critical number of ICT access centres, a critical mass of users (through the literacy programme) and a critical mass of locally relevant content. The project thus involved (a) setting up of multi-purpose community technology centres/ telecentres, one each for approximately 1000 families, (b) making at least one person in every family functionally ICT literate, and (c) creation of relevant local content (health, education, health, etc.). The project implementation was spearheaded by KSITM, along with local governments. They were supported by the local and national level private sector firms and local civil society organisations. It was 415 centres were surviving after two and half years and were primarily offering training, payment facilities, Internet browsing, E-mailing and some other IT services. The service delivery model of Akshaya is based on five core services offered by all Akshaya centres (Akshaya website[10]), eight industry related services offered by selected clusters of Akshaya Centres and five services to maintain good relation with community. Delivering e-governance services is one of the core services.

6. a. E-governance services

6.a.i. Electronic payment to Government - E-PAYMeNT.

This is on of the more successful e-governance services. After the successful completion of e-literacy training, extension of FRIENDS[11] payment services has been initiated through Akshaya Centres. KSITM developed an online transaction platform with State Bank of India as the Banking Solution Provider. Akshaya Centres in Malappuram are now collecting bills of Kerala State Electricity Board and BSNL through Akshaya Centres. Akshaya e Pay collections have crossed a collection of Rs.80 million in two years. The monthly collection is about 6 million from about 16,000 transactions. The service is successful on account of a number of factors including characteristic of the service (repeated), trust in the local entrepreneur as well as the institutions associated (Kiran 2006), etc. However, the service has been strongly opposed by employees pertaining to the participating departments. The success of the service has also drawn many players including private companies and MNCs who are trying to get profiles of subscribers who pay a particular amount and above with a view to target their messages on them. The payment system has however not been able to add more services in the last two years since they started primarily on account of interoperability issues, that are not purely technical in nature but is on account of the politics of bureaucracy.

6.a.ii Development Content

All the centres are provided CD ROMs containing locally relevant content in the local language. The content was prepared through a laborious process of technical vetting and field level testing. Contents pertaining to healthcare, education, legal aspects and agriculture is available. However, the study revealed that not many of the people are using this service. Attempts to link the Agricultural department's project for agro-advisory services also did not work. As note in Kiran (2006), one of the primary reasons is the issue of trust and need for institutional identity of the intermediary. Apart from that the situation is also on account of the lack of coordination and involvement of the domain department. Moreover the characteristic of the service, described later, is also another reason why its delivery over the telecentre is difficult. Providing various forms and helping applicants fill these forms are the

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[10] www.akshaya.net
[11] See Madon & Kiran (2002) for details about FRIENDS.

only activity that can even remotely be referred to as 'information' oriented e-government service.

6.a.iii Entitlements and Certificates

No such service based on IT platform is currently operation in the telecentre. One major reason is the lack of coordination in the backend. Issues of institutional trust is again an important reason. However, one could, from the payment case see the possibility of privacy issues creating huge issues on this front.

5. ANALYSIS

The case study identifies the difficulties in actual implementation of the 'integrated services'. The issues vary from the difference between the various e-governance services, that are often considered as 'homogeneous'. The problems of integration of services begin with the effort to channelise the front end to a common delivery point, forgetting the complex web of actors and institutions that sustain the service. The major issues affecting integration identified by the study are given below.

a.   Nature of E-governance services

It is seen that there to analytically differentiate the various e-governance services to citizens since this distinction has important implications on the way services are delivered over a telecentre. The concept of e-governance services is deconstructed against the construct of integration. This framework differentiates all major direct government to citizen interactions that can be ICT enabled and offered over telecentres into (a) making payments, (b) getting entitlements, (c) getting & providing information and grievance redressal. While making payments is a highly repetitive interaction, getting entitlements is less repetitive and seeking information has an uncertain degree of regularity. The regularity of interactions is critical from the point of view of interactions as well as the familiarity with systems and procedures. For example, since payments necessitate regular interaction, citizens can over a period of few months understand their role in the payment system. This reduces the need for an intermediary. However, with entitlements like birth certificates or land records, which happens once or twice in a life time for most citizens, the citizens have very little knowledge about the way the system works as well as their particular role in the process. Hence ordinary citizens use the expertise of intermediaries (referred to as agents), who is usually from outside the formal state mechanism in most developing countries.

When importance of the service is analysed, entitlements are considered more important by citizens in their life than making payments. The kind of information being sought would determine the importance assigned to getting that information. The three processes also differ over the need for undertaking backend process changes as well as ICT adoption before attempting to provide front-end services. A first level unpacking of telecentres is represented in figure 2.
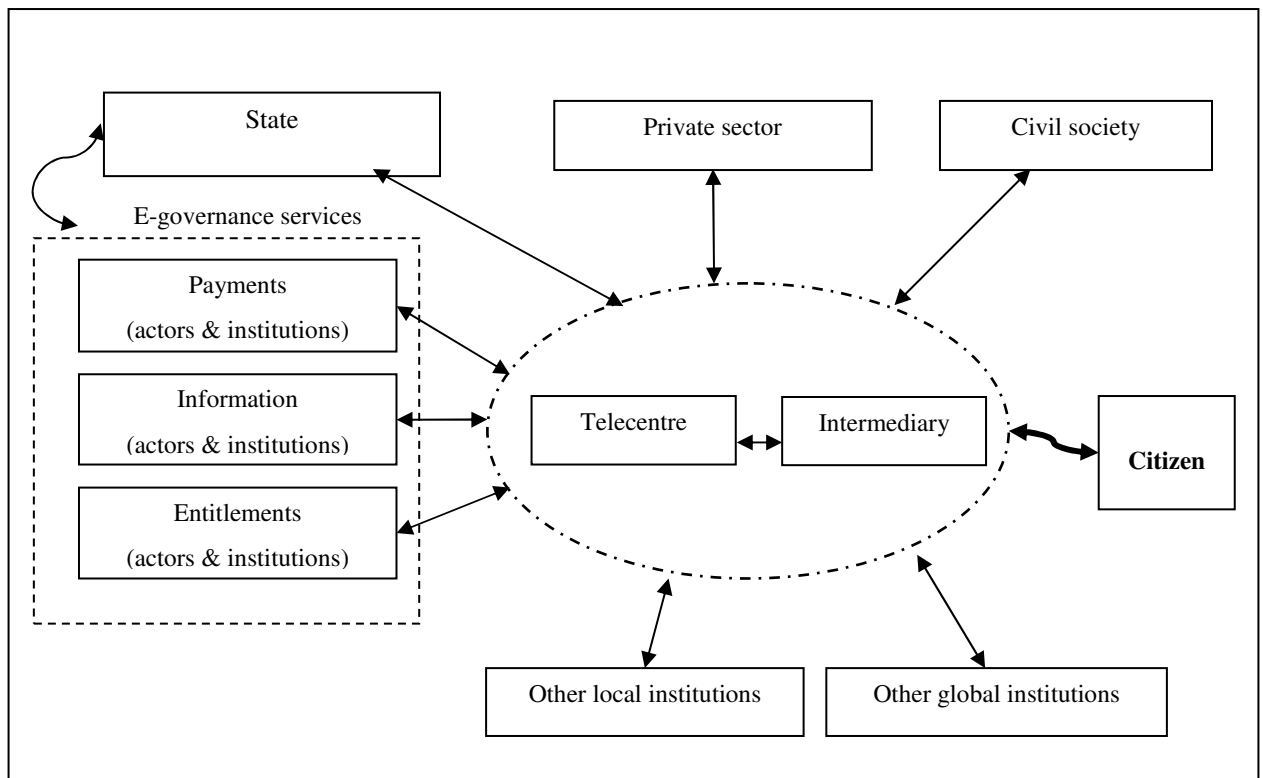
Figure 2: The first level *unpacking* of telecentres

b. Trust

The study reinforces the importance that IS literature, drawing on the experience in e-commerce and other ICT applications, has given to aspects of trust in ICT-mediated communication and transactions. Ihe studies have suggested that trust depends on perceptions regarding technology (Johnson 1997; Chopra & Wallace 2003; Carter & Belanger 2005; Salam et. al. 2005), trust regarding the information/service provided (Chopra & Wallace 2003), trust on the sources like vendors, electronic communities or government (Carter & Belanger 2005; Shinnie & Mullen, 2001; Chopra & Wallace 2003) and institutional mechanisms that safeguard integrity of transactions (McKnight et al. 2002; Pavlou & Gefen 2004; Warkentin et al. 2002). Kiran (2006), drawing on Giddens (1990), questions the simplistic notion of trust in the 'local' intermediary and has shown how institutional trust and trust in abstract systems affect the way services can be delivered. His argument is that different services require different intermediaries and so the single 'local' intermediary will not be enough to provide a range of services. This is because the 'access point[12]' to various services are different. Hence even if it is possible to technically integrate many services in the telecentre, users will not avail the service because of a lack of institutional/thin trust (Kiran 2006; Giddens 1990).

c. Interoperability and privacy

Interoperability and privacy are two major issues associated with integration of services. Hjort-Madsen (2006) has shown that interoperability is not just a technical issue and that economic and political factors are just as important when implementing enterprise architecture programs in government. During the study it was seen that there was no attempt at the state level to coordinate the different information systems initiatives[13] in various

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[12] Access point is the human face of a professional institution. While doctors are the access point to the institution of medicine, agricultural professionals are the access point to the institution of modern agricultural practices.

[13] The attempt has been limited to unsuccessful attempts at trying to focus on technological integration alone.

government departments. The coalition government structure as well as the lack of any immediate political incentives to share data and business functionality with other organizations seemed to impede any possibility of interoperability and integration. Moreover, as pointed out by Westholm (2005), on account of the governance network and the resultant outsourcing of public services and tasks to the private and civic sector, the issue of interoperability is even more complicated as it has now becomes a question of interoperability between different agencies or divisions in all three sectors.

Among the many privacy related issues, two major ones were highlighted above. On account of the way in which e-literacy was carried out, it is easy for most entrepreneurs to collect very detailed family level/individual level information, with out any understanding about the serious privacy issues involved. The issue of privacy becomes even more complex with increase in services and data being captured at the telecentre. As shown already many private companies including MNCs are interested in getting household as well individual data from the telecentres based on the activities that they undertake in the telecentre. In fact, in many telecentre projects, this is highlighted as a possible source of income and is part of the 'business model' of the telecentres.

d. Legal

Government services are embedded in a complex web of legal institutions (Bellamy 1999). Hence integrating services and providing them over a one stop centre is extremely complex. The complexities associated with the back end processes are explained by Bellamy (1999). However, there are legal issues at the point of delivery as well. In the case study it was seen that in spite of the possibility of making payments over the net through telecentres, many of the government related payments were not possible on account of legal reasons. The motor vehicle tax cannot be paid through the telecentre since the receipt will have to mandatory be endorsed by an officer of the department. Similarly local body taxes cannot be collected since the act prohibits collection by any one outside the parent department. Most often changes in law are cited as the easy solution to the problem. However the legal structures as well as the complex web of inter related issues including the interplay of politics and power in countries like India make such changes as well as integration difficult to achieve.

e. Cultural

Singapore is on country that is often highlighted as a success story for integrated services. With a culture of high collectivism and royal civil servants, it is easier for Singapore to call on agencies to comply with the e-government blueprint and carry out policies set by the top leadership and therefore lessons learned from Singapore in coordinating agencies and pushing for seamless e-government may not be applicable to countries with an entrenched culture of high individualism (Ke & Wei 2004). This is true in a different way for countries like India, as pointed out by Walsham and Sahay (1999). Drawing on the religious-cultural dimension they argue how rigid functionality and uncoordinated action is sustained as a practice in India especially in the context of Indian bureaucracy. It is hence extremely difficult in the case of India and Indian bureaucracy to see any meaning sense of purpose in integrating activities or services.

6. DISCUSSION & CONCLUSION

The study has questioned the simplistic notion of 'multipurpose' telecentre. It is multipurpose because of the idea that the technology has the potential to provide multiple services. The study has shown that this does not necessarily happen on account of a number of reasons. The study has shown that the nature of e-governance services cannot be treated as a homogeneous

group instead they need to classified based on certain characteristics. It is also shown that trust is an important factor to be considered in cases of service delivery and that multiple services would require multiple intermediaries with multiple institutional memberships to be simultaneously present in the telecentre for providing multiple services. The study also shows highlights issues of interoperability as well as privacy associated with the notion of integration of services. The study also shows how the contextual cultural factors affect the way integration is affected.

The enrollment of other actors in networks surrounding the technology requires that these actors adopt attitudes and actions congruent with those of the interests inscribed in the technology (Walsham & Sahay 1999). What is evident from the study is that this alignment does not seem to happen in the case of telecentres. If the multipurpose nature is on account of the technology and its 'objectified' properties, one is forced to ask the question: Multipurpose- for whom?

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Software Exports Development in Costa Rica: Contradictions and the Potential for Change

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Abstract

Software industry development is acknowledged as an important engine of economic growth for many developing countries. The role of national policy has been identified as a catalyst to software industry and software exports development. Academic and practitioner frameworks have emerged to guide policymakers to the factors that are critical to success. This paper adopts an institutional theory perspective on the strategy making and implementation process and examines how historically rooted taken for granted assumptions limit the possible courses of action and also may simultaneously open up new opportunities. Certain complexities and contradictions are highlighted through a longitudinal case study of Costa Rica where there is an ongoing strategic planning effort to increase software exports. Key findings from the research are related to the limitations of critical success factors type frameworks and improving our understanding of how software exports policy is influenced by local, emergent institutions which have been shaped by particular historical circumstances.

Software Exports Development in Costa Rica: Contradictions and the Potential for Change

1. Introduction

Software industry development is an important enabler of economic growth (al-Jaghoub 2004, Heeks and Nicholson 2004, Kambhampati 2002) thus policymakers and other stakeholders in many emerging countries such as Costa Rica, Jordan, Vietnam have become actively interested in developing their country's software industry sector, particularly exports (Al-Jaghoub 2004, Carmel 2003, Duong 2004, Paus 2005). The success of India and Ireland have contributed to this intense growth in interest in boosting exports, especially India which has experienced a spectacular growth over nearly the last two decades. According to NASSCOM (National Association of Software and Service Companies) in India, the combined software development (IT) and IT Enabled Services (ITES: call centres, accounting services etc) sectors revenues were $36.3 billion during 2005-06, up from $28.4 billion in 2004-05, reflecting a growth of 28 per cent. The Indian IT-ITES sector contributed 4.8 per cent to GDP in the financial year 2005-06. Similarly, in Ireland there was more than a doubling of numbers of software firms (291 to 690) during the nineties, with significant implications for employment generation. According to NASSCOM, the Indian outsourcing industry is in 2006 reported to employ one million. The growth in the software sector in India has contributed to productivity spillovers in other service companies and beneficial demonstration effects to other sectors (Arora et al 2001, Nasscom 2006). Although many new entrant countries are attempting to become the "next India" in software and services exports, this must be considered along with other development priorities (such as water, sanitation etc.) and the potential of alternative clusters as contributors to economic development. India's software export story is not all good news, for instance an export orientation in India has led to an underserved domestic market. Also, the global software and services market is highly dynamic and increasingly competitive with many new and emerging players in cheap labour countries where vendors are hungry for work and quickly developing technical and language capabilities. Volatility in the global market for software and services was most spectacularly demonstrated in 2001 when around 100,000 Indian programmers were "benched" largely as a result of a USA economic downturn.

When examining those countries that already engage in software exports, the role of national policy has been identified as an important driver of the software industry and exports development in both developing (e.g. India (Kambhampati 2002)) and developed (e.g. Finland (Ein Dor et al 2001)) country contexts. Duong (2004) describes how the many favourable policies, such as tax exemptions adopted by the Vietnamese government have had beneficial implications for the software industry in areas such as human resource development, telecommunication infrastructure, IT investment and Intellectual Property Rights (IPR) protection.

Policy formulation is concerned with developing and strengthening an interconnected network of organisations, people, infrastructure, legislation, markets and finance Policy frameworks have contributed to shaping industry trajectories, for example the focus on products in Israel, on Foreign Direct Investments (FDI) in Ireland and on software services in India (Heeks and Nicholson 2004). While previous studies have focused primarily on a post-hoc analysis of the impacts of policy measures (e.g. al-Jaghoub 2004), there has been limited analysis of ongoing processes through which policy measures are constructed and implemented.

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The aim of this paper is thus to improve our understanding of the institutional processes, their formulation and influences on national software exports strategy formulation and implementation in the context of developing countries. The central research question guiding our study is how do institutional influences create or impede the potential for change in the industry? An empirical study of the Costa Rican national software exports strategy formulation and implementation forms the setting for this inquiry.

The paper is organised as follows: we begin with a theoretical discussion drawn from institutional theory. This is followed by a description of the methodology, analysis and conclusions.

2. Theoretical framework

The theoretical perspective drawn upon in our analysis of national software exports strategy formulation and implementation derives from institutional theory (North 1990, Powell and DiMaggio 1991). This theoretical frame has wide acceptance as a valuable theoretical lens in relation to ICT and development (eg Avgerou 2003, Silva and Figueroa 2002). A good example is shown in Silva and Figueroa's (2002) paper that draws upon an institutional lens in relation to ICT policy in Chile to examine why some policies achieve their objectives while some others may not. Given the very wide diverse and fragmented ways in which institutional theory has evolved and been used over the years within organization studies and the social sciences, a key challenge confronting researchers is the apparent lack of a central frame of theoretical reference and set of concepts. For the purposes of this paper, we draw most closely on the work of North (1990), Powell and DiMaggio (1991) and Sautet (2005), as arguably their works provide useful insights to understand the key tenets of the theory in relation to institutional change and practical concerns of effective policymaking in developing countries.

Institutions represent the rules and norms that individuals follow in their daily lives or in the words of Douglass North (1990), "the rules of the game in a society….the humanly derived constraints that shape interaction" (p3). Institutions can take the form of formal or informal rules, for example the formal constitution of a country, or the socially accepted norms of behaviour towards the elderly in a particular society. Institutions only affect behaviour when they are enforced, formally when rules are infringed such as a fine for speeding, or informally, such as a sneer towards someone who is disrespectful to an elderly person. Where there is limited or no overlap between formal and informal rules, informal rules tend to take priority in shaping behaviour. There are always costs of conducting formal enforcements which increase as the overlap between formal and informal rules shrinks. Thus the smaller the overlap, the more difficult it will be for policymakers to influence individual behaviour, with higher enforcement costs. A schematic describing this logic is presented in Figure 1 below.
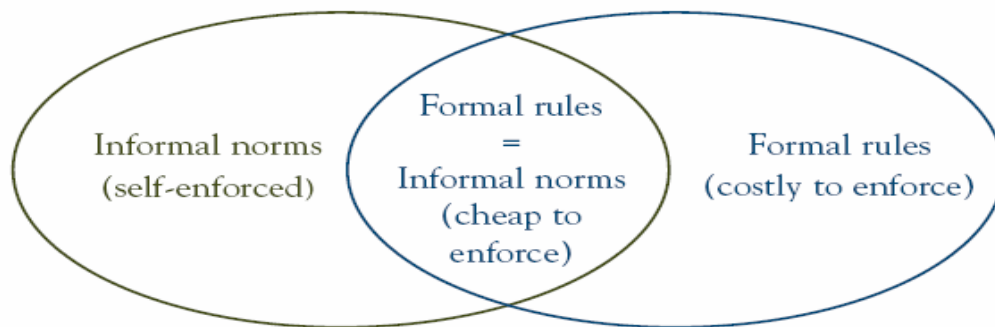
Figure 1: Interaction between formal and informal rules (Sautet 2005)

With this backdrop of the basic tenets of institutional theory in mind, our theoretical framework is characterised by three key assumptions:

- The 'organisation field': The conceptual tool of organizational field, sector, niche, or market enables an exploration of the role of the multiple actors and their associated institutions involved, including their norms and values. DiMaggio and Powell (1983:43) define the organizational field as "those organizations that, in the aggregate, constitute a recognized area of institutional life: key suppliers, resource and product consumers, regulatory agencies, and other organizations that produce similar services or products". The notion of field connotes the existence of a community of organizations that partakes of a common meaning system and whose participants interact more frequently and fatefully with one another than with actors outside of the field (Scott 1994 : 207-8)

- Nature of influences: The formal rules and informal constraints. An institutional approach will emphasize that reform of the formal institutions in a national software exports strategy and implementation process will require knowledge of both the formal and informal institutions that exist in a given society. The policymakers in charge of the process cannot reform the formal institutions based only on formal mandates such as legislating for new laws, and assuming that these will have the desired effect. Whether individuals and organisations follow the formal rules legislated by the policy makers will depend on the alignment between formal rules and informal norms of conduct.

- Contradictions: When institutions are in conflict, for example between the new directions and existing traditions, organizations and individuals may mobilise to defend the symbols and practices of an institution from the implications of others depending on their interests and what they want to preserve. Legitimacy is a generalized perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs and definitions. Whose values define legitimacy is a matter of concerted social power.

The above three concepts taken together, help us to understand the potential and challenges of institutions in shaping processes of change. Within the context of software exports policy formulation, a multiplicity of actors and their associated institutions (formal and informal),

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comprising an organisational field, come into play. The contradictions arising from these complex interactions provide both the potential and challenges to influence change. This guiding logic forms the basis of our analysis of the software exports strategy formulation process in Costa Rica.

3. Methodology: An action research approach

The authors were invited in 2002 by representatives of Costa Rica's Inter American Development Bank funded software industry development organisation 'Prosoftware'. We were to participate as consultants along with 'Cegesti', a San Jose based not-for-profit consulting organisation. Together, we were tasked with developing the Costa Rican strategy for enabling software exports. Our participation was within an "action research" framework (Baskerville and Wood Harper 1996) as we were expected to help in the formulation of the national strategy and its subsequent evaluation. The problem definition phase was the development of a plan for the empirical work after conducting a literature search of the Costa Rican software industry to identify the current state, the key stakeholders, and the particular technological and geographical focus of the industry. The authors visited San Jose for 3 weeks in August 2003 and returned for a week in September 2003. Interviews with these stakeholders ranging from the Minister of Science and Technology to university researchers enabled us to map out the relevant organisational field, and their formal and informal influences on the formulation and implementation of a national software exports strategy.

Interviews were semi-structured and focussed on the respondent's background, interests and influences with respect to software exports, the issues they considered relevant in developing a strategy, and to gauge their level of commitment to the development and implementation of a national strategy. Interviews were mostly conducted in the workspace of the respondent involving Spanish-English translators when the need arose. Two focus group sessions were conducted, one with representatives from the private sector and the other with university staff. In these focus groups, discussions were held on issues involving multi-stakeholder relationships such as university-private sector linkages, and problematic relations between small and medium firms with financial institutions. A large national level workshop was conducted on the topic of global trends in the software sector, bringing together various stakeholders in order to provide a broader awareness of the multiple inter-institutional issues, gain their "buy in" to the strategy formulation process, and elicit suggestions on specific initiatives to be taken. Three smaller workshops were held on themes identified through our problem identification process, focusing particularly on policy formulation and implementation.

In mid 2005, nearly two years on from our initial actions, four audio conferencing interviews were conducted. These interviews were facilitated by Cegesti and involved some key members of the software industry organisation. The discussion was focussed on challenges of implementing the specific policy directions that we had recommended in 2003.

In line with our view that institutionalization is a long term and on going process, one of the authors returned to Costa Rica in March 2006 to present at a software industry conference, part of which was dedicated to reflection on progress with the software export promotion strategy. During this time, six further interviews were undertaken with key stakeholder to bring us up to date with events and the effectiveness of the strategy and identify further future measures. In Table 1 below, a summary of the various sources of data collection over time is presented.

The meetings, workshops and interviews were mostly conducted in English and when the respondents preferred to discuss the issues in Spanish, the services of a local translator was

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drawn upon. During the national level workshop and one of the smaller workshops, professional simultaneous translation was provided.

Data collection mechanism	2003	2005	2006	Total
Interviews (co present)	18		6	
Interviews (telephonic)		4		28
Focus Groups	2			2
Workshops	4			4

Table 2: Summary of data collection sources

In addition to these primary sources of data collection, various secondary data sources, such as industry reports, organization brochures and website, industry statistics etc were analyzed to gain an understanding of other related institutional aspects.

Heeks and Nicholson (2004) Software Export Success Model guided the early phases of data collection and analysis and was helpful in mapping out the relevant organisational field. This model emphasizes the importance of creating synergies between a complex range of interconnected actors and issues such as national policy, education, infrastructure and international demand.

Data analysis involved a process of extensive discussion between the authors and the various stakeholders, in which we shared with them our opinions and findings, and gained their feedback and further comments. A report was presented in 2003 to Prosoftware, the organisation which commissioned the study, which provided the bedrock for the articulation of the national strategy. This was distributed widely and feedback was received on it from various stakeholders. This provided further useful inputs to the analysis and the framing of this paper. An academic paper based on our findings was presented to the IFIP 9.4 group in 2005 (Nicholson and Sahay 2005) and the feedback received also contributed to our analysis. Our continued reading of the academic literature (especially related to Institutional Theory) and discussions between ourselves has led to the current framing of the paper. Thus our approach is comprised of action and reflection based on appropriate analytical frameworks and considering alternative theories.

4. Case Study

We first describe briefly the processes of strategy making and implementation employed through this study, followed by some background on the Costa Rican software industry. Subsequently, we describe the relevant organisation field and analyse the formal and informal rules and institutional contradictions.

4.1 Process and description

The action research orientation focussed on the need to create formal and informal structures to enable the analysis, design and implementation of the software exports strategy. The first step of the process was to conduct a stakeholder analysis through various methods of interviews and focus groups described above. This process of analysis was inspired by Peter Checkland's (1990) Soft Systems Methodology, specifically the creation of a "rich picture" which helped to trace the interlinkages between the various stakeholders, and the mapping of the organisational field. Various relevant systems were identified through this process. Four

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task groups[1] jointly comprised of members from different stakeholder organisations were brought together and given the responsibility for designing solutions and shaping their implementation. These task force groups were provided with objectives and resources such as best practices from other countries. They were asked to develop recommendations on actions (short and medium term) required to meet the specified objectives, and also suggest indicators to measure progress.

For example, the task group on university-private sector linkages was comprised of members from both the universities and private sector firms, who were expected to jointly discuss the challenges to building these linkages, and develop joint recommendations on concrete actions to address the problems. In this way, the task group contributed to the identification of the problems, assessment and design of the solutions, and took responsibility and ownership of the action plan.   The working of the task group was facilitated by the Consultants Team (comprised of ourselves and Cegesti) providing resources in the form of the experiences and best practices from other countries, supervising joint meetings and monitoring progress.

The above approach built upon and also emphasized three issues. Firstly, strategy formulation is seen as an ongoing, continuous and iterative process. Secondly, the process is not linear with a clear start and end, but is cyclical in nature where the inputs provided by the task groups feed into making refinements to the strategy and actions emanating from it. Thirdly, the strategy making process has to be primarily owned by the people who have a definite stake in the process, and have the power and resources to institutionalize changes. Against the backdrop of this process, we now describe the substantive content of the case description.

4.2 The Costa Rican software industry

The Costa Rican software sector gained significant global publicity when the IT giant Intel established a development unit in San Jose, enabled through the direct involvement of the Costa Rican President (Ketelhoehn and Porter 2002). According to CAMTIC (2005) market research, in 2005 there were 150 software development companies, 91% of these are micro, small and medium sized. Applications "for and about the Internet" and "administration and engineering" prevail in software development. 2005 revenues for the software sector were US$173 million and the software development sector employed 4800 staff. There was a reduction 2004-5 in production and banking software and an increase in customized application development. It is claimed that 30% of production is exported, software products accounted for $71million of exports and exports to Central America have dwindled (from 60% in 2004 to 40% in 2005) whereas exports to USA have grown, rising from 13.3% in 2004 to 22% in 2005.

5. Analysis

Table 3 summarises the institutional analysis. The first column shows the actors in the relevant organisation field and our interpretation of the relevant formal and informal rules. The final column shows the contradiction between the strategy process attempts to influence change in the institutionalised practices, formal or informal, and the associated potential and challenges to change. To illustrate, we will focus on two of these institutional contradictions relating to the national software industry association, (CAPROSOFT), positioned as the key agent for change. Secondly, we consider the institutional contradiction presented by the organisation (called CINDE) responsible for FDI in Costa Rica, and the effect of its interventions in attracting large software and back office processing firms to Costa Rica.

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[1] The four task groups were on: university-private sector linkages; marketing, finance; and the role of CAPROSOFT (The national software association).

Nature of influences		Contradiction
Formal rules	Informal rules	
CAPROSOFT registry of association scope of the sector legally defined. By laws of this registry.	"Wine drinking club". Informal influence of longer term members to new sectors joining. Lack of energy / impetus for change – maintenance of status quo.	"Plateau of comfortable existence". Status quo "Costa Ricans will not offend each other"
CINDE Mandate of bringing in FDI intersectoral. Responsible to private shareholders, none to the industry or CAPROSOFT	Lack of participation or coordination with the software industry in appropriateness of FDI.	FDI killing the industry through the competitive forces it is generating
Angel investors to fund the development of small firms. Government schemes to help small firm development.	Angel investment linked to familial connections "DNA linkages" typically not involving start ups. Information circulated restrictively due to cronyism and inefficiency in information flow	Small firms do not get angel investment and are not able to apply. Access to information about government funding schemes is not given to firms so they do not apply
Formal constitutions of public universities regarding IP and research orientation. Formal work distribution - Teaching emphasis of public universities.	Fear of formal sanctions if researchers moved into applied research domains. Applied research discouraged – culture of superiority of basic research. Poor perceived pay. Academics work for other organisations and do consultancy.	Joint projects with private firms would be informally and formally discouraged. Resources could not be used for joint research with software firms. Vicious circle of no time for research bids and developing groups / reputation.
IADB formal expressed mandate of central and Latin American – giving money for making Costa Rican software industry more competitive internationally	Cynicism towards US funded development – history of dramatic / unpopular / negative USA interventions in Latin America	Initiative such as free ISO9001 training had very low take up. Cynicism used by some inert CAPROSOFT members to legitimate their maintenance of status quo.
ICE mandate of state ownership to support Costa Rican tele communications. ICE a monopoly controlling all telecoms services.	Corruption. Unions – many strikes. Slow and inefficient, poor service, expensive relative to other countries.	Software exports depends on cheap, high quality, competitive telecoms providers requiring non monopolistic multiple providers.
Ministry of Science and Technology mandate of support for technological clusters. Responding to government tenders requires a deposit.		Government do not buy from the local suppliers, as they cannot afford the deposit.

Table 3 Formal, informal institutions and contradictions in the Costa Rica case

5.1 Relevant organizational field

The organisational field is comprised of a range of actors from various organisations including:

- Minister of Science and Technology;
- Relevant university researchers and faculty;
- Consultants from the Inter-American Development Bank (IADB) sponsored organisation "Prosoftware";
- Managers from private sector firms including corporate financiers (e.g. Intel);
- Members and officials from the software industry association CAPROSOFT.
- Staff from IDB, banks, venture capitalists and angel investors;
- Officials from FDI promotion organisation la Coalición Costarricense de Iniciativas de Desarrollo 'CINDE';
- Officials from the Costa Rican trade promotion organisation Promotora Comericio Exterior de Costa Rica 'PROCOMER';

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- Officias from the Instituto Costarricense de Electricidad (ICE), the Government owned organization responsible for Telecommunications.
- Ourselves – researchers/consultants.

5.2 Nature of Influences and Contradictions

Table 3 summarises the formal and informal institutions within the organisational field and shows institutional contradictions. In the sections to follow, we focus on two of these instances. Firstly, we discuss the unwillingness to change of the CAPROSOFT actors. CAPROSOFT members comprise the entrepreneurs in the organisational field who were most relied upon as change agents. Secondly, we discuss some contradictions of the modus operandi of one particular organisational actor, CINDE, which while fulfilling its official mandate of attracting FDI did not consider adequately its impact on the local industry.

.1 Unwillingness to Change of Designated Change Agents

The IADB funding for strategic planning process in Costa Rica designated CAPROSOFT as the agent for change in the strategy process. A key recommendation of the strategy task force group on the role of CAPROSOFT was to create a new organisation with a wider formal constitution to include both the local and foreign activities of the software industry, as opposed to its currently primarily local mandate. Secondly, the existing CAPROSOFT was regarded as having a narrow focus in which business process outsourcing and call centre firms were excluded from formal membership to the association. Exemplars from successful countries such as India suggested that a national software association (NASSCOM) should have a wider and all-inclusive mandate to develop holistic synergies, and also have a powerful lobbying mandate with the national government.

Informally, some stakeholders perceived CAPROSOFT as being far from the designated dynamic catalyst for change. CAPROSOFT was regarded by many stakeholders as a "wine-drinking club" in which members had limited motivation or recognition for the need for change, and preferred the status quo. This was for three reasons: firstly the larger and older established software firms perceived themselves as "big fish in a small pond" where they had reached revenues in a stable market to maintain a comfortable lifestyle. International expansion into a strongly competitive market was not seen as critical to their survival. Such moves were perceived as a threat to their comfortable status quo and may undermine their existence. A software industry venture capital financier told us in an interview:

> Here people will be happy to earn a good salary, have a nice car, a nice house, have their children in a good school and owning 100% of their companies. And that's it. So there is a limited level of preference of risk taking or ambition.

Secondly, older, affluent and established CAPROSOFT members informally influenced the process by opposing the new sectors (such as call centres and other IT enabled services firms) from becoming members of the association. Thirdly, we experienced an informally expressed cynicism from several of the respondents concerning the origin of the financial aid for the strategy. IADB aid was perceived by some CAPROSOFT members as part of a legacy of USA's historical attempts to control several of the Central and Latin American countries such as in neighbouring Honduras, Nicaragua, Panama, Cuba and El-Salvador, and the violent and negative outcomes that resulted. Apparently, this contributed to some of the CAPROSOFT member to have a negative view of the attempt to change institutional structures, as it represented another subversive attempt to perceived "American imperialism". As a result of these informal institutions, IADB funded initiatives such as the cost free ISO9001 training and accreditation had a very limited take up amongst the local industry.

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In the midst of these informal institutions, the task force was faced with a difficult situation to create institutional change. We were also told of an informal social institution amongst Costa Ricans to avoid offending each other, especially because of the small size of the country where there was always the distinct possibility of meeting someone where you may need a favour in return. This seemed to have the effect of preventing clear and decisive action in the task force groups, in the fear of offending some one and resulting in negative action in the future. A senior CAMTIC member told us:

> Costa Rica is so small. It's so small that nobody can take the luxury of confronting anybody, because in no time you will meet again, in other circumstances, most likely the situation will be the other way around. So when you come to live here, you want no enemies. Confrontation is just not worth it, you know, to be living like that. So people prefer to manage relationships.

Due to recommendations from the task force, CAPROSOFT's formal rules and constitution were eventually rewritten to include call centre and back office processing firms and was renamed as Cámara Costarricense de Tecnología de Información y Comunicación (CAMTIC) in 2005. However, changing the formal and informal institutions only came about after a number of the senior members had resigned from CAPROSOFT in opposition to the formation of CAMTIC.

.2 FDI Growth Killing Local Industry

A key organisational actor in development of the software industry and exports was CINDE, whose formal mandate was to promote FDI into Costa Rica. Promoting the growth of the software industry with targeted FDI was shown to be important in the case of Ireland (O'Riain 1997). In India too, attracting Texas Instruments and Motorola, the first firm to reach Capability Maturity Model level 5, had demonstration effects in encouraging further foreign firms to set up similar operations. These processes contributed to spawn a whole new generation of entrepreneurs in India, and contributed to a change in the existing institutional structures which was previously dominated by family owned businesses.

However, in Costa Rica the process of encouraging FDI presented difficulties as it was uncoordinated and FDI entry tended to undermine the growth of smaller and indigenous firms. Formally, CINDE was responsible to private shareholders and not subject to any direct government controls. An early recommendation of one of the task force groups was to change the formal institutions of CINDE so that their FDI promotion efforts would also respect the growth needs of the local firms, such as by inviting their representatives to be part of decisions in formalizing FDI investments. These negative perceptions that some respondents had of the unilateral role of CINDE was based on the experience of Intel, which set up in Costa Rica, and based on higher salaries and the glamour of the multinational corporation image, were able to recruit trained software staff from other local firms. The relatively small size of the Costa Rican national pool of software staff contributed to magnify the negative effects of Intel's entry.

Despite considerable pressure exerted by the task force groups, the formal CINDE mandate was never changed. Although CINDE representatives attended the task force group meetings, there was a definite absence of any real participation from there or attempts to foster coordination with the software industry in deciding the appropriateness of candidates for FDI. The consequence of this in 2006 was that several new firms had set up in Costa Rica and drained the human resource from the smaller firms. There was a definite increased resistance to CINDE and their FDI attempts. A senior CAMTIC member told us in an interview in 2006:

> The companies that come in here and set up shop and hire people, that doesn't mean that any local companies are part of it. That's my point. Yesterday we had news that Fujitsu is setting up a high tech call centre with 500 people, $5 million. And we hear some of that every month.

The historical interests of the private shareholders of CINDE were to support their business interests and they thus did not support a change in the constitution, aims and objectives of their organisation. Some multinational firms such as Hewlett Packard increased their capacity by employing local staff and set up offshore outsourcing operations from USA. A bidding war between major firms such as Sykes and Proctor and Gamble to poach staff from each other has led to increased salaries, which could not be matched by the local industry. CINDE recognised the problem:

> Sykes, IBM or Hewlett-Packard or Intel, they have a different type of operation by definition, but they are demanding the same human resources. Cinde official

Higher education and other training colleges have not been able to provide the necessary human resources to meet fast growing demand for skilled staff. Several software firms were unable to afford the increased salary and in 2006 were reported to be on the brink of closure. A senior CAMTIC member explained:

> The only way for these local companies to compete is to be able to make similar offers like these. And the only way to do that is by if they do work for clients that also pay them well. And that won't happen with local companies working with local customers.

Costa Rica based firms were unable to recruit from neighbouring Central American countries due to formal restrictions on visas and work permits.

6. Discussion & Conclusions

Institutional analysis of the situation facing software exports policymakers in Costa Rica presents a "messy problem situation" (Checkland 1990) far removed from the context independent critical success factors models (e.g. Carmel 2003). From a practical standpoint, the conceptual tools of institutional theory allow a disciplined examination of the impact of context. As shown above, CINDE would not change its formal or informal practices to accommodate the growth of the software exports sector due to other conflicting priorities. The older more established CAPROSOFT members resisted institutional change due to vested interests. Institutional theory thus allows an understanding to be formed of why certain institutions prevail and others may change thus offering some potential to debate routes for change.

'Factors' models of the process of software exports development are useful to examine the best practices of other countries, some of which can be emulated by follower nations (Carmel 2003, Heeks and Nicholson 2004). However, our findings show that such models do not take into account the historical rootedness of formal and informal institutions which may affect development. Escobar (1995) points out to the need to consider structures of power along with local discourses of progress and development. Vested interests, attitudes towards progress and development; and power structures were highly apparent in the Costa Rican case some of which we have illustrated above. Decontextualised models such as Heeks and Nicholson (2004), Carmel (2003) and their antecedents do not take into account such embedded institutions. In fact, these models have little to say about implementation but implicit is an assumption of unitary groups in the context of application of the model and the

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rather naïve belief that organisations and their institutions can be aligned logically and rationally to a national vision. The Costa Rican case shows that a linear, top down methodology implicit in such approaches is quite misleading and inappropriate. More realistic is the institutional perspective on change which presents the analysis of an evolving set of interlocking and dislocating issues and constraints between organisations with a stake or influence on software exports success. We attempted to address this in the taskforce groups. Thus, the contribution of this paper is to show the importance of the multiplicity of institutional influences on a seemingly "rational" strategy making process and to critique the view that it is likely to progress harmoniously. The idea of institutional embeddedness to software exports development is important because such informal embedded institutions are often poorly understood, rarely written down and are sometimes unspoken. Practitioners in this domain need to acquaint themselves with local formal and informal institutions. In our own action research, we were partnering with a local San Jose based consultancy firm staffed mainly by Costa Ricans but with some consultants from neighbouring Central American countries. This alliance helped us to forge our understanding to a certain degree of the local institutions and events. Much of this was gathered in informal situations and we believe that research into such scenarios requires ethnographic techniques to attempt to grasp the informal attitudes which comprise institutions.

A further contribution is to expose the limitations of benchmarking, critical success and simple best practices frameworks such as e-readiness. Such simplistic models may enable policymakers to make a start in their analysis but any policymaking effort towards change will rapidly encounter the embedded local formal and informal institutions.

Our message is not all gloomy and there is potential for change in Costa Rica. The task force groups in Costa Rica had some success. As described above, a new industry association "CAMTIC" was formed and embraced a wider membership although there were some casualties from the old established CAPROSOFT membership. In 2006, the marketing task force successfully bid for further IADB funding (known as 'Link') to support small firms providing capital funds for their growth together with an incubator for small firm development. These created institutional structures, both formal and informal, provide an optimism for the future possibility for change.

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A METHODOLOGICAL PROPOSAL OF E-PROCUREMENT ASSESSMENT BY CITIZENS

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Abstract: Based on Heek's (2006) recommendations, and on the overview of recent literature, this study adopts a methodology focused on e-procurement benchmarking under an e-Citizens Transparency point of view. It is proposed a calculated indicator called A4 index. The external purpose of the study is to contribute for better and specific evaluation of e-procurement systems, together with an internal prospective purpose to call the attention of policy makers for the weakness and exposures surrounding the so far successful e-procurement experiences.

Keywords: accountability, e-government, e-procurement, govern, transparency.

A METHODOLOGICAL PROPOSAL OF E-PROCUREMENT ASSESSMENT BY CITIZENS

1. INTRODUCTION

Last decade, we have seen the growing efforts towards the introduction and development of different e-government solutions, as part of the modernization politics of the Public Sector all over the world. Particularly for the underdeveloped countries, the international financial institutions (e.g. Avgerou et al., 2005; Izaac & Biderman, 2005; World Bank [WB], 2004a) and multilateral organizations (e.g. Organization of American States [OAE], 2004; Haldenwang, 2004) played an important role in the guidance of this process.

A profusion of studies and surveys has been carried out by different players, with empirical approaches building a background on how to evaluate and benchmark e-government experiences. Heeks (2006) presents a complete analysis of this trajectory, pointing out that there is still a long journey to take until the reaching of an accurate evaluation methodology.

The fact is that we are facing a time when politicians frequently appeal to e-government solutions and the technology behind them to escape from corruption scandals within the government, or selling in campaign an image of efficiency, figuring out huge amounts of savings and benefits to the public administration on account of the implementation of these solutions. In other words, a false, or at least unproved, idea that e-government could be the cure for all evils. This is particularly the case of Brazilian e-procurement experiences both in national and sub-national levels.

It is true that, since the first trials to evaluate e-government experiences, Brazil has been ranked in a considerably high level, and the e-procurement solutions contributed for that, having been cited as benchmarks more than once (e.g. United Nations [UN], 2005; WB, 2005, Haldenwang, 2004, Sáfadi & Reinhard, 2004).

Therefore, it is for no other reason that Brazilian's federal government e-procurement system - *Comprasnet*, by the end of 2005, became the first e-procurement system in the world approved both by WB and the Inter-American Development Bank – IADB for use in local projects financed by the institutions.

Nevertheless, is *Comprasnet* benchmark status reliable enough to render it a corruption-proof certification? Moreover, how can someone evaluate the sub-national Brazilian e-procurement experiences performance?

2. INSIGHTS IN METHODOLOGY

2.1. Overview on Brazilian Recent Studies e-Procurement Oriented

Heeks (2006, p. 29) places academic production concerning e-government as a secondary research source. Haldenwang (2004, p. 423) points out that the efficiency gains of e-procurement experiences have not been properly measured yet so as to qualify the alleged greater transparency, market competition, and potential savings for public budgets.

Indeed, the review of the literature produced on recent years concerning Brazil e-procurement experiences confirms the authors' opinion: an excessive focus on the legal or institutional

conceptualization (e.g. Sáfadi & Reinhard, 2002; Alves & Dufloth, 2004); usually within a case study (e.g. Fernandes, 2003; Izaac & Biderman, 2005); making great use of official statistics and evaluations of the systems, or international benchmarking recognition (e.g. Sáfadi & Reinhard, 2002); overlooking a more critical and exempt analysis of these official sources (e.g. Izaac & Biderman, 2005); supporting conclusions of market competition improvement (e.g. Rodrigues & Oliveira, 2002); insertion of small and medium sized firms (e.g. Fernandes, 2003); time reduction of back office job (e.g. Almeida, Machado & Costa, 2002; Carneiro & Pereira 2005); operational cost reductions (e.g. Izaac & Biderman, 2005); simplification of budget planning and resource allocation (e.g. Haldenwang, 2004) and greater transparency (e.g. Menezes, Silva & Linhares, 2004). To sum up, these are some of the critics one can point to the academic production.

3. A4 INDEX

The proposed approach for this study is greatly influenced by Heeks' (2006) set of recommendations for benchmarking studies. The intention to begin a debate over a methodology appropriate to e-procurement benchmarking lies on the concept of Public Value, inherent to this kind of e-government solution, through a new calculated indicator of transparency and accountability.

Taking a virtual world without any kind of restrictions, a demand of whatever material or service, in whatever quantity, from back-office staff is immediately attended by supply market, in ideal competitive condition, providing the lowest price, all the time monitored by citizens. This is the essence of e-procurement system that happens to be the real benchmark to be chased by policy makers.

This theoretical system faces restrictions concerning:

- Specifications of materials and services;
- Quantity of demand;
- Processing time;
- Competitive supply market condition;
- Unit price;
- Transparency capability.

These restrictions take place as variables in a model of e-procurement evaluation, with distinct expectations and impacts, according to each player's point of view. A summary of these expectations and impacts over e-Citizens point of view is presented in Table 1:

Variable	e-Citizens		
	Expectation	Impact	Sample Measures/Indicators
Material/Service Specification	-Easy search	-Reduce search time/Improve interest	-Assessment over pre-defined specifications
	-Completion List	-Reduce frustrated search occurrences	-Presence/absence of pre-defined specifications
	-Specification precision	-Improve data reliability	-Redundancy specification codes survey
Quantity	-High level of e-procurement use	-Greater transparency and accountability	-Ratio of expenses through e-procurement bid forms over total expenses that can be standardized
Processing Time	-Minimization	-Perception of efficiency over administration	-Average time for conclusion of purchase process in a period

Market-Competitiveness	-Maximization	-Perception of reduction of non-competitive practices	-Average number of participants on e-procurement forms
			-Ratio of expenses of competitive e-procurement forms over total contracted expenses
			-Ratio of one participant e-procurement bid over total number of e-procurement bid within a period of time
Price	-Minimization	-Tax-payer (stackholder) perception of resources optimization	-Pondered average prices of pre-defined items
Transparency capability	-Contact channel	-Effectiveness of social control	-Accessibility to e-procurement site
			-Time of reply
			-Rate of usefulness of reply

Table 1. e-Citizens Variables/Restrictions in an Evaluation Model

In Table 1, a sort of potential sample measures or indicators related to specific variables of interest is also presented.

The approach proposed in this study is based on an assessment strategy, under an e-Citizens point of view, oriented to answer the questions bellow:

- Is the e-procurement site accessible?
- Given a specific material/service, can one find its code in the catalogue?
- What is the average unit price practiced by government for this given material/service?
- Is the performance observed relevant concerning the overall government expenditures?
- How long would it take to receive a reliable answer to these questions?

The material selected to carry out the exploratory survey over Brazilian federal and states e-procurement sites was none but the most common: Paper series A4 (ISO Standard 216), weight 75 g/m^2, size 210 x 297 mm, white color.

Apart from the symbolic reference to the traditional bureaucratic inefficiency image brought by this decision, the main reason for that concerns comparability, once it is used in every level of administration. Therefore, the selected material explains the reference to the evaluation index proposed.

It is not the purpose of this study to settle, at this moment, the measure components of the e-procurement performance function.

We assessed these measures through the results observed in a group of actions taken on the survey, related to the questions and variables of interest, as described in Table 2:

Action	Sample Measures / Indicators	Variable	Questions of research
Search Govern site			
Access Govern webpage			
Presence of E-procurement link	Accessibility to e-procurement site	Transparency capability	Is the e-procurement site accessible?
Presence of Search tool			
Positive returned search			

Presence of search tool on E-procurement site	Presence/absence of pre-defined specifications	Material/ Service Specification	Given a specific material/service, can one find its code in the catalogue?
Presence of Material Catalogue search tool			
Codes redundancy for the search	Redundancy specification codes survey		
Material Catalogue code selected I case of redundancy	Arbitrated		
Material Description returned from the search			
Unit Measurement indicated for the material selected			
Returned average price supplied	Pondered average prices of pre-defined items	Price	What is the average unit price practiced by government for this given material/service?
Returned time range of the supplies that are used for average calculation			
Traceability of the supplies that are taken us the average calculation			
Presence of E-procurement statistics	Ratio of expenses through e-procurement bid forms over total expenses that can be standardized	Quantity	Is the performance observed relevant taking the overall government expenditures?
Returned E-procurement supplies amount in R$ (2005)			
Assessment of expenses that can be standardized (2005)			
% E-procurement/ Expenses can be standardized			
Presence of Contact us by Phone	Time of reply	Transparency capability	How long would it take to receive a reliable answer to these questions?
Presence of Contact us by e-mail			
Record of date of e-mail consult			
Time of response			
Evaluation of usefulness of response	Rate of usefulness of reply		

Table 2. Assessment Survey Constructor

The indicator measuring the quantity related variable takes into account the recognized limitation of procurements processed by means of e-government services. The limitation relies on the impossibility to specify materials or services that do not fit a technical and reliable standard. Therefore, the insertion level evaluation of e-procurement use by administration took the ratio of expenses handled by this technology over the amount of expenses considered to be able of standardization. Taking the accounting structure enforced to the public sector in Brazil (Brasil, 1964) and under a conservative perspective, we assessed this amount through the account *Consumption Material* (Current class) added to *Equipment and Permanent Material* (Capital class) both as *Direct Application* (not *Transferences*). So, the indicator would be free of distortions by the presence of expenses of nature not suitable for electronic forms of acquisition.

4. SURVEY

Federal (national) and all states (27 sub-nationals) e-procurement services were traced and evaluated from November 2nd to 14th, 2006.

4.1. e-Procurement Site Accessibility

The first steps taken on the assessment concerning Accessibility measures showed a quite positive result, as presented in Table 3:

Region	State	Govern site mining	Access Govern Link	E-procurement link	Search tool	Returned Search
BR-Brasil	BR-Brasil	1	1	0	1	1
CO-Centro Oeste	DF-Distrito Federal	1	1	1	1	2
CO	GO-Goiás	1	1	0	1	0
CO	MS-Mato Grosso do Sul	1	1	1	1	2
CO	MT-Mato Grosso	1	1	1	1	2
N-Norte	AC-Acre	1	1	3	1	0
N	AM-Amazonas	1	1	1	1	2
N	AP-Amapá	1	1	3	1	0
N	PA-Pará	0	1	3	1	2
N	RO-Rondônia	1	1	0	0	
N	RR-Roraima	1	1	0	0	
N	TO-Tocantins	1	1	1	0	
NE-Nordeste	AL-Alagoas	1	1	1	0	
NE	BA-Bahia	1	1	1	1	2
NE	CE-Ceará	1	1	1	1	2
NE	MA-Maranhão	1	1	3	1	0
NE	PB-Paraíba	1	1	1	0	
NE	PE-Pernambuco	1	1	0	0	
NE	PI-Piauí	1	1	3	1	0
NE	RN-Rio Grande do Norte	1	1	3	0	
NE	SE-Sergipe	1	1	1	1	2
S-Sul	PR-Paraná	1	1	1	1	2
S	RS-Rio Grande do Sul	1	1	0	1	1
S	SC-Santa Catarina	1	1	3	1	0
SE-Sudeste	ES-Espírito Santo	1	1	4	1	0
SE	MG-Minas Gerais	1	1	1	1	2
SE	RJ-Rio de Janeiro	1	1	0	1	0
SE	SP-São Paulo	1	1	1	1	2
BR	BB-Banco do Brasil	4	4	4	4	4
Codes:	0 Negative or not available.					
	1 Positive.					
	2 Not tested due to previous positive result.					
	3 Link refers to traditional purchases page. Non e-gov.					
	4 Link refers to BB e-procurement service.					

Table 3. Accessibility of Brazilian e-Procurement Services

The general result was quite satisfactory. From 27 states pages, only 3 had the assessment process interrupted in this phase (RO, RR, RJ). The RJ case was more critical, as it represents 7% of the total expenses that can be standardized by the states (see Table 6).

From the 25 remaining pages, 7 links drive to traditional fashion purchases not consisting of e-solutions. Another unexpected result observed in ES page was the link of the state page accessing the e-procurement service of *Banco do Brasil*.

However, the most relevant finding concerns the difficulty observed for the access of GO and PE e-procurement pages due to the lack of a link or search tool in the official govern pages. Through other pages of the govern structure, it was found the e-procurement pages of these states. It would not be nonsense to say that this search through several secretariat pages would be beyond the capacity, or at least persistence, of medium-citizen. Considering that, at the end of the assessment process, the e-procurement solutions of these two missing states were placed within the best practices observed, the effect of an access failure for the overall assessment is clear. This may be the case of the interruption for RO, RR and RJ.

4.2. Finding Material Catalogue Code

Concerning the 25 remaining procurement pages, the assessment of the Specification variable was disappointing, as shown in Table 4:

Region	State	Material Catalogue Search	Codes Redundancy	Material Catalogue Code
BR	BR-Brasil	1	8	247478
CO	DF-Distrito Federal	0		
CO	GO-Goiás	1	2	4217
CO	MS-Mato Grosso do Sul	0		
CO	MT-Mato Grosso	1	3	7510001130002
N	AC-Acre	0		
N	AM-Amazonas	0		
N	AP-Amapá	0		
N	PA-Pará	1	3	139378
N	TO-Tocantins	0		
NE	AL-Alagoas	0		
NE	BA-Bahia	1	0	10798-0
NE	CE-Ceará	1	1	731-5
NE	MA-Maranhão	0		
NE	PB-Paraíba	0		
NE	PE-Pernambuco	1	1	1022598
NE	PI-Piauí	0		
NE	RN-Rio Grande do Norte	0		
NE	SE-Sergipe	1	1	11912
S	PR-Paraná	0		
S	RS-Rio Grande do Sul	1	11	107615
S	SC-Santa Catarina	0		
SE	ES-Espírito Santo			

SE	MG-Minas Gerais	0		
SE	SP-São Paulo	1	0	1022598
BR	BB-Banco do Brasil	0		
Codes: 0 Negative or not available.			1 Positive.	

Table 4. Brazilian Material Specification on e-Procurement Services

Public access to the material catalogue was not available in 15 out of 25 pages assessed. This analysis includes pages identified as non-electronic purchase forms (AC, AP, PA, MA, PI, RN and SC).

From these 15 frustrated accesses, 6 consisted of traditional purchase pages. It is reasonable to believe that the presence of e-procurement services contributes to turn public the access to material catalogue, notwithstanding the absence of this access observed in 50% of the e-procurement pages.

The searching of material on the remaining 10 sites, 9 of which belonging to states, presented occurrences of redundant codes, matching the same product specification (A4 paper). This problem was not observed in BA and SP sites. Otherwise, it calls the attention the high redundancy observed in the federal e-procurement service.

It is hard to determine the reason for this problem. Probably, it is due to the bad administration of material catalogue contributes. However, in some cases, it seems to be related to the inclusion of some information about application (e.g. whether for copy or printing) or measurement units (e.g. packages, boxes), as material description differential.

Notwithstanding that, these codes redundancy compromise the analysis over prices practiced by government. To avoid distorted findings, one would need to trace all codes for prices practiced, bringing results to a comparable measurement unit.

This difficulty for a comparative approach is increased by the heterogeneity observed in codification, technical precision of description and unit of measurement. Uniformity was only observed between PE e SP catalogues.

4.3.   Average Unit Price Practiced by Government

At this stage of the survey, the assessment of 25 procurement services revealed that only 3 (GO, PE, SP) had any kind of facility to provide average price calculation (Table 5):

Region	State	Average price supplied R$	Time Range (months)	Traceability
BR	BR-Brasil	0		
CO	DF-Distrito Federal	0		
CO	GO-Goiás	9,429	36	1
CO	MS-Mato Grosso do Sul	0		
CO	MT-Mato Grosso	0		
N	AC-Acre	0		
N	AM-Amazonas	0		
N	AP-Amapá	0		
N	PA-Pará	0		
N	TO-Tocantins	0		
NE	AL-Alagoas	0		
NE	BA-Bahia	0		

NE	CE-Ceará	0		
NE	MA-Maranhão	0		
NE	PB-Paraíba	0		
NE	PE-Pernambuco	11,70	3	1
NE	PI-Piauí	0		
NE	RN-Rio Grande do Norte	0		
NE	SE-Sergipe	0		
S	PR-Paraná	0		
S	RS-Rio Grande do Sul	0		
S	SC-Santa Catarina	0		
SE	MG-Minas Gerais	0		
SE	SP-São Paulo	7,29	12	0
BR	BB-Banco do Brasil	0		

Table 5. Average Unit Price Practiced on Brazilian e-Procurement Services

Taking solely the average price, SP showed the best result. Besides, the facility solution of the state provides the advantage of presenting average prices already calculated. Another functionality that deserves positive remark is the filtering possibility of prices within pre-defined regions of the state.

The average prices of GO and PE solutions had to be calculated, taking the purchase records listed from the consult, requiring internal treatment to bring unit measures to a common basis.

The described favorable description of SP solution is somewhat reduced due to the lack of traceability, once the consult neither reveals the records of bids taken for the average calculations, nor clarifies the calculation method (whether simple or pondered average). This implies that the consistency of SP results can be argued.

An unexpected aspect not properly treated in this study arose during the assessment process. The incident taxes over governmental purchases may be subject to local legal exemption, reflecting average prices distorted. This finding introduces another difficulty for comparison of governs performance.

4.4. Relevancy of e-Procurement

We collected accounting data from Fiscal Responsibility Law Reports (Brasil, 2005a), year 2005. The composition of the accounts *Material Consumption* and *Equipment and other Permanent Material* for each state is presented in Table 6:

Region	State	E-procurement statistics	E-procurement supplies (2005) (million R$)	Expenses that can be standardized (2005) (million R$)	% E-procurement / Expense that can be standardized
BR	BR-Brasil	0		8.801	
CO	DF-Distrito Federal	0		356	
CO	GO-Goiás	0		272	
CO	MS-Mato Grosso do Sul	1	116	146	79%
CO	MT-Mato Grosso	0		260	
N	AC-Acre	0		169	
N	AM-Amazonas	0		376	

N	AP-Amapá	0		96	
N	PA-Pará	0		370	
N	TO-Tocantins	0		129	
NE	AL-Alagoas	0		182	
NE	BA-Bahia	0		475	
NE	CE-Ceará	0		231	
NE	MA-Maranhão	0		114	
NE	PB-Paraíba	0		133	
NE	PE-Pernambuco	0		444	
NE	PI-Piauí	0		143	
NE	RN-Rio Grande do Norte	0		165	
NE	SE-Sergipe	0		128	
S	PR-Paraná	0		532	
S	RS-Rio Grande do Sul	1	79	471	17%
S	SC-Santa Catarina	0		392	
SE	ES-Espírito Santo	0		165	
SE	MG-Minas Gerais	0		1.010	
SE	SP-São Paulo	0		3.394	
BR	BB-Banco do Brasil	0			

Table 6. Level of Insertion of e-Procurement Practices in Brazil

Again, the result of the survey over official figures concerning amounts purchased through e-procurement services was disappointing. From 25 procurement services, only 2 presented overall financial information about their electronic purchases (MS, RS) on an annual basis.

This means that from e-Citizens point of view it is impossible to measure the insertion of e-procurement practices on the administration, and its overall standardized expenses demand in 2005 reached R$ 20 billion, with central government and SP being responsible for 61% of this amount.

Concerning that e-procurement solutions represent a better choice for administration needs of processing time and costs savings, the level of use of electronics forms of purchase is so far unrevealed to public audience.

4.5. Transparency Effectiveness

We evaluated transparency capability variable using the mystery user technique (Heeks, 2006, p. 27). Except for AP, and RN, we sent an e-mail containing a consult about the pathway for average price information in the procurement site of every administration with a *contact us* feature. The reply time and its usefulness were taken to measure the performance, and its results are shown in Table 7:

Region	State	Contact us by Phone	Contact us by e-mail	Time of response (days)	Usefulness of response
BR	BR-Brasil	1	1	0	0
CO	DF-Distrito Federal	0	5		
CO	GO-Goiás	1	1	9	

CO	MS-Mato Grosso do Sul	0	1	1	0
CO	MT-Mato Grosso	0	1	9	
N	AC-Acre	0	1	9	
N	AM-Amazonas	0	5		
N	AP-Amapá	0	0		
N	PA-Pará	0	1	9	
N	TO-Tocantins	1	1	9	
NE	AL-Alagoas	1	1	9	
NE	BA-Bahia	0	1	2	0
NE	CE-Ceará	0	1	0	0
NE	MA-Maranhão	1	1	9	
NE	PB-Paraíba	0	1	8	0
NE	PE-Pernambuco	1	1	9	
NE	PI-Piauí	0	5		
NE	RN-Rio Grande do Norte	0	0		
NE	SE-Sergipe	1	1	9	
S	PR-Paraná	1	1	0	0
S	RS-Rio Grande do Sul	1	1	9	
S	SC-Santa Catarina	0	1	9	
SE	ES-Espírito Santo	1	1	1	0
SE	MG-Minas Gerais	1	1	0	0
SE	SP-São Paulo	1	1	0	1
BR	BB-Banco do Brasil	1	0		
Codes: 0	Negative or not available.	1	Positive.	5	Service not working.

Table 7. A Very Nice Table

Besides AP and RN, which presented no channel contact, the *contact us* service for DF, AM and PI was not operating. From the remaining 20 procurement sites, 8 replied in less than 2 days, while 11 services did not reply until the submission date of this paper.

Taking the usefulness measure, we found only one answer (SP) attending the consult satisfactorily. We could relate SP performance to the availability of the function (average price search) in its site. Nevertheless, if that was the case, the question is how to explain the absence of reply from GO and PE, up to the submission date, since both services could have also replied.

Regretfully, these findings place a doubt over the image sold of greater transparency on account of e-procurement use by govern administration.

5. CONCLUSION

There is no doubt that e-procurement solution became a real alternative for Brazilian governs, in national and sub-national levels, to improve efficiency of administration. This study proved the presence of such tools in 63% of state governs, besides federal e-procurement most famous *Comprasnet.*

Following Heek's (2006) recommendations, we developed a theoretical framework to support a proposed new calculated indicator of transparency and accountability applied to e-

procurement assessment under e-Citizens point of view. The material selected to carry out the survey over Brazilian e-procurement services, Paper series A4, nominates the proposed index.

The assessment strategy was oriented to answer questions related to some of the variables identified in the theoretical framework. These variables were Transparency capability, Material/ Service Specification, Price and Quantity.

Except for the measure concerning Accessibility, all other measures taken on the survey brought results that conflict with the benchmark status given by international organizations (IADB, UN, WB) and found in the literature.

It is true that few e-procurement experiences reached an overall performance that could deserve a benchmark qualification.

However, taking a critical approach, the findings of this study reveal the weakness of the assessment methodologies used to support a transparency-certified quality to Brazilian e-procurement solution. In fact we are too far from this.

It is our concern that policy makers on e-procurement solutions pay more attention to the weakness of the services described in this study, taking measures to: improve the administration of material catalogues, looking for ways to harmonize them; provide statistics on government purchases, segregating traditional from e-procurement data; provide consistent figures on average unit prices practiced, and ascertain the effectiveness to the contact channel with citizens.

Therefore, it is time for policy makers to review their concepts of transparency towards a fairy and constructive one that permits, through an easy and reliable comparative approach, citizens to become a real player in the role of e-procurement.

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MULTINATIONAL ENTERPRISES IN DISSIMILAR CULTURAL CONTEXTS: THE ROLE OF GLOBAL VIRTUAL TEAMS

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Abstract: Multinational Enterprises face major impediments to transferring firm specific advantages within the MNE network given their relatively low capacity to absorb knowledge from other internationally dispersed units. Additionally, because MNE units are located in two (or more) distinct nations, the effectiveness of cross-border transfer of organizational knowledge is profoundly affected by the cultural diversity of its corporate members engaged in such transactions. Global virtual teams, conversely, hold the promise of enabling dispersed groups to overcome distance and time barriers with the use of information and communications technologies (ICTs) by facilitating communicative practices, process structures, and information processes. This study offers a theoretical framework that explains the potential benefits of global virtual teams to multinational enterprise practices in dissimilar cultural contexts by explicitly examining the role of technology, culture, and absorptive capacity in the cross-border transfer of knowledge within the MNE network. It also presents a set of propositions distilled from empirical evidence and theoretical considerations to guide future research in this area.

Keywords: Global Virtual Teams, Culture, Multinational Enterprises, Absorptive Capacity, Organizational Knowledge, Information and Communications Technology (ICTs), Cross-border transfer of knowledge.

MULTINATIONAL ENTERPRISES IN DISSIMILAR CULTURAL CONTEXTS: THE ROLE OF GLOBAL VIRTUAL TEAMS

1. INTRODUCTION

The cross-border transfer of firm-specific advantages is a key ingredient of success in Multinational Enterprises (MNEs) (Dunning 1958; Hymer 1976; Vernon 1966). These advantages are usually geographically dispersed in countries where MNE subsidiaries perform specific value-creating activities (e.g., Cantwell 1995; Dunning 1995; Florida 1997; Shan and Song 1997; Rugman and Verbeke 2001, Rugman and D'Cruz 2000; Tsai 2001).

Information technologies have advanced at a relentless pace during the past several decades — enabling new organizational forms (such as distributed group work) likely to enhance the cross-border transfer of organizational practices (Mowery, Oxley, and Silverman 1996; Subramaniam and Venkatraman 2001; Rugman and Verbeke 2001; Tsai 2001). In particular, global virtual teams provide the means for work that is carried out at a distance by electronically connecting dispersed organizational sites (Lipnack and Stamps 2000; Montaya-Weis, et al., 2001; Mowshowitz 1997. Interestingly, although there is a great deal of research on global virtual teams in developed nations, there has been little work on how this modality of group work can enhance the cross-border transfer of firm-specific advantages in developing countries. This is critical because cultural factors may play an important role in determining the success of IT in the process of cross-border transfer of knowledge (Bhagat, Kedia, Harveston, and Triandis 2002).

This study investigates the effects of global virtual teams and cultural diversity on cross-border transfer of knowledge within culturally diverse MNE units. Specifically, this study develops a research model along with a set of propositions that advances research by examining the following question: What is the impact global virtual teams and culture in the cross-border transfer of organizational knowledge in dissimilar cultural contexts? The next section presents the framework and its propositions. Then, it is discussed the major contributions of this research.

2. THEORETICAL FRAMEWORK

Proponents of the resource-based view sustain that organizations are constantly engaged in processes that enable them to exploit external resources in order to leverage their competitive advantage (Barney 1991). In this respect, absorptive capacity is a major determinant of the firm's ability to exploit innovative practices from external sources (Cohen and Levinthal 1990). Applying these notions to the context of MNEs, the successful engagement in competitive strategies relies on the firm's ability to absorb new ideas and generate new outputs by using mechanisms that enable MNEs to capture and transfer knowledge from one unit to another (Tsai 2001).

However, the effectiveness of cross-border transfer of organizational knowledge has a great deal of complexity because it usually involves dissimilar cultural contexts (Bhagat, et al. 2002). For example, organizations located in collectivist cultures that emphasize paternalist practices, in-group goals, and relationships (e.g., Brazil, Chile, and Venezuela) are likely to encounter difficulties in transferring knowledge to organizations located in individualist cultures where individuals see themselves as independent of collectives and prefer to work

guided by their own preferences, needs, rights, and contracts (e.g., USA, United Kingdom, Sweden).

Given that cultural diversity and organizational practices are embedded within individuals' cognitive processes (Daft and Lengel, 1984), this study builds upon a cognitive approach by focusing on the process of knowledge transfer between organizational members. Accordingly, we emphasize communication structures that support information flows between globally dispersed individuals by implying that the development and diffusion of subsidiary-specific advantages requires appropriate organizational mechanisms (i.e., technology) to leverage a firm's absorptive capacity, thereby enhancing the transfer of knowledge (Rugman and Verbeke 2001).

2.1. Global Virtual Teams

Global virtual teams seem to be a laudable alternative to enhance MNE performance given that they enable dispersed groups to overcome distance and time barriers, thus facilitating communicative practices, process structures, and information processes. When operating in the virtual setting, team members interact and communicate electronically using a variety of technological mechanisms such as electronic message recording, issue analysis, audio and text message exchanges, e-mails, and electronic discussion tools (e.g., Jang, Steinfield, and Pfaff 2002; Jarvenpaa and Leidner 1999; Maznevski and Chudoba 2001; Rockett, Valor, Miller, and Naude 1998; Vogel et al. 2001), which are likely to "… excel at enhancing the velocity of knowledge transfer …" (Bhagat, et al. 2002 pp. 207). According to Zigurs and Buckland (1998) these information and communications technologies (ICTs) can be classified along three dimensions: a) communication, b) process structuring, and c) information processing.

Communication support refers to the tools that support communication processes by providing capabilities such as input, feedback, time, and space configuration. For example, when the technology is used to physically configure communication channels, it enables individuals to simultaneously enter information by instantly sharing knowledge during group decision making processes (Dennis 1996).

Structuring support relates to mechanisms such as a group's agenda enforcement, devices to store a complete record of group interaction, and software that helps groups in establishing norms, routines, and procedures on how to use the technology features (DeSanctis and Poole 1994). In general, the structuring support tools guide and coordinate groups' activities by helping group members interact with each other.

Information processing refers to the information manipulating capabilities such as aggregating, evaluating, sharing, or structuring information. These features may help individuals to better understand the information stored and integrate differing opinions (Sambamurthy and Poole 1992). For example, while culturally diverse groups may exhibit divergent opinions regarding new organizational practices, information processing capabilities support multicultural groups by promoting sharing of information and offering analytical tools to evaluate the information in a more objective fashion (Nunamaker, Dennis, Valacich, Vogel, George 1991).

In the following sections we theorize on how the implementation of global virtual teams with information and communications technologies (ICTs) will enhance absorptive capacity, thereby improving the cross-border transfer of knowledge within the MNE network (see Figure 1).

2.2. Propositions

Absorptive capacity has been addressed in various research areas such as IT management (Boynton, Zmud, and Jacobs 1994), organizational learning (Kim, 1998), strategic management (Szulanski 1996), and international business (Kedia and Bhagat 1988). In particular, Zahra and George (2002) suggest four key components of absorptive capacity: acquisition, assimilation, transformation, and exploitation of knowledge. Acquisition and assimilation capture a firm's capabilities to identify, gather, and absorb external knowledge; whereas transformation and exploitation reflect a firm's ability to modify and/or adapt the knowledge gathered in a way that it can arrive at different patterns and levels of usage. In this study we are concerned with the transfer of knowledge regardless of how it is modified to be used in different organizational contexts. Therefore, based on the discussion above we refer to absorptive capacity as the set of organizational routines and processes by which units within the MNE network acquire and assimilate firm-specific advantages.

The acquisition dimension of absorptive capacity refers to the organization's interface with the external environment (Boynton, Zmud, and Jacobs 1994; Cohen and Levinthal 1990; Kim 1998). Cognitive and behavioral research (e.g., Bower and Hilgard 1981) indicate that the process of acquiring knowledge is intrinsically related to concepts, objects, and patterns that one has stored in his/her memory. Thus, the ability to store knowledge is critical to memory acquisition because it enables new events that establish links with pre-existing concepts. The establishment of these links tends to positively influence the ability to evaluate and use outside knowledge (Cohen and Levinthal 1990). Furthermore, cumulative past experience influences organizational cognition in terms of how a firm will engage in future information searches (Rosenkopf and Nerkar 2001), interpret incoming information and act upon it (Moorman and Miner 1997), and manage its knowledge base (Tripsas and Gavetti 2000). In short, acquisition is positively affected by the firm's interface and storage mechanisms, which enables the identification and search of competitive advantages located within the MNE network (Zahra and George 2002).
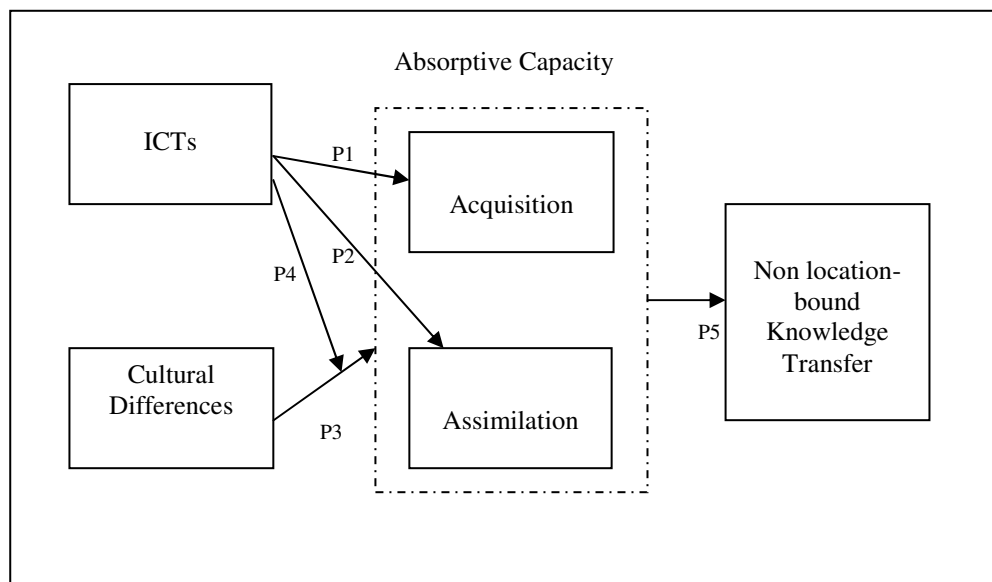
Figure 1- The Research Model

As has been previously argued, information and communications technologies support group communication processes by offering functionalities (e.g., simultaneous input, anonymous input, input feedback, and group display) that allow group members to communicate with each other by crossing time and distance boundaries. These interface mechanisms include

storage devices that allow teams to electronically record prior conversations, documents, and organizational practices and procedures. Additionally, such database infrastructure allows its users to quickly search for related information, thus providing means for comparison between new and already stored information. Group members can also access the knowledge repositories through the internet so those of them with different areas of expertise may contribute significantly on the process of importing external technologies (Rocha 1997). In short, when global virtual teams use information and communications technologies to communicate and interact, they are, in fact, also using such tools as storage mechanisms that enable them to identify and acquire information. Hence:

Proposition 1: *Information and communications technologies, when used as a storage device, will positively influence a MNE's capability to acquire knowledge within its network.*

The mere fact that an organization is able to identify and acquire specific advantages from other units does not mean that the recipient unit will extract value from the acquired knowledge. Because of this, competitive advantage also requires firms to assimilate the new knowledge (Kim 1998; Szulanski 1996). Assimilation refers to the firm's routines and processes geared towards the internalization, evaluation, and interpretation of the information gained from the external environment (Kim 1997; Zahra and George 2002). Thus, it requires information mechanisms that facilitate activities such as exploration, analysis, evaluation, and organizing (Zahra and George 2002).

Information and communications technologies such as group decision support systems (GDSS) have been designed to support the exploration of unstructured problems in a group setting. These systems often include tools (e.g., electronic brainstorming, agenda setting, voting, and topic analysis) to aid groups in several decision-making processes by inducing members to work smaller parts of the task separately. When guided by a set of structures teams tend to better evaluate and interpret the information exchanged (Applegate, Konsynski, and Nunamaker 1986); thus, these functionalities are likely to enhance the group's ability to assimilate new information.

Information and communications technologies also provide information processing mechanisms to sort, categorize, evaluate, and search for specific pieces of information within a database. In general, these mechanisms provide filtering and layering of information capabilities. First, the filtering functionality allows organizing the information in a way that relevant content is visually positioned together to enable the formation of cognitive maps, thereby enhancing absorption of information. Then, the layering process enables a cognitive synchronization that improves team performance by facilitating team members' information processing capabilities. The information is organized in such a logical fashion that the apparent complexity of information is reduced so that those members are able to absorb smaller pieces of information at a time. Recently, this mechanism has been used on the web in the form of hypertext. To sum up, process structuring and information processing mechanisms promote knowledge assimilation by helping individuals to process and internalize external knowledge. Hence:

Proposition 2: *Information and communications technologies, when used as a process structuring and information processing mechanism, will positively influence a MNE's capability to assimilate knowledge within its network.*

Cross-border knowledge transfer among MNEs involves two or more units in at least two countries (Rugman and Verbeke 2001). Therefore, cultural differences play a significant role in determining the efficacy of such global transactions (Kedia and Bhagat 1988). Cuture has been studied in various areas including marketing (Aaker and Maheswaran, 1997; Clark,

1990; Tse et al., 1988), international business (Bhagat, et al. 2002), and management (Hosfstede, 1991). Consequently, scholars have proposed many different definitions of culture. For example, Hofstede (1980) suggests that culture is the collective programming of the mind that distinguishes the members of one group from another. Hall and Hall (1990) define culture as a system for creating, sending, storing, and processing information. Adopting these two perspectives to the study of knowledge transfer within the MNE, we refer to culture as the system for creating, sending, storing, and processing information that distinguishes organizational members from different countries.

Furthermore, most of the cross-cultural research has adopted Hofstede's (1980; 1991) framework that categorizes national cultures along four main dimensions: individualism, power distance, uncertainty avoidance, and masculinity. For example, individuals in a society classified as high in uncertainty avoidance tend to behave guided by explicit and formal rules and regulations, thus being more prone to rejecting novel ideas. Conversely, individuals in a low uncertainty avoidance society tend to behave in a more flexible way, thus enabling the acceptance of novel ideas. Furthermore, people in individualist cultures are usually motivated by their own preferences, needs, rights, and contracts. On the contrary, individuals in collective cultures in general place great emphasis on the group and behave guided by norms, duties, and social obligations. Therefore, culture influences ways of thinking by affecting how individuals interpret and make a sense of organizational knowledge (Bhagat, et al. 2002).

While a number of studies have empirically demonstrated the differences between the national cultures of developed and developing countries, recently Hewett et al (2006) found that both the United States and Latin America scored differently in most of the above cultural dimensions. The United States scored highest on the individualism dimension (score equal to 91), while Latin America countries scored from 12 (Venezuela) to 46 (Argentina). These results suggest that the United States places emphasis on what is best for the person, while in the Latin American countries the behavior tends to be based on the collective. Additionally, the power distance score for the United States was 40, while the Latin American scores ranged from 49 (Argentina) to 81 (Mexico and Venezuela). This suggests that when engaging in knowledge transfer processes, individuals in Latin America are likely to adopt more hierarchical processes in comparison to individuals in the United States. Finally, the scores also differed in regards to the uncertainty avoidance dimension. The U.S. scored 46 while the Latin American countries scored from 76 (Venezuela) to 86 (Argentina and Chile). These scores suggest that Latin American individuals are more willing to adopt structuring and controlling processes in comparison to U.S. counterparts.

In short, Hewett et al's (2006) results support the notions that individuals from dissimilar cultural contexts interpret and manipulate organizational information differently, thereby constraining the effectiveness of cross-border transfer of organizational knowledge (Bhagat, et al. 2002). With this respect, cultural differences are likely to influence absorptive capacity. In fact, Kim (1998) indicated organizational learning as a function of absorptive capacity to understand the process of technological transformation in a large automobile industry. Kedia and Bhagat's (1988) study also showed similar effects of cultural differences on knowledge transfer across nations.

To sum up, there is clear evidence on the constraining effects of cultural diversity on MNEs' ability to fully exploit innovative practices from its subsidiaries. Thus, it is expected that cultural variations among participants within the MNE network are likely to negatively impact their ability to acquire and assimilate knowledge from external sources. Hence, we propose:

Proposition 3: *Cultural differences will negatively influence a MNE's absorptive capacity in terms of acquisition and assimilation of knowledge within its network.*

Effective acquisition and assimilation of overseas information requires communication intensity among teams (Allen 1977; Egelhoff 1988; Ghoshal, Korine, and Szulanski 1994; Nohria and Ghoshal 1994; Subramaniam and Venkatraman 2001; Tushman and Nadler 1978). For example, Subramaniam and Venkatraman (2001) found that transnational project teams whose members communicated frequently with overseas partners to gain information and learn about different organizational practices and routines outperformed those teams whose members communicated sporadically with their peers.

Additionally, when observing the communication patterns exhibited among culturally different members, empirical evidence suggests that the frequency and predictability of communication leads to trust, thereby improving team performance (Jarvenpaa, Knoll, and Leidner 1998; Jarvenpaa and Leidner 1999; Kayworth and Leidner 2000; Maznevski and Chudoba 2001). Specifically, teams that used computer based technologies to increase the frequency of communication among their geographically dispersed members outperformed those teams in which members failed to communicate and perceived others as being absent. In other words, when information and communications tools are used to increase the ability to interact in a continuous and repetitive fashion, team members tend to be better off in terms of interpreting, evaluating, and making sense of others' information.

The literature on virtual teams has also examined the impact of cultural differences among team members on group processes such as coordination (Johanson, Dittrich, and Juustila 1999; Maznevski and Chudoba 2001; Robey, Khoo, and Powers 2000) and communication (Kayworth and Leidner 2000; Sarker and Sahay 2002; van Ryssen and Godar 2000). While a few studies have indicated that cultural differences tend to negatively impact performance in virtual teams, these effects are likely to dissipate if members use appropriate communication interfaces that enable them to understand and accept their cultural differences (Robey, Khoo, and Powers 2000; Sarker and Sahay 2002). For example, when examining a company that successfully implemented global virtual teams, Suchan and Hayzak (2001) found that virtual collaborators performed well because their managers recognized communication and the maintenance of a culture of extensive knowledge sharing as key assets of group work. Thus, all else being equal, the negative impact of cultural differences on a firm's absorptive capacity are likely to dissipate when virtual collaborators use tools to promote knowledge sharing and improve communication frequency. In short, we expect information and communications technologies to influence the strength of the link between cultural differences and absorptive capacity. Hence:

Proposition 4: *Information and communications technologies, when used as a communication interface, will positively moderate the relationship between cultural differences and a MNE's absorptive capacity.*

Firm-specific knowledge, a major asset of today's competitive organizations (Stewart 1997), is internationally dispersed within the MNE network (e.g., Rugman 1981; Dunning and Rugman 1985). For instance, while some overseas subsidiaries' practices might reflect innovative processes to deal with managerial actions, others might engage in alternative ways of coordination and control of their asset base. Because these geographically distributed initiatives play a critical role in contributing to the MNE overall performance, the ability to cross-border the transfer of knowledge within the MNE network is fundamental to leverage a competitive advantage of MNE units (Subramaniam and Venkatraman 2001).

The cross-border transfer of organizational knowledge is not void of managerial challenges, however. Some organizational routines, tasks, processes, practices, and norms are not easily transferable because they reflect a deep culture-specific set of values and frames of reference of the holder company (Bhagat, et al. 2002; Rugman and Verbeke 2001). Therefore, it is healthy to differentiate firm-specific knowledge based on the complexity involved in the transfer of knowledge from the holder to the recipient organization.

With this in mind, Rugman and Verbeke (2001) categorized firm-specific knowledge along two dimensions: non location-bound knowledge and location-bound knowledge. Non location-bound knowledge represents the firm-specific capabilities that can be potentially transferred across borders and can be conceived as either a functional, production-related proprietary asset or as an organizational capability to efficiently coordinate and control the MNE asset (Rugman 1981; Dunning and Rugman 1985). Conversely, location-bound knowledge refers to the firm-specific abilities that are related to intrinsic characteristics of a specific location, thus being difficult to adapt and transfer in order to be used on other locations. Our framework focuses on the non location-bound knowledge because it is context independent, offers economies of scale, and requires low marginal costs to be transferred to foreign subsidiaries (Rugman 1981; Dunning and Rugman 1985). In addition, it can be exploited and diffused by other firms within the MNE network without substantial adaptation (Rugman and Verbeke 2001).

As has been discussed earlier, absorptive capacity identifies the extent to which the recipient firm has the ability to value and acquire external knowledge (Cohen and Levinthal 1990; Kedia and Bhagat 1988). Therefore, all else being equal, the MNE's ability to acquire and assimilate knowledge improves its effectiveness in regards to the transfer of knowledge within the MNE network. Hence:

Proposition 5: *A MNE's absorptive capacity in terms of acquisition and assimilation will positively influence the transfer of non location-bound knowledge within the MNE network.*

Although the above five propositions imply that the three technology dimensions are distinct, it should be noted that they interact significantly. Theoretically speaking, we could generate additional propositions to reflect the complexity of these interactions. However, such propositions are beyond the scope of this paper. Our current research efforts are best directed at testing both the validity and the generalizability of the above-mentioned five propositions.

3. DISCUSSIONS AND CONCLUSION

Current literature on MNEs suggests that it is critical to acquire and identify firm-specific advantages within the MNE network. Also, the resource-based view suggests that because firms are conceived as historical and social entities their ability to acquire and exploit resources to gain competitive advantage depends upon their managerial capacity to absorb knowledge. This research has demonstrated how the implementation of information and communication technologies (ICTs) by global virtual teams moderates the constraining effects of cultural differences on absorptive capacity, thereby enhancing the cross-border transfer of organizational knowledge.

For researchers, this study offers three significant contributions to the literature. First, it suggests that MNEs' ability to absorb, generate, and apply knowledge is profoundly affected by its endowment of appropriate use of information and communications technologies and the cultural diversity of its organizational members. Second, drawing on a resource-based view of the firm, it is offered a theoretical framework that integrates five key research concepts— multinational enterprises, global virtual teams, absorptive capacity, cultural diversity, and

knowledge transfer. Despite a great deal of research that has indicated the potential benefits of global virtual teams, to the best of our knowledge no study has systematically examined the relevance of this new organizational arrangement in the MNE. Furthermore, by examining cultural diversity, this study also incorporates the complexities of knowledge transfer in dissimilar cultural contexts. As such, this theoretical effort guides empirical work and generates additional propositions in this area. Third, it identifies three technological dimensions and how they moderate the impact of cultural diversity on absorptive capacity. In doing so, it is provided some insights into the questions "what drives the transfer of knowledge in MNEs?" and "how can global virtual teams enhance a MNE's absorptive capacity?". These are key issues to the analysis of a firm's reconfiguration of its knowledge base so that it can obtain a sustainable competitive advantage in today's highly competitive and turbulent marketplace.

This research also has several managerial implications. First, a number of developing nations in Latin America such as Argentina, Brazil, Chile, and Mexico are increasingly competing in the global economy as the main destinations for the offshore of IT. As the number of offshore location increases, there is a need for the understanding on how IT managers in the recipient countries should manage the cultural aspects in an effort to improve the firm's performance. Second, understanding the underlying processes of cross-border transfer of knowledge in culturally dissimilar countries reveals unique factors relevant for IT managers operating internationally. The framework suggests that the adoption of new organizational structures in Latin America may necessitate unique managerial techniques due to the cultural differences between developed and developing countries. Finally, this study also provides managerial insight on how global virtual teams can enhance a MNE's cross-board transfer of knowledge, thereby leveraging a competitive advantage. A managerial intervention based on this approach may ultimately stimulate collaboration among and engender effective knowledge transactions between firms.

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DIGITAL INCLUSION PROJECTS IN DEVELOPING COUNTRIES: PROCESSES OF INSTITUTIONALISATION

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Abstract

This paper concerns digital inclusion projects in developing countries and, in particular, focuses on processes of institutionalisation of such projects. Three case studies are described and analysed. The first is the Akshaya telecentre project in the state of Kerala in India. The second is a community-based ICT project in a town in a rural area of South Africa. The third is the efforts of various agencies on telecentre projects in the mega-city of São Paulo in Brazil. The cases are analysed through a simple theoretical schema derived from institutional theory. The analyses are used to derive four key processes of institutionalisation which are argued to be of relevance to all digital inclusion projects: getting symbolic acceptance by the community; stimulating valuable social activity in relevant social groups; generating linkage to viable revenue streams; and enrolling government support. The paper concludes with some theoretical, methodological and policy implications.

Keywords: digital inclusion, developing countries, institutionalisation processes, institutional theory, telecentres, India, South Africa, Brazil.

DIGITAL INCLUSION PROJECTS IN DEVELOPING COUNTRIES: PROCESSES OF INSTITUTIONALISATION

1. INTRODUCTION

It is increasingly recognised that the so-called digital divide is not just a matter of unavailability of information and communication technologies (ICTs), but also of the social, political, institutional and cultural contexts which shape people's lack of access to ICTs, or their inability to use them effectively (Warschauer 2003). These problems apply to the socially excluded in all countries of the world, the Fourth World in the language of Castells (1998). However, it can be argued they are particularly acute in the developing countries, where large numbers of people do not have access to technology, nor the educational background or support to develop their skills in using technology to improve their own lives, or the lives of the communities within which they live.

One response to the above over the last decade or so has been a variety of digital inclusion projects in a wide range of contexts and countries (Hunt 2001; Kanungo 2003; Salvador et al 2005). These projects normally aim not only to deliver ICT access to particular targeted groups, but also to provide various types of support for learning and capacity building. Thus they aim to use ICTs to contribute to the broader goal of social inclusion (Trauth et al 2006). In this paper, we draw on experiences from digital inclusion projects in three different countries and contexts. These involve telecentres in the state of Kerala in India and in the city of São Paulo in Brazil, and a community-based ICT project in a town in a rural area of South Africa. In each case, we investigate the achievements and problems of the projects over a period of several years. This enables us to examine the changing nature of the projects, and the ways in which the projects do or do not become institutionalised over time.

The paper is organised as follows. The following section provides a brief discussion of some important challenges facing digital inclusion projects, and introduces selected concepts from institutional theory as ways to analyse these challenges. Experiences in our three case studies are then outlined, and related directly to the theoretical concepts. We then use these analyses to describe and discuss some key processes of institutionalisation of digital inclusion projects. Finally, we draw conclusions on the contributions of the paper and future research directions.

2. DIGITAL INCLUSION AND INSTITUTIONALISATION

Three issues can be identified from the literature as of critical importance to digital inclusion projects . Firstly, what has been the *value* of these projects? It is well-known in the IS field that the evaluation of the costs and benefits of technology is problematic, and this certainly applies to digital inclusion projects (Reilly and Gómez 2001). Who has benefited from the projects and in what ways? How can we assess these benefits? One concern, for example, is that digital inclusion projects may miss the least-advantaged groups in the communities that they aim to serve and thus, ironically, produce a local form of digital divide within these communities.

Even if we can be reassured that a digital inclusion project is delivering value, a second key issue is the *sustainability* of the initiative over time (Harris et al 2003). For example, most projects are started with funding from local or central government, aid agencies or NGOs. However, long-term financial sustainability implies the need to develop indigenous funding sources and sustainable revenue streams. Sustainability is not just a matter of money, but also of the development of institutional arrangements for the continuity of staffing levels, and the

long-term cultural and political support for the initiative from government officials, politicians, and the community itself.

Individual projects may deliver value and be sustainable, but the scope of such projects is often limited. A crucial issue for developing countries is *scalability.* Sahay and Walsham (2006) define scaling as the approach through which a product or process is taken from one setting and expanded in size and scope within that same setting and/or also incorporated in other settings. The unfortunate word 'replication' is sometimes used for this process, which implies the 'copying' of an initiative in a straightforward way. However, scaling of digital inclusion projects is not a simple matter of repeating a formula elsewhere, but a much more complex problem involving the development of a heterogeneous network constituted of technology, people, processes, and the institutional context.

In discussing the challenges of digital inclusion projects above, it is clear that processes of institutionalisation, or lack of them, are crucial to the long-term value, sustainability and scalability of such projects. This suggests that institutional theory may provide a fruitful analytical approach. We do not have the space in this short paper to give a substantial review of institutional theory. However, the theory has developed over a long period of time, and offers a wide range of concepts and approaches to analyse institutional persistence (Meyer and Rowan 1977; DiMaggio and Powell 1983) and institutional change (Oliver 1992; Greenwood and Hinings 1996).

The potential value of institutional theory in the IS field has been recognised for some time (http://www.istheory.yorku.ca/institutionaltheory.htm). In particular, a number of authors have applied institutional theory with a focus on IS in developing countries (Avgerou 2002, Silva and Figueroa 2002; Bada 2003; Miscione 2007), reflecting an interest in the relationship between ICTs and the institutional contexts in which they are embedded. This paper falls within this genre, in that we will draw on selected elements from institutional theory in order to analyse our field data. In particular, we build on the following definition of institutions from one of its principle theorists:

'Institutions are multi-faceted, durable social structures, made up of symbolic elements, social activities, and material resources.' (Scott 2001, p49).

Drawing from this definition, therefore, we wish to investigate the processes whereby digital inclusion projects can become institutionalised through the creation of structures of symbolically accepted goals linked to relevant social activities and supported by appropriate material resources. However, institutionalisation is not a one-off static event; institutions need to be re-created or maintained over time. With respect to digital inclusion projects, therefore, we need to also investigate the dynamics of institutional stability and change. We turn now to our three case studies, each of which we will analyse through the theoretical perspective introduced here.

3. AKSHAYA TELECENTRE PROJECT IN KERALA, INDIA

The first case study concerns the Akshaya telecentre project that was launched in 2002 as a pilot in Malappuram District in the South Indian state of Kerala. The case description which follows is based on a two-year research study from 2002-4 carried out by Shirin Madon. She was involved with the project from its inception and she carried out about 100 hundred interviews with government officials, politicians, telecentre entrepreneurs, private sector employees and various citizens. Although data collection was done mainly through semi-structured interviewing, additional data were obtained through participant observation,

attendance in public meetings, and the study of press reports and websites. More details of the research methodology are given in Madon (2005a, 2005b).

3.1 Case Description

Four interrelated processes are described below which have affected the Akshaya telecentre project at different points in time. The first process relates to peoples' perception of Akshaya as valuable for achieving Kerala's unique development model. Over the past 50 years, the state has evolved from being relatively poor and ridden with caste and class conflicts into a state with modest levels of economic growth but high levels of social development indicators, including a vibrant civil society. However, since the late 1990s, the lack of economic productivity, especially in rural areas, coupled with high unemployment was beginning to act as a serious threat for the development that had been achieved in the state. This led to an increasing expectation by the state government that information technology could act as a catalyst for improving rural economic productivity and for maintaining high levels of social development. There was multi-level acceptance of this ideology by citizens and local bodies and it had the strong backing of the state government, which facilitated the telecentre project by developing the initial suite of applications, identifying the locations of the centres in the pilot district and facilitating loans for the entrepreneurs to set up their centres.

The creation of an initial set of values for the Akshaya project built a foundation for setting in motion a second process – that of establishing local appropriation of the project. By early 2003, a critical mass of 630 telecentres had been established in the pilot district, and an extensive e-literacy programme had commenced which was funded strategically by the local political bodies to signal their participation. Mechanisms for achieving local appropriation of the project during its e-literacy phase were established through the vigorous grassroots campaigning that was undertaken at the time in order to mobilize communities to accept the project as their own. This campaigning played an important role in achieving social acceptance of the project, communicating the message that it was 'government approved'. This resulted in a large percentage of the local female Muslim population coming forward for training. By the end of December 2003, the project was deemed successful in terms of achieving significant value for the state in terms of its development goals. Throughout the district, one person per family had achieved basic IT literacy skills and the project had generated a significant livelihood for entrepreneurs, many of whom had already managed to recuperate around 50% of their initial outlay. But despite these successful indicators, it remained unclear as to whether the project would sustain itself over time.

After the euphoria of the e-literacy phase, another crucial process became important for ensuring that the project could sustain its intrinsic value as a conduit for socio-economic development. In this post e-literacy phase, there was a concerted effort to generate new commercial revenue streams for the entrepreneurs. Companies were encouraged through several promotions to consider selling their products and services, such as handicrafts, soaps, insurance policies, and banking services, through the Akshaya centres in order to generate a regular revenue stream for entrepreneurs. But problems were encountered in generating corporate confidence. No legal entity was established with whom companies could negotiate and formalize a contract, nor was there a clear channel of communication between companies and government regarding economic policy, which would ultimately affect the ability to sell products and services through the Akshaya centres.

The post e-literacy phase also led to a push by the state government to promote locally-relevant content in key socio-economic sectors such as health, education and agriculture. This was attempted in 2004 by experimenting with a health-mapping project in which the local

village council conducted a health survey of its population with the intention of using the Akshaya centres to register data about the health status of the local population. However, the project hit an obstacle because adequate linkages had not been established with the local health planning apparatus, causing suspicion about the integrity of data collected and of the ownership of sensitive health data. Appropriate institutional support was clearly needed to support this activity. An interesting linkage has recently formed between the Akshaya project and the state's agricultural department to use the e-centres in Malappuram as information points for providing advice on agriculture. Expert advice would be provided both remotely through a web portal connected to a team of agricultural officers and locally through the physical intermediation of a local extension officer who would communicate verbally with the farmer.

A final process we consider important for the project to survive over the long term is the learning that is or is not carried forward from the pilot to the roll-out phase of the project. Akshaya has now been rolled out to 6 more districts in Kerala but the model has been different. There are fewer centres, which means that levels of coverage will eventually be less than in the pilot district. Another difference is that entrepreneurs are mainly business people rather than being driven by a concern for social development. As more autonomy has been given to entrepreneurs in the location of sub-centres, there is a fear that the project may compromise on its socio-economic development priorities. Compared to the pilot phase, the roll-out districts have seen far less local campaigning to mobilize community interest in the project.

3.2 Case analysis

The first phases of the Akshaya project can be viewed quite positively through the perspective of the institutional elements introduced earlier in the paper. There was widespread promotion and acceptance of the Akshaya project as being linked symbolically to Kerala's unique development goals, and to the social activity of gaining e-literacy in the community. This was supported by appropriate material resources in terms of 630 telecentres in the pilot district, and vigorous grassroots campaigning to mobilize communities. The e-literacy activities in the centres were complemented by various non-IT based activities such as clubs for women and children.

The later phases of the project are much less clear in terms of their achievement of digital inclusion goals. The attempt was made to symbolically link the Akshaya telecentre project to the stimulation of entrepreneurial activities. However, the selling of goods and services was hindered by a lack of appropriate material resources in the form of a legal selling entity or clear industry-government communication channels. Similarly, symbolic linking to key sectors such as health was hindered by a lack of institutional linkages between the local health planning apparatus and the telecentre initiative. The extension of the project outside the Malapurram district is still in its early days, but there are initial concerns that the symbolic linking of the extension project to entrepreneurship rather than to social development goals, and the relatively low level of material resource in terms of telecentre coverage, may compromise digital inclusion goals in favour of supporting the selling activities of entrepreneurs.

4. SIYABUSWA PROJECT IN MPUMALANGA, SOUTH AFRICA

Our second case study concerns a long-term community-based development project in the small town of Siyabuswa in South Africa, where we will focus on the ICT-based interventions. The case description which follows is based on an action research study

involving Dewald Roode and colleagues from the University of Pretoria over a period of ten years starting in 1994. As with all action research projects, data collection involved the continuous documenting of direct participant action linked to more reflective processes of discussion, reading and writing. More details of the project and the associated research methodology can be found in Roode et al (2004) and Phahlamohlaka et al (2007).

4.1 Case description

Siyabuswa is a small town in a rural area, situated about 130 km north-east from Pretoria in the Mpumalanga province of South Africa. In 1994 the Department of Informatics at the University of Pretoria became involved in SEIDET, the Siyabuswa Educational Improvement and Development Trust, a community initiative started in the early nineties by a small number of individuals, led by a member of the local community, Jackie Phahlamohlaka. The project provides supplementary tuition on Saturdays to secondary school learners in selected learning areas.

The first ICT intervention at Siyabuswa was early in 1998 when the Department of Informatics and a private company established a computer facility with 27 computers at SEIDET. Since then, all students have been required to complete a computer literacy course and regular use is made of the facility during teaching. The SEIDET Board also issued a request to consider ways of involving the community of Siyabuswa by making a computer literacy course available to the people of the community. The first local computer literacy course for people from Siyabuswa started in October 1998. This was first offered via satellite from the campus of the University of Pretoria, but since March 1999 has been presented by SEIDET teachers at Siyabuswa. Dating from 2000, the SEIDET computer training facility was operated as a franchise of a Pretoria-based private training company. In 2006 the local facility acquired the rights to the training material of the company, and it now operates totally independently.

What has been achieved at Siyabuswa has been of great value to the local community. The training facility is owned and operated by members of the community, and provides highly valued services to a broad spectrum of community members. Many of the graduates have found computer-related employment. Some are exploiting their newly acquired skills, and their activities show all the signs of developing into small businesses. The facility is self-sustaining, and receives no outside funding. After eight years of continued, albeit slow, growth, the facility and what it stands for has become an accepted fact within the Siyabuswa community.

The early success at Siyabuswa led the primary local actors to expand activities to nearby KwaMhlanga and Vaalbank, where training facilities were established, as offspring of the SEIDET facility, in 1999 and 2000 respectively. It was therefore quite natural to consider further expansion of the SEIDET concept into the deeper rural areas of Mpumalanga, which reach up to the Swaziland border. In October 2001, the private training company referred to earlier, and researchers who had been involved with SEIDET, launched the Sustainable Development Initiative (SDI), aimed at building human capacity in rural communities through the careful and planned use of ICTs.

The basic idea of the SDI was to establish computer training facilities, similar to that of SEIDET, as development hubs in selected rural communities. The SDI was planned around four phases: first, the selection of suitable candidate trainers; second, the training of the selected candidates; third, the identification of suitable rural communities in Mpumalanga; and fourth, the empowerment of these communities through the establishment of local

computer training facilities with the assistance of the employed trainers. Funding was obtained from a central government agency, and the private company provided the required computer and office infrastructure for each of the planned facilities. The aim was to involve the community deeply in the whole undertaking, and to let them benefit financially from the facilities. The private company would only gain through the royalties payable on the use of its training material. Three communities were selected and training started during 2003. Although the projects in the different communities started off with great local enthusiasm, progress slowed down when support from the provincial Department of Social Development did not materialize. This led to a decrease in support from the local communities and, ultimately, to the demise of the whole SDI project by the end of 2003. While some success was achieved, mainly in the sense that an awareness of computers, the internet and what ICTs could mean for a community had been created, the project failed to reach its main objectives, namely to build human capacity and to establish development hubs in communities.

Reflection on the relative failure of the project suggested a number of reasons. First, it is very difficult to establish a sustainable facility in communities that are so poor that people cannot afford to pay for ICT training, which was the case for two of the communities. A facility in such communities should, if it is to become a development hub, assist with the inflow of financial resources into the community, and needs to be sustained through outside funding until such a situation is reached. Second, the importance of developing a relationship of trust between the community and the "outside" developers cannot be overstated. The trainers who were employed in the communities were not local to those communities and their motives were suspected to be primarily financial. While deep rural communities are quite isolated, most of them have experienced attempts by 'outsiders' to profit from them. Communities were also perplexed about the motives of the initiators of the project, and the question 'why are these people doing this' was insufficiently addressed in briefing sessions with community leaders. A final reason pertains to the failure to align the project with regional and governmental activities. Regular feedback sessions were arranged with the Department of Social Development of Mpumalanga, but each time reporting to a different official. Building of a relationship of trust was therefore difficult, but more time should, therefore, have been spent on this.

4.2 Case analysis

The symbolism of the SEIDET initiative was a project for and by the Siyabuswa community. Although staff from the University of Pretoria were involved throughout, a key lead figure was a member of the local community who had gained a higher education and wished to contribute to the community from which he came. The social activities which were developed over a period of more than ten years started with additional secondary school teaching but further developed through ICT initiatives and more general computer literacy courses. In terms of material resources, the long-term institutional support of the University of Pretoria can be considered crucial in maintaining activities until they were self-supporting.

With respect to the later SDI initiative in other communities in Mpumalanga, the symbolism of 'for and by the community' was never established. The project initiators and the trainers were outsiders whose motives were often suspected. Some social activities around IT literacy did take place, but these fell away to nothing in the end. In terms of material resources, poor enrolment of government support meant that the inadequate resources of the local communities themselves were insufficient to maintain the viability of the project.

5. TELECENTRES IN SÃO PAULO, BRAZIL

Our final case study concerns telecentre projects in the city of São Paulo in Brazil. The case description which follows is based on a long-term research project, starting in 2001 and continuing to the present time, carried out by Nicolau Reinhard and colleagues from the University of São Paulo. The research project used an actor-network theory framework, with data collection involving extensive participant observation of telecentre projects, and many interviews with government officials, telecentre managers and telecentre users. Additional data sources have included surveys of telecentre users and press reports. More details of the telecentre projects and the research methodology are given in Macadar and Reinhard (2006) and Macadar (2004).

5.1 Case Description

São Paulo is a mega-city with a population of about 17 million people. There are many poor people in the city, with roughly half the population being in the lowest socio-economic classes. These classes are the main target of digital inclusion programs, including telecentre projects. Such projects have proliferated over the last five years and there are now hundreds of working telecentres throughout the city. These fall into three main categories. Community telecentres are normally installed and co-ordinated by government agencies, but are located in neighbourhood community centres and operated by community leaders. They provide free internet access and digital literacy courses. Centrally located government telecentres are situated in places such as government buildings and public service centres, and they provide convenient access to e-mail and e-government services, mostly to the working adult population. Usage rates tend to be very high for these centres, particularly for the large centre in downtown São Paulo. Finally, there are a range of special purpose telecentres, set up by government, private donors or non-governmental organisations (NGOs) and located in places such as schools, prisons, and NGO offices.

An important program with respect to community telecentres is that set up by the City of São Paulo. There are currently 148 such centres at the time of writing. Surveys have shown that the majority of the users of these telecentres are teenagers with only about 20% of the users being over 25 years of age. They are mostly frequent users of the telecentre, with some teenagers, either studying or unemployed, spending much of their day at the centre. Most of the usage time is spent searching for information, communicating through services such as e-mail, taking IT literacy courses and playing games. The telecentre program is still very active, with new telecentres being installed on frequent basis, and with an increased emphasis on the provision of IT courses for the centre users.

However, despite the vigour and expansion of the City of São Paulo telecentre programme, there is a significant gap between the original espoused social development goals of the programme and actual usage patterns. The initial plan for the centres envisaged having local communities and civil society organisations teaming up with telecentre management to provide content and services through the internet of direct relevance to the community as a whole. This has not happened. Local telecentre supervisory councils have been abolished with some of the reasons given by local government officials being that the councils had become 'politicised' and that 'members tried to take control of the telecentre to serve their personal interests'. It is worth noting that the current political party in power in São Paulo is centre-right and that many local activists at community level are members of the opposition Labour Party.

Although the goal of the local government telecentres may have shifted, the program is still high on the political agenda of the mayor and his party. There is a prevalent political discourse throughout Brazil as a whole which favours the installation of telecentres for free

access to the internet and other computing resources. In addition, since the community telecentres in São Paulo serve mostly young people, they are seen as a way of 'keeping the youngsters off the street' and thus as a tool to reduce violence. No politician would dare to deactivate a public telecentre since this would be viewed as a hostile political act towards that local community, and would likely result in serious action to oppose it.   An increasingly common model for the community telecentres involves a partnership between local government and an NGO in particular priority areas. Local government funds pay the salary for a local co-ordinator, a technical support person and a limited monthly expenses budget. The partner then provides all other resources, including additional personnel.   Staff who are recruited through an NGO avoid City Government employment liability, but one negative effect of this is that turnover of personnel is high.

The best-known programme of special purpose telecentres is that run by an NGO called the Committee for the Democratization of Information (CDI). This is a highly regarded digital inclusion programme with over 700 centres throughout Brazil and 175 centres abroad. Their primary goal is social inclusion of the less-advantaged in society, with digital literacy courses as their main activity. They rely mostly on donations from companies in the form of money and recycled computers. They have partnerships with local NGOs and city governments, providing management and teaching competence to their partner operators. In order to utilise the recycled computers donated by companies, they have set up technical laboratories where they repair, refurbish and cannibalise used computers. These laboratories also help their trainees to become competent as computer technicians. CDI's original goal was to have users pay small fees to cover operational costs, but users are becoming increasingly unwilling to pay this fee. This calls into question the financial sustainability of the centres, which remains an open issue for CDI's management.

5.2 Case Analysis

The initial symbolism for the City of São Paulo telecentre programme revolved around community-led digital inclusion. However the social activities that this stimulated primarily involved only one subset of communities, namely unemployed or underemployed young people. Although the programme was relatively well supplied in terms of material resources such as computers and centre staff, little resource was made available to support the build-up of broader community-based activities. The symbolism of the project has shifted in recent years, partly due to a change of local government, towards keeping the young and poor off the streets. The issue of the provision of material resources has also shifted towards partnering with NGOs, although this has resulted in some negative consequences such as high staff turnover.

The CDI programme has the symbolic goal of social inclusion through digital literacy. Social activities supported, in addition to digital literacy training, have also included the training of computer technicians. The material resources of CDI have been supplemented by partnering with companies, resulting in donations of money and equipment. Despite this, issues of financial viability remain. The centrally-located government telecentres have the symbolism of delivering e-government services to the people. They have been successful in this respect, with high usage rates, although the typical user is a working adult who is not from the poorest parts of the City population. Resources have been good for these initiatives, but it is questionable whether they make a significant contribution to digital inclusion goals.

6. DISCUSSION

The three cases which we have described and analysed above demonstrate a wide variety of experience and a complex mix of success and failure of digital inclusion projects. In addition, they show that such projects change significantly over time. Early successes may not always be sustainable or scalable, but on the other hand persistence sometimes brings rewards after initial difficulties. Although the case experiences are each unique in themselves, they also have some common features. In particular, we discuss below four key processes of institutionalisation derived from our field data and analysis. These processes were important in all our case projects, and we would argue that they are of relevance to digital inclusion projects more generally.

A first institutionalisation process for digital inclusion projects involves *getting symbolic acceptance by the community* who are the targets of the project. This was achieved in the e-literacy projects in Kerala by the linking of the projects to Kerala's development philosophy, partly through vigorous grassroots campaigning. However, acceptance became more problematic later when the goals shifted towards stimulating entrepreneurial activity. The project at Siyabuswa was highly successful in gaining community acceptance being seen as both by and for the people, not least through the leadership of a person from the community itself. In contrast, the later extension project failed to gain acceptance in the new deep rural communities with considerable suspicion about the motives of the 'outsiders' who were promoting the project. Community acceptance of the City of São Paulo telecentre initiatives was an initial goal which was only partly achieved, with the projects continuing in the communities, but with increasingly limited community participation.

A related process is *stimulating valuable social activity in the relevant social groups.* The e-literacy projects in Kerala were very successful in this respect with the widespread participation of groups such as Muslim women who are often part of the socially excluded. Similarly, although on a narrower scale, computer training at Siyabuswa spread from school children to the community at large. This was also the objective at the wider deep rural project, but this was not achieved. The telecentre projects in São Paulo have succeeded in stimulating activity in certain groups such as the underemployed young and, through the centrally-located government telecentres, working adults in the City. However, with some limited exceptions, many of the socially excluded in the poorer communities have not been reached through these projects.

A third process of great importance in sustaining digital inclusion projects over time is *generating linkage to viable revenue streams.* The later attempts to do this in Kerala have been problematic with only limited success in generating entrepreneurial revenue, and some concern that the expansion of the entrepreneurial symbolism approach to districts outside Malapurram may compromise social inclusion goals. The Siyabuswa project has, in the end, become self-financing, but it is worth noting that this would most probably not have been achieved without the continuous long-term backing of outside agencies such as the University of Pretoria. Revenue remains a problem for the São Paulo telecentres aimed at the digitally excluded, including those under the auspices of the City government. However, some innovative models are being tried including partnerships with NGOs and, in the case of the CGI projects, with donations in cash and kind from commercial organisations.

A final process which was important, and often crucial, in all the case studies was *enrolling government support.* This was achieved successfully in the Kerala case in the e-literacy phase through the strong symbolic linking of the project to the state government's espoused development goals. It is currently more problematic in the entrepreneurship phase with some potential conflict between the state government's approach and wider social inclusion goals. The linkage to government was not that important during the development of the Siyabuswa

project, due to its relative small scale and the backing of other agencies. However, a key reason for failure of the later deep rural project was inadequate government backing, and the project initiators recognise that more effort should have been devoted to achieving government support. The enrolment of political forces in the São Paulo case study has been a crucial feature throughout, but this can be something of a mixed blessing. For example, the political views of the current centre-right government of the City of São Paulo often conflict with those of local community activists, resulting in disagreement concerning the goals and methods for digital inclusion projects. Various partnership models between outside agencies, government and NGOs are being tried, but the outcomes of these experiments are yet to be clear.

7. CONCLUSIONS

This paper has analysed three digital inclusion case studies through the theoretical lens of institutional theory. We have not undertaken a full institutionalist account of each of the cases, although this would be a worthwhile exercise. Rather, we have selected a simple theoretical schema based on institutional theory as a way of highlighting similarities and differences between the cases. Implications were derived in the previous section concerning key processes of institutionalisation which need attention in all digital inclusion projects. We hope that other researchers will wish to use and extend our approach elsewhere.

In terms of methodology for such research work, it is important to note that in all three of the cases there was major change over time, and understanding of the projects would have been much more limited by a snapshot approach. Thus, we would suggest that longitudinal research is particularly appropriate for research on digital inclusion projects. This supports the more general argument in Walsham and Sahay (2006) that more longitudinal research is needed on issues such as the scalability and sustainability of ICT projects in developing countries.

With respect to policy implications, we would argue that our work shows a clear need to improve the practice of evaluating digital inclusion projects in developing countries. Rather than building a framework for evaluation which focuses solely on impact, we suggest the need for approaches which try to understand key institutionalisation processes over time, and which document these processes in some detail. Digital inclusion projects are complex in nature and need to be better understood in terms of their benefits and problems. We hope that our paper makes a small contribution to such increased understanding.

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INNOVATION IN ICT CLUSTER: INTERPRETIVE FRAMEWORK AND CASE ANALYSIS IN CHINA

Research in Progress

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Abstract:

Empirical study shows that most ICT advances occurred within ICT clusters, which is gathered by complimentary ICT enterprises and related research and service institutions. In this paper, the author try to explore the following intriguing questions on this phenomenon: what is the relationship between ICT and clusters, what is the mechanism within that is responsible for explaining occurrence of ICT in clusters; And in what way innovations can be facilitated under localised environment in ICT clusters especially developing countries. The author addresses these problems in frameworks of interpretivism, which can be divided into two categories: context analysis – social capital, institutions and industrial features, and process analysis – path dependency and collective learning process. Considering that better understanding can be attained by addressing the features of ICT as distinct technologies, the author conceptualises ICT into two characteristics: ICT as unphysical products (distance doesn't matter) and ICT as knowledge existence. Thus the discussion is naturally led to explore the distinctive innovation process within ICT clusters, in which knowledge sharing and collective learning are of high importance. At last, a case of Chinese Zhongguancun Science Centre (ZSC) is analyzed as illustrations for the innovation mechanism and paths for development of ICT clusters.

Keywords:

Innovation, Cluster, ICT, Interpretive Framework, Path-dependence, Collective Learning, Zhongguancun Science Centre

Innovation in ICT Clusters: Interpretive Framework and Case Analysis in China

1. INTRODUCTION

A set of debatable ideas connects ICT development, cluster and innovation – innovation across organizations and clusters in particular. Combining them, we are naturally led to ask if rapid development in computer and communication technology innovation is internally connected with clusters; whether these cluster developments are leading to the difference of technology innovation between regions and countries; and how the dynamism of cluster innovation works under environment of distinct institutional frameworks of developing countries. Such questions arouse concerns about the ways technology advances at cluster levels: path-dependence and collective learning. The concerns are long-standing and the additional issue here is whether historical evidence in ICT magnifies the tension between the two ways.

Neo-classical economists argue that increased return – which means the average production cost tend to decrease as the total amount of production increases (Krugman et al. 1996; Mills 1967). Goldstein and Gronberg (Goldstein et al. 1984) proposed that based on the fact that many enterprises have maintained long-term auxiliary and collaborative relationship with a bunch of other enterprises, collaboration within clusters of enterprises reduces effectively those cost incurred by locations, and enterprises are able to benefit more from division of labour.

The European school of GREMI (Groupement de Recherche Eupopeen sur les Milieux Innovalieurs) emphasize the concept of social cultural environment (Milieu), which links together both the phenomenon of company clusters and their innovation activities (Bramanti et al. 1997). Research stream on national innovation system represented by Nelson, argues that technology innovation and diffusion needs massive support from national departments and institutions, as well as informal elements such as culture and social habits (Nelson 1993).

Path dependence is "a significant break from traditional neoclassical explanations of the development of economic institutions and technological artefacts" (Kenney et al. 1999). It is also widely accepted that technology and institutions in embedded within certain district or clusters co-evolve as the market selection process goes on (Granovetter 1985; Nelson et al. 1982). Saxenian indicates that Kenney and von Berg fail to specify the mechanism by which technological trajectories are established and reproduced, or by which entire regional economies might become victims (or beneficiaries) of path dependency (Saxenian 1999).

This paper provides an overview of theories and evidence on these questions, relating levels of ICT innovation to economic growth and spatial agglomeration in China. We address these problems in frameworks of interpretivism, which can be divided into two categories: context analysis – social capital, institutions and industrial features, and process analysis – path dependency and collective learning process.

2. ANALYTICAL FRAMEWORK

"Existence is interpretation and interpretation is existence"

-- Heidegger

In arguing that distinguishing subject (I) from object (the thing perceived) is at odds with actual experience, where understanding operates without reflections, philosopher Heidegger maintains that the separation of subject and object denies the unity of being-in-the-world (Heidegger 1962), which is used as most important research methodology in ICT analysis.

Interpretive methods of research adopt the position that our knowledge of reality is a social construction by human actors. In this view value-free data cannot be obtained, since the enquirer uses his or her preconceptions in order to guide the process of enquiry (Walsham 1993), and furthermore the researcher interacts with the human subjects of the enquiry, changing the perceptions of both parties.

If social construction of reality serves as the ontological premise while interpretive approach as the epistemological basis in this paper, the context/process analytical methods are the ways this paper practice this ontological and epistemological directions. In this paper, we investigate the whole collective behaviour of cluster considering social context and history as well.

Interpretive Framework	
Context	Process
Social Capital	Path-Dependency
Institutions	
Industrial Features	Dynamism of Knowledge Sharing

Figure 1 Analytical Framework

2.1. Context

With respect on issues of this paper on ICT cluster, the context analysis is composed of following factors: social capital, institutions, and industrial characteristics. Our first position is that the cluster should have established very strong social capital a sense of community and as the impulse to do something for the benefit of the group rather than out of narrow self-interests has been on the wane in recent years (Willcocks et al. 1995). Involvement in industry collaborations indicates the institutions that are important in collective cooperation between companies, such as business associations, joint venture and so on.

2.2. Process

It is different to construct good models in process analysis. A complete research in process should be based on longitudinal case studies. The approach here is used refers to the proposing that process analysis can be linked to the path-dependency dimension and dynamism of collective learning dimension. Path-dependency contributes an overview of the development history, and at the time indicates future directions according to the technological trajectories. We introduce the collective learning process as complementary part suggested by Saxenian (Saxenian 1999), which is capable of developing argument innovation mechanism.

3. ICT FEATURES, CLUSTER AND KNOWLEDGE SHARING

Social study of ICT emphasizes the impact of ICT characteristics on economical activities such as clusters. Theories stemmed from transaction cost and increasing returns represent mainstream research perspectives taken by ICT academics (Cordella 2000). On one hand, different from other high technologies, information and communication technology represent that kind of general-purpose technology, which can be utilized and always been utilized by almost every sector of social economy. One of the most important impact of progress in ICT lies on the mass reduction of transaction cost in economy. On the other hand, as an industry, ICT sector has a specific input-output mode, creating the first copy of software or the first design of semiconductor chip is costly, requiring high amount of valuable human resources and financial capital, however, it is obvious that producing further copies will cost virtually nothing (Quah 2001).

3.1. Clustering Forces and ICT

According to Quah, "geographical agglomeration emerges as an equilibrium outcome to resolve the tension between centripetal and centrifugal forces" (Quah 2001). Increasing returns and scales economics belong to the category of centripetal force, however, centrifugal forces are always neglected by researchers (Quah 2001). And there are obvious considerations in centrifugal force. First, transportation cost between production and consumption location. Secondly, degree of competition in certain locations. Third, high concentration generates cost of congestion (Quah 2001).

Considering all these positive and negative forces in mechanism of clusters, it is very important to note that development on ICT, which is deemed as general-purpose technology, have significant impact on the balance between centrifugal and centripetal forces, in the way that ICT influence the increasing returns, and knowledge spillover processes. Another important of ICT lies in its disrespect for geographical distance. In such a case, transportation cost is reduced to nearly zero. The zero transportation cost directly result in the possibility that manufacturers tend to turns attention to stay in community with customers and potential customers, where knowledge creation and knowledge sharing is easily diffused (Hippel 2002).

3.2. Knowledge and ICT

"ICT products themselves behave like knowledge"(Quah 2001). On one hand, knowledge which can be contained in ICT is infinitely expansible (David, 1993), the first copy of certain piece of idea or invention blueprint is quite costly to create, however, subsequent copies have marginal cost zero. This suggests a change in the nature of goods and services to become themselves more like knowledge (Quah 2002).

Research conducted by Coe and Helpman (Coe et al. 1995) examines cross-country technological progress and its relation to R&D activities, indicating that knowledge spillover across different economy, locations or nations do occur, however, those tacit knowledge that

are nurtured by specific local culture cannot copied and transferred across countries. Other scholars such as Jaffe (Jaffe et al. 1993) use patent-citation evidence to argue that geographic localization of knowledge do exist and difficult to transfer to other locations. In all, it has been found that knowledge contained in technology (intellectual property) is capable to spread, however, tacit knowledge can only spread incompletely and gradually, not fully and instantaneously.

Another strand of views in knowledge spillovers also provides necessary complementary argument. For instance, Lucas emphasized the relationship between human capital and knowledge spillovers. According to his view, the immobility of human capital in certain locations accounts for levels of knowledge spillovers, in recognition that codified knowledge is much easier than tacit knowledge to spread.

A critical consideration is the transferability of knowledge: the flow of knowledge among firms in a cluster. Transferability results from both the character of the knowledge itself and from the characteristics of the firms involved, ICT firms have its own way of knowledge transferring for example. In general, knowledge that is simpler, codified, less tacit, and less path dependent is more likely to be mobile. Hamel summarizes this as knowledge transparency and relates the ease of transfer directly to this transparency (Hamel 1991).

4. CASE STUDY ANALYSIS

4.1. History Summary

In ZSC, although government officially established the science park in 1989, the development of high-technology activity is the outcome of long-lived relationships between industry and universities and institutes where industrial expansion occurred with the jumping development of semiconductor technology after China's economic reform in 1978. ZSC benefits from a strong science base, in electronics and computing in particular. In 1980s, the so-called "Electronics Street" gathered by various merchants selling all kinds of computers and other ICT products, stemmed from a local initiative supported by private capital which aim to introduce advanced technology from abroad and produce information and communication products in local factories.

The most obvious advantage that ZSC possess is its high concentration of clusters of top universities (29 universities and colleges). For example, Tsinghua University and Chinese Academy of Science, located at centre of ZSC, are China's top institutes in natural science and engineering, while Beijing University located not far away has long been regarded as leader in democracy and freedom; People's University, also located near around, the nation's leading institute in social science. It has never been questioned that other clusters in China are able to ravel ZSC in intellectual resources.

Spinouts from research institutes and university laboratories started the expansion process after 1990, which was reinforced by open policy environment created by favourable government and legal development in intellectual property. Also, the influence of huge success in Silicon Valley across Pacific has generated great impetus for both enterprises and government to imitate and catch up. In 1985, there were only 70 firms (or factories) located near wider ZSC site, most of which are neither ICT or any other high technology related firms, and those related with ICT technology are most conducting business on ICT product trading and marketing without any R&D activities. After 1990, situation begins to change. Innovative high technology firm emerged and expanded throughout the whole agglomeration,

which is illustrated by the orientation of huge new business start-ups towards innovative and high-tech activities in the ZSC area.

4.2. Social Capital, Industry Features and Collective Learning

The geographical location of the town, surrounded in the nation's capital which is full of powerful government bureaus, has partly determined industrial growth by preventing ZSC from engaging in mass-production industry, and encouraging the development of high concentration of intellectual property and regional headquarters including international giants. This lack of industrial past has been seen as an advantage, making it possible to create a new breed of industry untrammelled by inappropriate traditions.

A major development has been the production of computer assembly at the end of the 1980s as the mass consumption of computers arises in China. Rise of computer industry made possible the economic expansion of the region, favoured changes and expansion in other industries, and encouraged the birth of academic scientific expertise. This change has its deep local roots in which most of early Chinese computer industry rely on the import of technology and has little self-innovation capability. More and more local enterprises realised that they cannot obtain high-value-added profits unless possessing self-developed core technology in products. At the end of the 1990s, the electrical and computer equipment industry was strong and fast growing, represented by Lenovo, the largest computer producer in ZSC. Lenovo successfully purchased IBM PC division in 2004, which rockets the Chinese No.1 IT producer into the world top 3 computer producers. Interestingly, after surprising growth in IT industry, Lenovo moved its headquarter into New York, the reason is simple – the lack of active capital in ZSC.

The development of high-tech activities in ZSC issued in part from the strong and long-lived relationships between the industrial milieu and the university. ZSC is the first research pole in China with 55,000 students and 13,000 research staff in nearly 39 research institutes and various corporate research institutes. This pole is specialised in physics, electronics, engineering, biotechnology and medical sciences. The strong presence of applied sciences nurtured the development of high-technology activities. Large local corporations such as Lenovo, Founder, Microsoft, Hewlett-Packard offerd a potential customer base for new firms, and have also been a source of spin-off companies. Indeed an expansion of innovative industries since the end of 1980s has given a decisive impetus to research, and reciprocity. The relationship between research and enterprise has built a specific innovative culture in ZSC and is part of the local identity. For instance, in 1985, under the impulsion of Professor Wang Xuan, founder of the Founder Corporation, with the support of local manufacturers, applied his new invention of Laser Printing System into China's printing industry and gained huge success in both Chinese and foreign printing markets.

Drawn together by the challenge of geographic and technological frontiers, the pioneers in ZSC created a technical culture that transcended firm and function. They developed less formal social relationships and collaborative traditions that supported experimentation, which can be even conducted in clubs and pubs. They created firms that were organized as loosely linked more like a co-operational team rather than a hierarchy company. Either due to the reason that they intend to imitate the success model of Silicon Valley or they just create this environment without intention, engineers and entrepreneurs were creating a more flexible industrial system, on organized around the region and its professional and technical networks rather than around the individual firm.

However, ZSC has its natural-born problem – venture capital. The lack of venture capital is partly due to the immature level of Chinese financial markets, and banking system, and partly because of the high rate of failure in start-ups. After leading Chinese innovations on state-of-art information and communication technologies for more than 20 years, ZSC begins to lose this absolute leading competitive edge from the beginning of 21 century. High-technology districts in Shanghai (SPIP), Hong Kong, Shenzhen and Hangzhou emerged as new technology innovation centre alongside two Chinese most economically prosperous regions: Changjiang Triangle (led by Shanghai) and Zhujiang Triangle (around Hong Kong) regions, while ZSC in capital Beijing, far from China's economy centres geographically, is still enjoying its history-formed leadership. It is true that ZSC is still and will be one of the most important ICT innovation centres in near future. The current reality is that ICT innovations in China will enter a stage where there is no absolute "centre".

5. Conclusion

If economics measurement such as increasing returns and division of labour are central to cluster development originating from neoclassical economics tradition, the path-dependency and collective learning are recognized more important in ICT innovation exhibit its own characteristics – general-purpose technology and high-speed growth – that distinguish it from others. ICT also behave like knowledge, which have unequal effects on different people with different interpretive capabilities. The high-speed growth in ICT industries require efficient collaboration between companies, which can be best satisfied by geographical clusters, due to the fact knowledge spillovers or transferring especially tacit knowledge spillover can be best stimulated by community practice.

There are more issues should be considered. Venture capital is such a factor that is so important in policy making. Research evidence shows venture capital accounts for the major reason for disperse effect displayed in ZSC, in which many enterprises moved their headquarters to Shanghai and Hong Kong, financial capitals of China, to find new opportunities. Another issue relating to policy is about national innovation system, ICT clusters development can never be successful unless embedded in an effective national innovation system, which includes legal system, R&D systems, and basic science research and so on.

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IMPLEMENTATION OF AN ANTIRETROVIRAL THERAPY MODULE IN ETHIOPIA: ISSUES AND CHALLENGES

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Abstract: This research was carried out in an attempt to introduce computer-based antiretroviral therapy module in the public health sector of Ethiopia that brought together different technical and non technical elements forming an actor-network. It details how the module is designed, redesigned and implemented in some of the ART Clinics in Addis Ababa drawing upon the notions of moments of translation and inscription of ANT. The moment of problematization was catalyzed by the insufficient capability of the manual system to satisfy the needs of some of the actors and the need to achieve own goals for others. This moment laid down the ground for the development and implementation of the ART module, an encryption designed in accordance with the manual ART system, to be an obligatory passage point for all of the actors as a means to satisfy their own goals. Further to negotiation, flexibility of the design to accommodate local context of use and availability of local capacity to design, change and provide continuous enhancement and support were crucial to interest and bring additional actors aboard the network and to mobilize them and, hence, successfully implement the module, which in turn attracted other actors to join the network.

IMPLEMENTATION OF AN ANTIRETROVIRAL THERAPY MODULE IN ETHIOPIA: ISSUES AND CHALLENGES

1. INTRODUCTION

Development and introduction of IS in organizations is not always a success factor. Some systems fail to work prior to introduction, during introduction or after they are introduced to an organizational setting. Some of the causes of failures can be the project team's assumption that the computer system would bring about changes in the work practices of personnel (Heath and Luff, 2000); ISs are viewed as objects (Askenas and Westelius, 2000); lack of proper understanding of how automated systems actually are integrated in the work they support (Gasser, 1986); potential fear of lose of control over data (Markus, 1983); denial of the existence of power relations and conflicts in an organization and technology is seen as unproblematic and neutral (Mitev, 2000).

The successful development, introduction and use of IS calls for the involvement of not only technological elements but also the social and local context of use and close interplay between technical, institutional and economical factors (Braa, Monteiro and Reinert 1995). Technologies, especially systemic, they argue, cannot be transferred but learned through the process of local context based translations. Taking all the actors into consideration is the way to develop and implement systems.

HISP[1] Ethiopia with the support of collaborating countries developed an Antiretroviral Therapy (ART) module with the aim to ensure evidence-based service provision, planning and management of ART and to eventually realize an HIV/AIDS Management System (IHAMS[2]). Consequently the module is implemented in five ART Clinics in Addis Ababa, Ethiopia.

This paper explores the development and introduction of the ART module in Ethiopia drawing upon ANT, particularly, the concepts of inscription and translation under the HISP action research framework (Braa, Monteiro and Sahay 2004). To this end, the paper sets the theoretical framework and concepts used to explain the case in the following section. The research method is presented in section three followed by a section on staff composition, data collection, analysis and major problems of the manual ART system. Section five discusses the introduction of computer based ART module from ANT perspective. Finally, concluding remarks are given in section six.

2. THEORETICAL FRAMEWORK

The IS literature states user participation and involvement to be essential only to develop systems that adequately capture user requirements and, hence, a system that satisfy user informational needs (Butler and Fitzgerald, 1997). High degree of direct and indirect user participation, therefore, cannot guarantee the successful implementation and use of ISs in an organization. Diffusion of innovations, the theory of reasoned action, the technology acceptance model, the theory of planned behavior, and social-cognitive theory are among the

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[1] HISP (Health Information System Program) is a network of health institutions and the academics. For more information on specific programs, see Braa, Monteiro and Sahay (2004), http://hisp.org, http://www.hispindia.org and http://www.aau.edu.et/faculties/dis/site/hisp/index.htm.

[2] IHAMS is planned to encompass the management of voluntary counseling and testing, prevention of mother-to-child transmission, opportunistic infections, sexually transmitted infections, home-based care, ART pharmacy, indicators, GIS, service mapping, referral linkage and TB functions.

core theoretical frameworks that have received widespread validation for many technological innovations. However, they neglect the realities of implementing technology innovations within organizations, especially when adoption decisions are made at the organizational, division, or workgroup levels, rather than at the individual level (Gallivan, 2001).

The outcomes of applying traditional innovation models are sensitive to the fit between the assumptions underlying these models and the specific features of the adoption context and the technology in question. These approaches fail to satisfy the purpose: when the adoption decision is made at the organizational level and employees are mandated to use the technology; for more complex technologies and adoption scenarios which require high levels of coordination across multiple adopters; or where the technology has a high "knowledge burden" (Gallivan, 2001). Instead, technology use and other outcomes depend on implementation activities that must be coordinated and synchronized across many adopters who may be distributed across multiple departments or geographic locations.

The Actor Network Theory (ANT) that has born out of the interdisciplinary field of STS (Monteiro, 2000) helps us deal with the world of hybrid entities (Tatnall and Gilding, 1999). It provides a language to describe how, where and to which extent technology influences human behavior and vice versa at a flexible granularity of analysis (Monteiro, 2000). Different actors, both human and non human, interact and influence one another while accomplishing tasks forming networks. It is this network that links together the technical and non-technical elements (Monteiro, 2000) which in turn can be a network by itself and/or part of another actor-network.

ANT is concerned with studying the mechanics of power as this occurs through the construction and maintenance of networks.

> [ANT] explores the ways that the networks of relations are composed, how they emerge and come into being, how they are constructed and maintained, how they compete with other networks, and how they are made more durable over time. It examines how actors enlist other actors into their world and how they bestow qualities, desires, visions and motivations on these actors. (Tatnall and Gilding, 1999, p. 959)

ANT gives equal explanatory status to all actors (Monteiro, 2000; Tatnall and Gilding, 1999) following the principles of: agnosticism (analytical impartiality), generalized symmetry (no special analytical explanatory status) and free association (the elimination and abandonment of all a priori distinction between the technological or natural, and the social) (Callon, 1986). It considers a path of innovation in which all the actors co-evolve.

Durability of the actor-network is crucial to sustainability and can emanate from the durability of the bonds that hold the actors together and/or from the composition of durable and simplified networks (Tatnall and Gilding, 1999). Here the notions of inscription and translation are very important. The notion of inscription can "describe how concrete anticipations and restrictions of the future patterns of use are involved in the development and use of technology" (Monteiro, 2000, p. 77). The term 'immutable mobile' is used to describe such inscriptions to refer to the stable and unchanged nature of the inscription (Tatnall and Gilding, 1999).

Aligning the interests of actors in the network through continues negotiation, brining others aboard and re-interpretation, re-presentation or re-appropriation of an inscription, which is also called translation, assures stability and social order (Monteiro, 2000). The size of other actors brought on the network indicates the amount of power that has been exercised (Latour

1986). Shaping and reshaping of the inscription is essential for its continued existence and spread. Inertia of the innovation cannot account for its spread.

> The key to innovation is the creation of a powerful enough consortium of actors to carry it through, and when an innovation fails to be taken up this can be considered to reflect on the inability of those involved to construct the necessary network of alliance amongst the other actors (McMaster, Vidgen et. al. 1997 in Tatnall and Gilding, 1999, p. 961).

Translation involves all the strategies through which an actor identifies other actors and arranges them in relation to each other. It involves *problematization, Interessement, enrolment and mobilization* (Madon, Sahay and Sahay, 2004). The actor first problematizes the situation and makes others to develop interest on the innovation and follow it. Following, the actor facing the problem will be convinced that their problem will only be solved by the solution forwarded to them. As a third momentum in the translation process, alliances are consolidated through bargaining and making concessions. Finally, partners are mobilized making then legitimate spokespersons of the groups they claim to represent. This process is facilitated if other possibilities are first blocked off (Tatnall and Gilding, 1999).

This paper explains the development and implementation of an ART module in ART Clinics in Ethiopia drawing upon the notions of inscription and translation as discussed above following the research method presented below.

3. RESEARCH METHOD

The research adopted a qualitative approach with the underlying epistemological and ontological notions of the interpretive philosophy. Accordingly, the phenomenon under investigation is assumed to be subjective which can exist only through the actions of humans in creating and recreating it emphasizing on the subjective meanings, social-political, and symbolic actions of humans (Morgan, 1983, Orlikowski and Baroudi, 2002, Walsham, 2002). Valid knowledge construction and evaluation involves understanding how practice and meanings are formed and informed through in depth examination of and exposure to the phenomenon of interest (Orlikowski and Baroudi 2002, Walsham 2002). These studies assume that:

> "people create and associate their own subjective and inter-subjective meanings as they interact with the world around them. Interpretive researchers thus attempt to understand phenomena through accessing the meanings that participants assign to them." (Orlikowski and Baroudi 2002, pp: 55)

Anchored in this assumption, the author of this paper collected data concerning the nature and drawbacks of the manual ART system and the development, introduction and rollout of the ART module from ART Clinics in Addis Ababa from March to August 2006. The primary informants of this research were the staff of four ART Clinics in four Hospitals such as the Armed Force and Military General Hospital (AFMGH), Tikur Anbesa Teaching Hospital (TATH) and Zewditu Memorial Hospital (ZMH, Zewditu for short). Besides, the AACAHB is responsible for the overall operation of ART service in Addis Ababa city, the national HAPCO takes care of it at a national level and four[3] USA-Based Universities provide technical support throughout the nation, i.e., all of them have direct interaction with the system. These informants were significant to help understand the overall operation of the

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[3] Four universities from the USA such as the University of Washington (I-TECH), John Hopkins University (JHU), University of California (UC) at Santiago and University of Colombia have been mandated to lead all ART related efforts in Ethiopia. To facilitate their activities, Ethiopia has been logically divided into four parts and each part is given to one University.

manual system, pinpoint its drawbacks and regarding implementation and rollout of the module. Zewditu was used as a case to capture the details of ART data creation, collection, compilation, management, flow and utilization aspects of the manual system.

The research mainly employed unstructured interview to collect the necessary data supplemented with onsite observation, discussion and review of both electronic and print documents. Various publications of the FMOH and others on ART and related matters informed this research about the management and coordination structure, and the flow of patients and information at different levels.

Furthermore, as member of HISP Ethiopia, I was engaged in most of the discussions made with different stakeholders, including the above, concerning implementation and rollout of the ART module. I have also participated in the development process through testing/evaluation of the module and reflecting the result back to the developers.

All of the interviews were conducted in the offices of the interviewee while they were on duty. As a result, most of the sessions held at the Clinics and the Pharmacy were full of interruptions predominately by patients. I have transcribed the interview immediately after each session and presented the result back to the informants occasionally. I also have developed an activity diagram detailing the ART process using the Unified Modeling Language and presented the result back to the interviewee for comment. This process was repeated until the activities were properly captured. Altogether, a total of 36 unstructured interviews were conducted as stated below:

RESPONDENTS	SIZE	FREQUENCY
ART Coordinator	3	5
Physician	2	4
Nurse	2	3
Data Clerk	1	8
Pharmacist/ Druggist	2	4
Laboratory Tech.	1	2
AACA HB Official	1	2
Representative of USA-Based Universities	2	7

Table 1: Respondents by specialization and frequency

4. THE RESEARCH SETTING

HIV was first detected in Ethiopia in 1984 and the first two cases were reported to the FMOH in 1986 (FMOH-Ethiopia, 2004a). The population lost to AIDS was about 900,000 by 2003 and it is projected to reach 1.8 million by 2008 if present trend continues. The following table shows the major HIV indicators in Ethiopia.

ALL AGES	2002	2003	2004	2005	2006	2007	2008
Adult prevalence (%)	4.2	4.4	4.6	4.7	4.8	4.9	5.0
HIV-pos population	1,361,628	1,474,758	1,590,967	1,706,016	1,820,914	1,930,785	2,037,112

HIV-pos pregnant women	119,147	128,122	137,596	146,570	155,165	162,756	169,410
New HIV infections	218,064	231,415	244,384	253,308	263,616	269,436	277,141
Adult HIV incidence (%)	0.66	0.68	0.67	0.68	0.69	0.66	0.66
New AIDS cases	113,255	122,697	132,677	143,129	154,193	165,681	177,232
Annual AIDS deaths	105,478	114,690	124,178	134,124	144,545	155,515	166,901
Annual population increase		1,962,766	2,013,537	2,063,749	2,112,666	2,157,623	2,198,854
No. newly needing ART		245,394	265,354	286,258	308,386	331,362	354,464

Source: FMOH-Ethiopia (2004b) AIDS in Ethiopia: Technical Document for the Fifth Report

Table 2: Major HIV indicators, Ethiopia

Among the major solutions established to combat the pandemic is ART (FMOH-Ethiopia, 2004a). To this end, the FMOH has developed policy and guidelines that sets the minimum criteria for resource requirements, the management and coordination structure, the flow of a patient, and the report/information flow of health related indicators (see figure 2, 3, and 4) and trained manpower, prepared data collection and reporting forms.

ART may bring the envisaged positive impacts if properly administered with 100 % coverage. Its success is also highly tied to patients' adherence to regimens which in turn demands follow up throughout the lifetime of patients. However, since ART is supposed to be taken for life and due to the ever increasing size, provision of care and support for patients maybe compromised. The increasing size of patients makes care givers to collect and manage huge amount of data on paper which turns out to be unmanageable in the near future in a resource constrained setting. The tendency can have negative effect on evidence-based service provision, planning and management of the service.

Zewditu is a general hospital that offers In-patent and Out-patient services mainly to patients referred to from health centers in Addis Ababa and other parts of the country, and it is directly accountable to AACAHB. The Hospital started ART in 2003 to patients coming from within the hospital and other health facilities mainly from Akaki/Kaliti and Cherkos sub-cities. Since the beginning of ART until September 8, 2006, 10,356 patients enrolled to ART out of which 5,938 and 3,695 of them started and were on ART, respectively (FMOH-Ethiopia, 2006). The following table presents the composition and responsibility of staff of the Clinic:

Staff	Responsibility	Role in Data Collection
Physician	Diagnose and treat HIV/AIDS patients.	Fill out some parts of intake and follow-up forms, drug prescriptions and different types of test requests.
Clinical Nurse	Offer service in the Card Room, counsel patients, assist physicians and take care of patients with poor adherence and those who have ART related problems.	Fill out some parts of intake and follow-up forms and different types of test requests.
Lab. Technician/ Radiologist	Conduct laboratory/ radiology tests.	Fill out the test report form and copy the result of the test into appropriate register books, and compile monthly test related data.

Pharmacist/ Druggist	Drug stock management, dispense ARV's, counsel on drug adherence and follow up of patients.	Fill out drug dispensing forms, and compile drug consumption related report.
Data Clerk	Record each transaction patients make with the Clinic into Register Books and compile statistical and cohort reports at different frequencies.	Fill out Pre-ART and ART Register books based on intake and follow-up forms, patient folder and screening report and produce patient and regimen related reports.

Table 3: Staff composition and responsibility

The staff meets every Thursday to make all rounded discussion about ART and ART in the Hospital in particular. It is used as a forum for sharing experiences, address problems and discuss future plans.

4.1. Data Collection and Analysis

All ART Clinics in Ethiopia use the same kind of paper-based forms to collect clinical and non clinical data about patients. These forms consist of lots of columns and the same data is required to be duplicated here and there. The huge amount of data to be collected, the requirement for duplication and the constantly increasing patient size aggravates the problem of accurate data collection, analysis and presentation. It also complicates the process of reviewing the medical history of a patient at hand.

One of the physicians stated the following in relation to filling out forms:

> *… data recording in the forms took about 45 minutes initially, when we were new to them. Now we are familiar with them and it takes only fifteen minutes to do it …*

The patient's folder and the referral/screening report are the first sources of information for filling out some of the fields of the Pre-ART Register book which consists of about 38 fields (16 of them are optional). The seven pages intake form, consisting of 25 fields per page on average and the Follow-up form, consisting of 35 fields (some of which are optional) are used as sources of data for the ART Register Book that has 68 fields and for the Pre-ART Register Book.

Further to the size, some of the fields are repeated several times in some of these forms. The Intake form has 10 mandatory fields repeated in all of the seven pages and 17 mandatory fields exist on both the Intake and Follow-up forms. Besides, the Pre-ART and ART Register Books, altogether having 106 fields, are duplications of what is already recorded in the Intake and/or Follow-up forms. Added with the ever increasing size of patients, let alone summarizing and analyzing data on time, data collection has become difficult and resource consuming.

As a result, the Data Clerk which is supposed to fill out Intake form A (patient registration form), 1st part of form E (social assessment form) and the headings of all of the Intake and Follow-up forms is no more doing it. Rather, it became the responsibility of ART Nurses and Physicians who are busy discharging their own duties. Furthermore, it became difficult for the Data Clerk to go through the Intake and Follow-up forms of every patient and copy the data into the Pre-ART and ART Register Books.

Currently, an ART Physician diagnoses about 40 patients per day on average and there are 5 ART Physicians on duty five days a week. It means that, on average, the Data Clerk goes trough the folders of 200 patients, extracts the required data and copies them into the Pre-ART and ART Register Books everyday. Recognizing the problem, the Clinic introduced its own abridged version of the Follow-up form that has only 14 fields. This new arrangement demanded the Physicians to rewrite some of the data from the Follow-up form into the new one everyday.

The Data Entry clerk said the following:

> *"… my responsibility is difficult to discharge. If I'm absent for one day*
> *from my job, I will get piles of documents waiting for me…"*

From the discussion, one can see how problems related to data collection can bring change on the way an organization discharges its responsibilities. Compilation of monthly Pre-ART, ART, and Regimen reports is another activity of the Clinic. The Data Clerk demanded two full working days to produce a one month report and it took two months for four people working overtime to produce a cohort report for all of the months in a year. The problem can be aggravated by the increasing size of patients, which is the current trend, and the inherent problem of human. Hence, further to huge resource consumption, the quality of the report maybe compromised.

In ART adherence level of more than 95% (missing no more than one dose per month) is required for patients to get the envisaged benefit. Poor adherence facilitates the development of drug resistant viruses. As theses viruses rapidly replicate, the treatment fails and the individual can no longer benefit from the therapy. Transmission of drug resistant virus in the community leads to a superimposed epidemic of drug resistant HIV. Therefore, it is crucial to support people on ART throughout their treatment. (FMOH-Ethiopia 2005)

At Zewditu patients with next appointment date are not identified unless s/he is present. Usually, patients that fail to show up on the scheduled date are identified long after it is lapsed. In order to identify such patients, the Data Clerk often reviews the Pre-ART and ART Register Books and picks up those patients' whose records were not updated for the last couple of months. Then fetches the folders of these patients' and verifies the date. Based on the result, she updates the status as "lost" to follow up in the respective Register Books. She sometimes makes further attempt to clarify the reason and reflects the change in the Register Books, if she succeeds. In a nutshell, it is possible to say that the existing system does not facilitate follow up and provision of support.

The Pharmacy uses software to manage its stock and daily transactions and produce reports. According to the Pharmacist, the software satisfies most of their requirements. It is easy, for example, to identify patients who didn't show up on their appointment date. However, it doesn't produce all the reports required by the AACAHB and FMOH in the required format and lacks integration with the Clinic.

The Pharmacy system was introduced in January 2005 and it uniquely identifies patients using the Hospital's patient number. After the introduction, the Clinic started to uniquely identify patients using ART number. This lack of either physical or conceptual integration has attributed to the existence of data mismatch between the Pharmacy and the Clinic. In addition, all patients visiting the Clinic may not also visit the Pharmacy and due to errors made during report compilation, these systems produce different reports.

These are some of the major problems of the manual ART system which have a profound influence on the overall operation of the therapy. The following section discusses the processes of an ART module implementation in ART Clinics.

5. IMPLEMENTATION OF THE ART MODULE: AN ANT PERSPECTIVE

The ART module[4] was developed to run on standalone and/or networked environments with a web-based interface taking the Ethiopian context into account. As an example, it accommodates the Ethiopian calendar and complies with forms and guidelines of the FMOH. The development process involved several stakeholders, the beneficiaries being active throughout.

The module is meant for solving the data management problems ART Clinics thereby imroving the therapy. It computerizes the processes of maintaining Pre-ART and ART Register Books, and Follow-up and Intake data of patients, generates Pre-ART, ART, Regimen and Cohort reports at a period defined by the user. The module also has appointment, search and analysis functionalities, to mention the few, which the manual system was not able to offer.

The development and implementation of the module in ART clinics in Ethiopia formed an actor-network composed of human and non-human elements including the inscription itself. This section presents the analysis using the concepts problematization, interessement, enrollment and mobilization of translation.

5.1. Problematization

HISP Ethiopia with the support of HISP International, particularly a professor from the University of Oslo approached the AACAHB to deal with the idea of developing computer-based system that automates ART. The problems of the manual system together with the need for evidence-based service, the value placed in ICT/IS, the e-government plan were impetus. The development and implementation of the module involved the AACAHB, ART Clinics, HISP Ethiopia and International, and Developers forming a network.

The AACAHB wants to plan, execute, monitor and evaluate the activities of ART Clinics in Addis Ababa based on evidence. It is getting fixed format monthly report which may not be sufficient to grasp the service, patient, drug consumption, etc in detail.

At the Clinic the number of patients is increasing from time to time and huge amount of data is being collected even per patient. Resource mobilization was necessary to compile those mandatory reports let alone produce others. So far the system doesn't facilitate patient follow up. The Clinic demands to collect, manage and analyze data about patients and regimens from different angles to improve the service.

HISP International as part of its goal to improve HIS in developing countries, trains students at M.Sc. and Ph.D. levels. Students are supposed to be exposed to the actual working environment and provide both theoretical and practical contributions through its action research framework. In case of the ART module, two M.Sc students have developed it and its

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[4] The ART module was developed by two M. Sc. students at the University of Oslo, Department of Information Science who are also members of HISP in collaboration with other members of the HISP network.

design and implementation involved others including the author of this paper. The author of this paper has participated and led discussions aimed at implementation and rollout of the module in different parts of the country.

Those Ph.D. and M.Sc. students working their field works in Ethiopia are hosted by HISP Ethiopia that has been working in collaboration with five RHBs to improve the HIS. HISP Ethiopia contributes its share towards meeting the goals of HISP International and provides necessary resources and facilities with the support of HISP International and working environment through its partners.

The developers with the support of the professor formulated the ART module to be the obligatory passage point (OPP) with the ultimate aim of realizing a full-fledged HIV/AIDS management system. Hence, the present focus is confined to ART only excluding all others such as pharmacy, laboratory, TB, etc. The following figure illustrates the actors and the OPP.
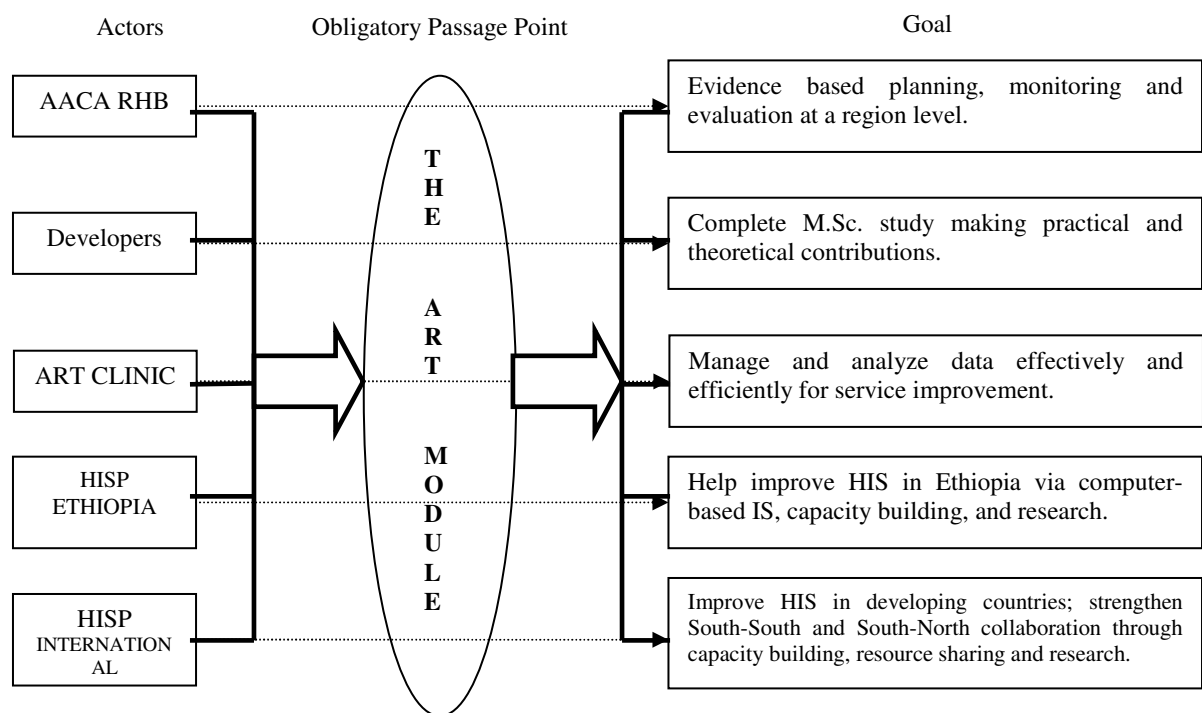
Figure 1: Illustration of Actors and the OPP

All the actors appreciated the data management and analysis related problems of the manual ART system and accepted the proposed solution. They agreed to pilot/implement the module at Zewditu where the number of patients is relatively large followed by Menelik II and Yekatit 12 Hospitals. After introduction, the HISP project hired and trained a data clerk at Zewditu. Since then, the data clerk has been inputting data from the Pre-ART and ART Register Books, and Follow-up and Intake forms into the module, i.e., both systems are running in parallel.

5.2.   Interessement

Interessement is about convincing the actors that the only way to solve the problem is via the proposed solution. This process was supported with presentations, demonstrations and discussions. One of the AACAHB official who also has engaged in the process said the following:

> *I'm very happy with the feature and functionality of the software. I have mandated you [the HISP Ethiopia] to implement the module in ART clinics where we are responsible for. I will also tell more about the nature and feature of the software to the higher officials so that it can be rolled out.*

There was a need to transfer stable patients to lower level health facilities in Addis Ababa. However, the HB officials found identification of such patients difficult, and hence, approached the developers to include the functionality into the module. After it is accomplished, the AACAHB official said the following:

> *Really it is very interesting to easily identify those patients who are stable using the system which otherwise could be time taking and cumbersome.*

The coordinator of the Clinic said the following:

> *… now we don't have problem of getting information. We can get it easily and timely but we have financial constraint to implement all our plans and solve patients' problems. …*

The Data Entry clerk also said the following:

> *… the computer based system is really fantastic; it has features which we did not have before. … for example the possibility of producing cohort report till the date you choose. It also simplifies the task of report compilation; with three or more mouse clicks you can produce a report which otherwise takes three to four days. I'm very happy with the new system. I'm hoping that the new system alleviates me from the burden of report compilation.*

In addition to the negotiations, flexibility of the module and the existence of local capacity that is able to change, enhance and provide support facilitated acceptance of the module and, hence, to isolate the actors from 'contamination'.

5.3. Enrollment

Other actors are supposed to join the network for the proposed solution to sustain across space and geography. To this end, the author of this paper held discussions with the National HAPCO, the University of Washington[5] and the University of California at Santiago[6] several occasions.

The first discussion held with the two Universities was aimed at problematization and interessement, and laid down the ground for succeeding discussions, demonstration and agreement. Both appreciated the existence of data management and analysis related deficiencies at ART Clinics but wanted to evaluate the proposed solution.

During the second meeting, the HISP Ethiopia team presented the existing HIV/AIDS data management problem and its plan and approach to solving the problem – step-by-step

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[5] The University of Washington is responsible for ART related activities in Tigray, Amhara and Afar Regional States.
[6] The University of California at Santiago is responsible for ART related activities among the Uniformed Forces.

realization of an integrated HIV/AIDS management system – and demonstrated the ART module. The meeting emphasized the need for collaboration and resource sharing and agreed to put it into practice. Consequently, the module was introduced in Police Hospital and Federal Prison Health Center with some modification.

Zewditu, which informed development of the module, started ART before the introduction of Intake forms, i.e., early patients do not have intake data and reports have been compiled from ART and Pre-ART Register Books. Hence, the resulting ART module included interfaces/forms that are alike to the manual ART and Pre-ART Register Books meant for accepting data from the keyboard. However, there is no need for designing these interfaces for those Clinics that started ART after the introduction of Intake forms, such as the last two, and for those patients who have Intake data. Once data from the Intake and Follow-up forms are entered, the Register Books can be generated as reports avoiding data reentry since Intake and Follow-up forms are the sources of the Register Books. Accordingly, the software was customized to reflect the new context accounting for 'negotiation of interest'.

The enrollment phase introduced new context of use that demanded for improvement of the module to reflect the new context. And, hence, flexibility of design and negotiation of actors' interests are essential to bring others aboard the network.

5.4. Mobilization

Once the needs of the actors are satisfied, it is possible to say that they can speak on behalf of the solution provider. The AACAHB official supported the implementation of the module in ART clinics and spoke in favor of it at a conference in the presence of representatives from the FMOH which were challenging the solution.

> *…we have been hearing rumors from different angles that the FMOH is trying to introduce software. So far, we didn't see anything and in the meantime HISP approached us and developed software that satisfied our need…. We will keep on using it….*

The newly joined actors such as the two USA-based Universities started to speak in favor of the module and against software offered by one another University. One of the representatives said the following:

> *Lots of resources were allocated by one of our partner Universities to develop ART software which focused on supporting research. I think this one is better satisfies the data management and reporting needs at a facility level.*

They communicated the importance and feature of the module to people at the National level. The University of Washington also took the product to demonstrate and implement it in Tigray.

These increasing interests served as impetus to further develop the module technically and function wise attracting the University of Oslo and HISP South Africa. This way we believe the implementation will scale up technically, geographically and function wise.

6. CONCLUSION

ART Clinics collect huge amount of data per patient and they are required to duplicate them here and there. Added with the ever increasing size of patients' accurate data collection,

timely analysis/compilation and presentation of reports can become difficult, especially in a resource constrained settings. These burdens forced the Clinic to introduce its own data collection form, on top of the nationally recognized forms, and shared the data collection and duplication tasks to Physicians and Nurses. Despite the solutions, let alone summarizing and analyzing data on time, data collection has become difficult and resource consuming. The manual system is also in efficient to support follow up of patients.

The design, development and implementation of the ART module to solve some of the above problems of ART Clinics involved heterogeneous actors forming an actor-network. HISP Ethiopia with the support of its partners has developed and implemented the module in some of the ART clinics bargaining for further expansion in terms of geography, functionality and technology. The design took the local context of use into consideration.

The implementation involved convincing different actors and brining them aboard the network. This process was facilitated through flexibility of the design to accommodate different contexts of use and availability of qualified staff to support and change it. The process of implementation not only took the ultimate end users but also donors who are involved in supporting ART in Ethiopia. Further to the existence of real life problem and a computer-based ISs (solution), continuous negotiation with stakeholders, accommodation of actors' interests and availability of local capacity to accommodate context based requirements and provide continuous support and enhancement are necessary to succeed in the implementation of ISs.

Acknowledgement
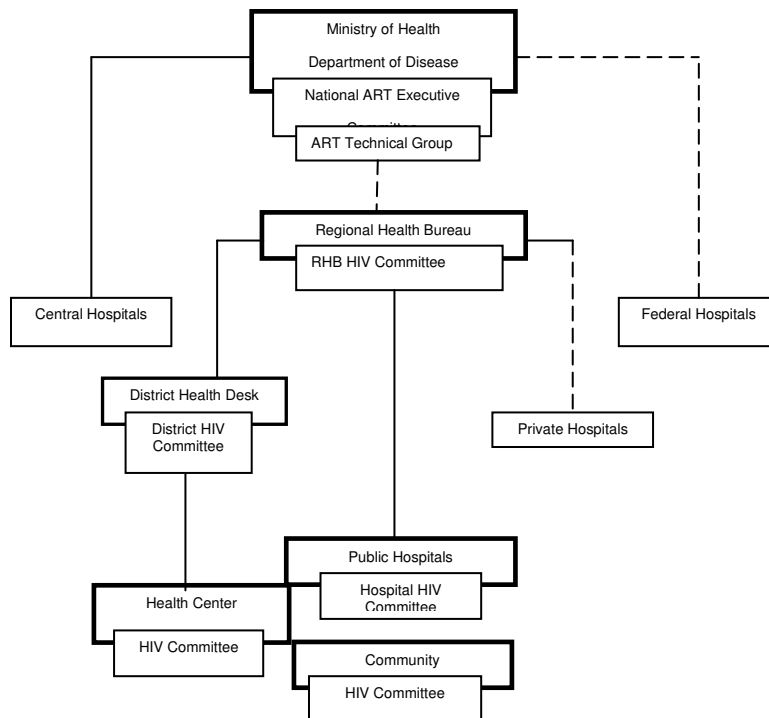
Figure 2: ART Management and Coordination Structure

Source: FMOH-Ethiopia (2005): Guideline for Implementation of Antiretroviral Therapy in Ethiopia

Figure 3: Report/Information flow of health related indicators
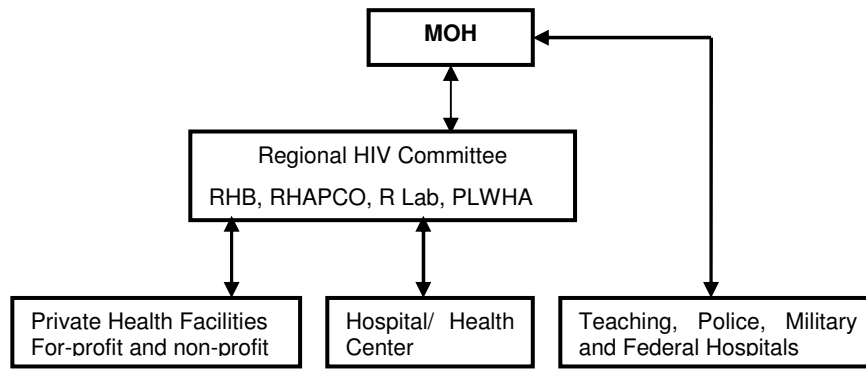
Figure 4: Report/Information flow of health related indicators

Source: FMOH-Ethiopia (2005): Guideline for Implementation of Antiretroviral Therapy in Ethiopia
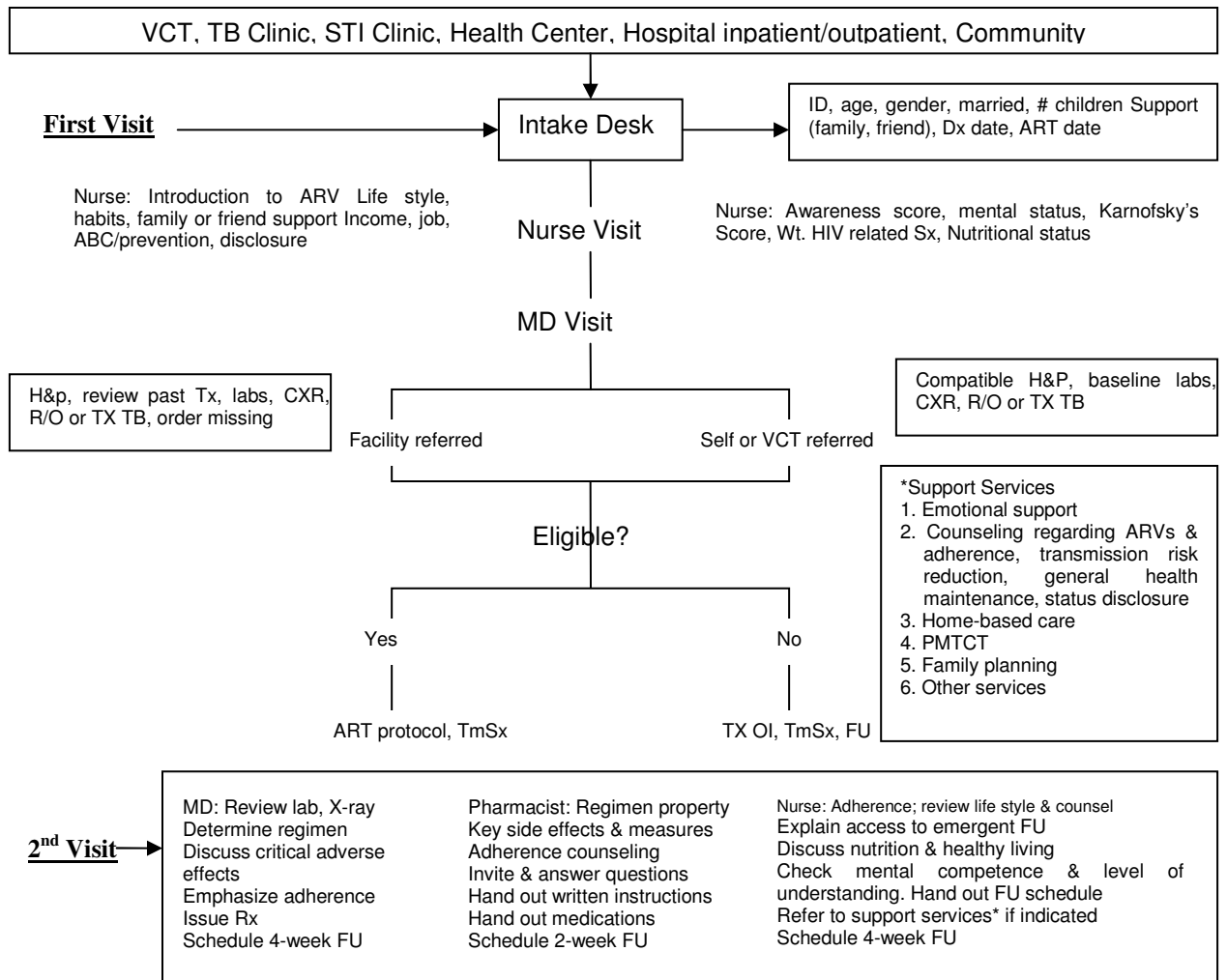
Figure 5: ART Patient Flow

Source: FMOH-Ethiopia (2005): Guideline for Implementation of Antiretroviral Therapy in Ethiopia

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GLOSSARY OF ACRONYMS USED

AACAHB	Addis Ababa City Administration Health Bureau
AIDS	Acquired Immunodeficiency Syndrome
ANT	Actor Network Theory
ART	Anti Retroviral Therapy
ARV	Anti-retroviral
FMOH	Federal Ministry of Health
GIS	Geographic Information System
HAPCO	HIV/AIDS Prevention and Control Office
HB	Health Bureau
HISP	Health Information System Program
HIV	Human Immune Deficiency Virus
HMIS	Health Management Information System
IHAMS	Integrated HIV/AIDS Management System
OI	Opportunistic Infection
PLWHA	People Living with HIV/AIDS
PMTCT	Prevention of Mother to Child Transmission (of HIV/AIDS)
RHB	Regional Health Bureau
STD	Sexually Transmitted Disease
STS	Science and Technology Studies
TB	Tuberculosis
VCT	Voluntary Counseling and Testing
ZMH	Zewditu Memorial Hospital

MICROCREDIT AND CORRESPONDENT BANKING IN BRAZIL: WHAT IS MISSING?

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Abstract: Despite the important role of correspondent banking in Brazil towards taking banking services to the bankless population, this channel has been concentrated mostly on payment services, not reaching the level of offering credit (or microcredit) to the poor. This paper presents a preliminary report on a research in progress which focuses on the discussion of potentialities and limitations of correspondent banking as a major channel for microfinance. The framework proposed for this research is influenced by three theoretical perspectives: social shaping of technology (SST), structurationist view of technology, and contextualism.

Keywords: correspondent banking; microcredit, microfinance; information technology models

MICROCREDIT AND CORRESPONDENT BANKING IN BRAZIL: WHAT IS MISSING?

1. INTRODUCTION

During the last few years, the Brazilian banking industry has been affected by a number of regulatory changes, as part of government policies aimed at poverty reduction. Since access to banking services in general is one of the needs of the poorer segment of the population, and since one of the most crucial strategies for implementing microfinance is connecting it to the traditional financial system (Alves and Soares, 2006), one of these changes is related to the use of so-called "correspondent banking" outlets (**CBs**).

First, the legislation governing the issue was modified by a series of measures in order to allow banks to develop IT-enabled partnerships with a wide range of non-banking businesses (such as supermarkets, pharmacies, post offices, grocery stores, etc), allowing them to operate as retail operators for banks (Alves and Soares, 2006; Kumar et al., 2006). A second regulatory change was a regulation introduced in 2003, requiring all banking institutions to designate at least two percent of their sight deposits to microfinance loans – a requirement that has not yet been fulfilled by the banks, as they are, allegedly, still developing specific capacities for microfinance operations (Kumar et al., 2006). These two changes were interconnected in origin and conceived of as two sides of the same regulatory strategy. On the one hand, banks became obliged to offer credit to the poorest segments of society, historically unassisted by banking services; on the other hand, they were given the conditions to accomplish this task at relatively low cost, through the use of CBs.

In practice, the policy has not yet achieved its desired results. There has been a huge growth in banks' outreach, thanks to the installation of extensive CB networks. However, contrary to what had been predicted, this growth has not given rise to virtually any microcredit expansion, at least so far. This suggests two interrelated questions, which comprise our research problem. First, *What are the reasons that Brazilian correspondent banking has not yet fulfilled its original purpose, in terms of microcredit expansion?* And, *What actions should be taken to help the model play its desired role?*

This research-in-progress paper presents a preliminary discussion of the issue. The paper is divided as follows. Section 2 describes the Brazilian CB model, highlighting its recent growth. Section 3 provides a brief portrait of the use of CBs for delivering banking services, demonstrating that the expected credit expansion is still far from being achieved. Section 4 comments on the theoretical framework guiding the investigation. Finally, Section 5 concludes the article by describing the methodological procedures that will guide each of the following research steps.

2. BANKING CORRESPONDENTS IN BRAZIL: OVERVIEW

The original definition of correspondent banking referred to an arrangement between two banks, under which one bank (the correspondent bank) accepts deposits of, and performs services for, another (the respondent bank). In most cases this agreement will allow banks to operate in a market where the respondent bank has no physical presence. However, changes in recent years, due particularly to the increasing possibilities of information technology (IT) for linking organizations, have allowed the emergence of new modalities of CBs. In the Brazilian model, for instance, a CB must be a non-bank firm.

Major banks in Brazil have taken the opportunity and located their CB networks in lottery agencies, post offices, retail establishments such as supermarkets, mini-stores, drugstores, gas stations, and so forth. As a great part of these agents are located in poor areas, such as urban

slums, various disadvantaged neighborhoods and even remote rural locations, the system can provide poor people with many benefits in terms of access to banking services.

There are several reasons why this particular model has emerged in Brazil. First of all, Brazil is internationally recognized as one of the most advanced countries in automated banking technologies and procedures. The high inflation rates that prevailed for decades until the mid-1990s provided major incentives for banking automation, leading to the development of superior expertise in this area. Second, as it is relatively expensive to operate branches, banks are motivated to develop alternative cheap retail channels. Finally, the government has promoted the creation of the model, with the aim of extending banking service delivery to poor, bank-less areas, thereby making possible some of the aid programs that deliver money to the very poor.

According to figures from the Brazilian Central Bank, by October 2006 CBs in operation in Brazil totalled 80,312, concentrated in a small number of banks (Table 1)[1]. In the last few years the number of CBs has risen consistently, and today they amount to more than four times the steady total of 18,000 regular bank branches in the country (Figure 1). Some studies also indicate that the use of correspondents has grown at high annual rates over the last few years, regardless of the measuring unit employed: 7% per year on average in terms of service points, 20% in number of transactions, and more than 100% in value (Alves and Soares, 2006).

Institutions	Correspondents	%	% acum
ABN Amro Real	33389	41.6	41.6
Caixa Econ. Federal	12761	15.9	57.5
Banco Popular do Brasil (BB)	6590	8.2	65.7
Bradesco	5477	6.8	72.5
Lemon Bank	4480	5.6	78.1
HSBC Bank Brasil	1954	2.4	80.5
Banco Fininvest	1794	2.2	82.7
Banco Nossa Caixa	1784	2.2	85.0
Banco BMC	1047	1.3	86.3
Banco Triângulo	983	1.2	87.5
Banespa	837	1.0	88.5
Citibank	772	1.0	89.5
Unibanco	690	0.9	90.3
Others	7754	9.7	100.0
Total	**80312**	100.0	

Source: Banco Central do Brasil

Table 1 - CBs in operation in Brazil (October 2006)

As a result, all Brazilian municipalities, including those located in remote, barely accessible

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[1] Table 1 presents official data provided by the Brazilian Central Bank to the authors in October, 2006. It should be pointed out, however, that the number of BCs accredited to ABN Amro Real, and hence the total, are overestimated. This suspicion was confirmed by an executive from the bank in a personal interview to the authors in November, 2006. Despite rendering the percentages in Table 1 biased, this does not invalidate our statement that BCs are concentrated in a limited number of institutions.

areas, are nowadays served by CBs. This situation contrasts clearly with that existing prior to 2002, when there were more than 1,400 municipalities completely lacking in banking services (Alves and Soares, 2006).

Figure 1 - CBs growing from 2000 to 2005 (thousands)
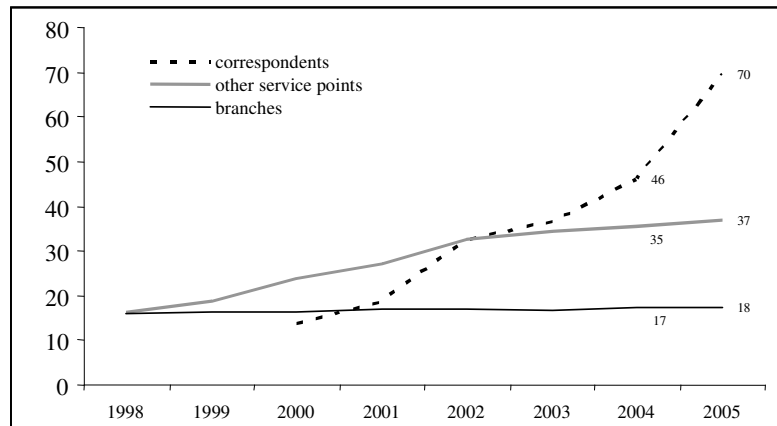
Source: Banco Central do Brasil

3. USE OF CBs FOR MICROCREDIT: CURRENT SITUATION AND CHALLENGES

The range of services that banks are allowed to offer through CBs is very wide, and includes virtually everything offered through traditional bank branches: account opening, deposits and withdrawals, payment services (such as invoice payment receipts and tax collection), payment of government benefits and pensions, and many others, including credit services (Thompson et al., 2003; Kumar et al., 2006). However, the services that Brazilian banks are actually offering through CBs are narrowly concentrated in a limited group of services. As Table 2 indicates, credit represents a very marginal share, corresponding to 0.3% of the transactions and 0.5% of the value handled by all correspondents in 2005. Payment services are dominant by far, amounting to no less than 70% and 95%, respectively. This indicates that, despite its success in achieving extremely rapid growth and enlarging bank outreach, the use of CBs in Brazil is still far from achieving one of the main purposes for which it was created, namely, the delivery and expansion of microcredit.

	2002		2003		2004		2005	
	No.	%	No.	%	No.	%	No.	%
Transactions (millions)	899.8	100.0	1015.9	100.0	1221.6	100.0	1440.8	100.0
Account openings	0.3	0.0	1.2	0.1	4.6	0.4	6.3	0.4
Deposits	11.9	1.3	24.4	2.4	47.6	3.9	70.8	4.9
Withdrawals	28.7	3.2	52.8	5.2	83.7	6.9	116.1	8.1
Credit	0.9	0.1	1.2	0.1	1.7	0.1	3.6	0.3
Payments/benefits	60.0	6.7	84.7	8.3	104.0	8.5	122.3	8.5
Invoice payment receipts	783.5	87.1	821.0	80.8	927.7	75.9	1011.3	70.2
Other services	14.5	1.6	30.5	3.0	52.3	4.3	110.4	7.7
Values (R$ billion)	120.5	100	515.5	100.0	1197.0	100.0	1948.8	100.0
Deposits	1.8	1.5	3.0	0.6	6.7	0.6	24.9	1.3
Withdrawals	3.5	2.9	7.8	1.5	14.8	1.2	37.3	1.9
Credit	5.6	4.6	6.3	1.2	8.0	0.7	10.6	0.5
Payments/benefits	2.8	2.3	4.5	0.9	8.4	0.7	12.0	0.6
Invoice payment receipts	106.6	88.5	492.3	95.5	1155.7	96.5	1851.4	95.0
Other services	0.2	0.2	1.5	0.3	3.4	0.3	6.5	0.3

Source: Banco Central do Brasil

Note: information supplied by Bradesco, BMG, Lemon Bank, Nossa Caixa, Banco Popular do Brasil (BB), Caixa Econômica Federal and ABN Amro Real.

Table 2 - Banking correspondents – volume and value of transactions (2002-2005)

This situation suggests that, despite CBs' success in offering payment services and benefits, the expansion of credit availability will demand more than what has already been done by the current CB model. Since banking services can be divided into two broad categories, transaction-based and relationship-based (Diniz, 2004), it is possible to understand why a transactional service for payment was adopted right away while a relationship service as credit will be more difficult to implement through some electronic channel.

We believe that better understanding of the CBs network operation, including understanding of the IT-based model underlying their functioning, is one of the keys to being able to effectively address the "microcredit expansion" issue. Because the medium through which CBs are supposed to deliver credit is necessarily interwoven with IT models, our research will seek to add to knowledge of these models, sketching a typology of different technological and business models and recognizing changes or adaptations that are likely to be made in order to "empower" CBs in their core mission.

4. THEORETICAL FRAMEWORK

The framework proposed in this research is influenced by three theoretical perspectives social shaping of technology (SST), structurationist view of technology, and contextualism. Although these three streams of thinking share a number of ontological and epistemological assumptions, they have been combined because each of them offers particular concepts of great value for our research purpose.

4.1 SST (social shaping of technology)

The SST (social shaping of technology) studies were strongly influenced by sociology of knowledge (Berger and Luckmann, 1967) and social construction of technology (Pinch and Bijker, 1984; Bijker and Law, 1992). Aiming at overcoming the deterministic concept of technology often found in technology management literature, where technology is taken for granted, SST views technology implementation as the outcome of social processes of negotiation between networks of social actors. Such a view pays special attention to actors' interpretations of the meaning and content of technology, and emphasizes the identification of occasions where decisions and actions regarding technology management and change may be

undertaken (Clausen and Koch, 1999). We retain three important concepts from SST studies: relevant social groups, technological frames and IT implementation as a negotiation process.

- *Relevant social groups* refers to a set of people who share a common geographical space or occupy the same functional boundaries. In addition, relevant social groups also share a set of assumptions about a given subject of interest. Subgroups and alliances between groups form social spaces and play important roles in the choice of management strategy and use of technology. In our research, the relevant social groups will probably be: (a) users of CBs, sharing a common geographic and socio-economic situation; (b) bank agents or institutions; and (c) providers of CB services, including micro-stores, post offices, drugstores, etc.

- *Technological frames* refers to basic assumptions, beliefs, and expectations that people hold about a specific technological application (Davidson, 2002), including not only the nature and role of the technology itself, but the specific conditions, applications and consequences of that technology in particular contexts (Orlikowski and Gash, 1994). The concept of technological frame is similar to interpretive schemes (Giddens, 1984; Bartunek, 1984) and provinces of meaning (Weick, 1993). Technological frames might be shared within a relevant social group because members are likely to share common relationships and experiences with a particular IT application (McLoughlin et al., 2000). In our research, we expect that the technological frames of the designers of the technological platform supporting the CB network will differ from those of CBs' providers and individual users.

- IT implementation and use as a *process of negotiation* is also central to SST. Not only the content of technology itself, but the set of actors and relevant groups taking part in the negotiations, with their different interests, commitments, perspectives and positions in the structure, will influence the process and outcomes of the technologies put in place (Clausen and Koch, 1999). In our research, the process of implementing and using CB platforms will be analyzed, with particular attention to the negotiation between different social groups, the role played by IT and the consequences in terms of social impacts.

4.2 Structurationist view of technology

The *structurationist view of technology* represents an import stream within IS research (Pozzebon and Pinsonneault, 2005). Like SST and contextualism, the structurationist view of technology is a process theory which accommodates multiple levels of analysis, is contextually and temporally situated, and avoids the blinders of non-historical accounts of social phenomena (Orlikowski and Robey, 1991). Since Anthony Giddens reformulated the relationship between agency and structure in an unconventional way (Giddens, 1984), a number of researchers have adopted and used structuration theory to study the relation between IT and human action (Jones, 1997). We outline here one of the concepts borrowed from the structurationist view:

- *Technology-in-practice.* This concept was proposed by Orlikowski (2000), who focuses on the enactment of technology, pointing out that there are always boundary conditions on how people use physical properties of artifacts. People can (even if they do not) redefine the meaning, properties and applications of a given technology during and after implementation. In our research, technology-in-practice will be represented by the CBs' technological platform and the functionalities put into operation and being used.

4.3 The contextualist research

The contextualist research approach was first introduced by Pettigrew (1985, 1990) and has gained significant attention among IS researchers (Ngwenyama, 1998; Orlikowski, 1996; Walsham, 1993). Arguing that much research on organizational change is aprocessual and acontextual in character, Pettigrew (1985, 1990) emphasizes three elements: content, context and process.

- *Content* refers to the socio-technical characteristics of the IT application being implemented and used by particular actors in a given level of analysis.

- *Context* refers to the social setting where the IT application is being implemented and used.

- *Process* refers to the understanding of how the IT application is implemented and with what kinds of consequences.

Pettigrew claims that content, process and context are equally important and should be considered in concert. He also outlines the way that different levels of analysis are interconnected and interdependent. As Pettigrew (1990, p.269) explains, when applying a contextualist lens, we look for "continuity and change, patterns and idiosyncrasies, the actions of individuals and groups, the role of contexts and structures, and processes of structuring" over time.

4.4 A multilevel framework

Thus, we propose a **multilevel framework***,* presented in table 3*,* which combines social shaping views of technology, structurationist perspective on technology and contextualism. It is <u>multilevel</u> because it incorporates inextricably linked levels of analysis: <u>individual, group</u> and <u>local community</u>. It combines three central concepts (<u>relevant social groups</u>, <u>technological frames</u> and <u>technology-in-practice</u>) and three interconnected dimensions (<u>content, context and process</u>). This multilevel framework will help to identify occasions and mechanisms for implementing IT applications for social purposes.

We call this a framework for inductive research because no hypotheses or propositions are offered. The framework will simply guide the empirical work. Although key concepts are identified (e.g., relevant social groups and technological frames), their relationship and interaction with particular contexts remain to be discovered. The understanding of the process is seen as fundamental.

Context (3 levels)	Process		Content
Local community *Relevant social group* Individual	People build their *technological frames* over time. *Technological frames* are likely to be shared within *relevant social groups* and they are likely to differ among different *relevant social groups.*	The implementation of an IT application is a *process of negotiation* where different groups exert influence on the way the technology will be implemented and used.	*Technology-in-practice* represents the ongoing result of such negotiation, with a number of characteristics and consequences.

Table 3: Multilevel framework

5. METHODOLOGICAL APPROACH AND NEXT STEPS

In order to answer the two research questions, a research design was conceived in terms of two phases. The first research question aims to identify the reasons that Brazilian correspondent banking has not yet fulfilled its original purpose, in terms of microcredit expansion. In order to answer this question, we are planning to identify the existing CB models in Brazil and to identify the characteristics of those CB models which are more successful in terms of credit offering, relating their success in terms of relationship services with the technology and business model adopted by them. In terms of research design, we will rely on three basic methods of data collection: (a) extensive analysis of official and public documents; (b) participant observation in meetings and conferences related to the subject; and (c) a qualitative survey carried out involving managers working with correspondent banking networks and/or micro-credit agencies (currently, 14 interviews have already been done).

The second research question aims to identify what actions should be taken to help the model play its desired role. This requires a process-based approach in order to better understand the mechanisms and practices underlying the operation of Brazilian CB models. In terms of research design, we will follow a case-based qualitative methodology, which has been selected in order to better capture the complexity of the phenomenon (Stake, 1998). A certain number of banks and their network of CBs will be examined in depth, following a **multiple case study** strategy, which is appropriate given that the research seeks to build a theoretical explanation of the subject "IT-enabled CBs" (Eisenhardt, 1989). The case-based approach has been suggested as one of the most appropriate research strategies for conducing empirical work in process-oriented research, and the benefits of using it are likely to be strengthened when it is also comparative (Pettigrew, 1990).

In order to analyze the data, we are using our multilevel concept framework. Each of the previous categories, including relevant social groups, technological frames and technology-in-practice, are used to identify the compose CBs technological and business models.

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Information Communications Technologies and Regional Integration: Africa and South America

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Information Communications Technologies and Regional Integration: Africa and South America

Abstract

This paper examines the relationship between information and communication technologies (ICTs) and regional integration as a pathway to socio-economic development in Africa and South America. Both regions face a colonial legacy often characterized by stronger external economic and political ties to the developed world than between the countries in the region. The transfer of technology and building of infrastructure networks are also influenced by this North-South relationship. However, regional organizations are currently involved in efforts to strengthen technological infrastructure such as ICTs, as well as the enhancement of economic and political ties. This paper suggests a framework with which to combine research on integration, ICTs and development, and provides a brief analysis for each region of some ICT initiatives and their potential impact on regional integration. The paper concludes with suggested applications of this theoretical framework for further research, particularly in order to assess the desired outcome of development.

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Introduction

Information and Communication Technologies (ICTs) and regional integration are both seen independently as tools to foster socioeconomic and political development. ICTs are also critical for integration within and between countries to enhance the flow of communication, information, and production. In that process ICTs are both direct agents of development as well as facilitators of integration which in turn promotes socioeconomic development. While the linkages between ICTs and development on the one hand, and regional integration and development on the other hand are made intuitively, there is no organized theoretical model for explaining these connections. Research and policy have often proceeded independently; with claims made either for the utility of regional integration and cooperation for economic growth, or that of ICTs for socioeconomic development, especially in the context of Africa and South America.

Indeed, these regions are compelling cases for examining the relationship between ICT development, socioeconomic development and regional integration. Both regions share a colonial past which developed them in particular ways, resulting in a deficit of infrastructure for transportation and communication between countries in the region. As a result, many often have more efficient connections with Europe and North America than with each other. Regional integration is pivotal to regional development if only by reducing dependencies on the developed world for trade.

The absence of a theoretical framework that captures the interstices between these issues has significant implications for research and policy recommendations in Africa and South America. This paper addresses this deficit by suggesting an integrated theoretical framework that facilitates a conceptualization of the intersections of discourses in ICTs, regional integration and socioeconomic development in the two regions. Such a framework will enhance research, analysis and policy in these areas. To achieve our purpose, it is necessary that we briefly review the relevant theories of integration and development, and the theoretical linkages between ICTs and socioeconomic development.

This paper is organized in three major sections. In the first section following this introduction, we discuss some of the prevailing theories and suggest an integrated model that facilitates a deeper understanding and analysis of the processes of regional cooperation, economic development and ICT adoption in Africa and South America. In the second section, we apply our suggested theoretical model of integration, ICTs and development as a conceptual framework to examine some of the on-going projects in Africa and South America. The case study encapsulates the various programs and projects adopted by policymakers and other key actors in the regions to build economic capacity through regional integration and ICTs. We conclude in the final section with recommendations for further research.

A. Theoretical framework of integration, ICTs and development

I. Comparative regional integration

Theoretical and practical approaches to regional integration are largely based on the experience of European integration since the 1950s. (Laursen, 2004) The European model, for example, suggests that nation-states follow a series of linear steps, beginning with lower level

economic integration (such as in trade) and moving on to the integration of monetary systems and fiscal policies.

Almost four decades ago Nye (1968) warned of the difficulties in comparing regional integration, and that assuming each example would and should follow the European experience was flawed. With examples from Africa and Central America, he showed that the steps discernible in European integration are not necessarily followed in the same order in other regions, and that economic integration can occur even with weakening political integration. (Nye, 1968: 859) What is recommended, therefore, is an analysis of integration in layers, separating political, economic and social factors, before assessing how they might relate to each other. This approach would be useful in the African and South American cases, where arguably the main goal of integration is regional economic development, not political integration.

Neofunctionalism was the most frequently used theory of integration in research on South America during the 1960s and 1970. It however failed to show how economic integration links to political integration (Axline, 1981). Neofunctionalism, especially as developed by Ernst Haas in *The Uniting of Europe* focuses on the development of a supranational state via the interaction of interest groups and political elites (Pentland, 1973). The earlier theory of functionalism, attributed to David Mittrany, had as well the goal of political integration, with the rationale of achieving peaceful relations among warring nation-states, but with this global community emerging through "an administrative network which better serves human needs" (Pentland, 1973: 83). This network, it is suggested, would be driven by technological advances and the functional need to cooperate. Functionalism therefore best explains how ICTs can enhance regional economic integration in Africa and South America. Explicitly downplaying the role of national governments, in the functionalist model of integration technocrats and citizens utilizing networks of communications and transportation, for example, cooperate and integrate the systems across borders. It is then assumed that "creative association and cooperation in problem-solving provides a learning-situation in which participants are gradually weaned away from their allegedly irrational nationalistic impulses toward a self-reinforcing ethos of cooperation." (Pentland, 1973: 84)

We suggest that a functionalist approach can facilitate an examination of integrative efforts at infrastructure development, as well as going beyond infrastructure to see how citizens and groups are interacting to achieve and utilize this development. However, by itself, it fails to provide adequate explanations for the relationships between regional integration, ICTs and development. For one thing, its emphasis on technocrats as key agents of change contradicts our concept of development as socioeconomic growth that benefits the greater number of people, especially the most vulnerable. Secondly, the experiences of Africa and South America differ significantly from that of Europe, the context in which functionalism was developed. With an emphasis on reduction of foreign dependence, and regional economic development at the forefront of integration initiatives in these regions, the expected outcome of international integration is problem-solving for national and regional development issues, rather than a shift in the legitimacy of political institutions. Indeed, political institutions might be strengthened during this stage of integration until adequate infrastructure capacity is built to increase non-state interactions.

II. Development Theory

Development theory can be defined as the body of theories that focus on issues of economic, social and political development in countries in the periphery. It "seeks to account for the

uneven pattern of development worldwide and to recommend measures to overcome underdevelopment" (Martinussen, 1997:8). Modernization theory was the prevailing theory of development up to the 1970s. It considered internal factors in its explanation of underdevelopment and therefore prescribed internal (or structural) changes to facilitate growth. However, in focusing on internal constraints to development, modernization theorists overlooked the structure of the international political economy and the ways in which it adversely affected the development efforts of countries in the South. And it was to correct this "oversight" that dependency theory emerged in the late 1960s and 1970s, and redirected attention to external factors of underdevelopment. Dependency theorists such as André Gunder Frank (1967) and Dos Santos (1970) argued that underdevelopment is created by the unequal relationship of exchange and dependence that exists between core countries and those in the periphery.

By the 1980s, dependency theory was itself virtually dead (Chilcote, 1994). But some of its assumptions re-surfaced in Castells's analysis of the factors that continue to hinder development in the South, particularly sub-Saharan Africa (Castells, 1996: 83-95). According to him, the causes of the region's marginalization and poverty are attributable to over-reliance on the export of primary commodities, negative terms of trade which, "as a result of the structure of exports, make it extremely difficult for Africa to grow on the basis of outward orientation of its economies." (p.83)

Theories, policy prescriptions and initiatives based on the classical understanding of development have since moved in different directions. Rather than top-down economic policies, other programs promoting decentralized patterns of development have become prominent, and emphasis has at various times shifted to projects which directly target the poor, especially in rural areas (Brohman, 1996). One such perspective focused on basic-needs strategy as a more useful approach to achieving the kind of economic growth that benefits the majority of people in developing countries. Toward the end of the 1970s, African countries, for instance, began to adopt a basic-needs strategy of development especially one that included regional and continental integration in ways that would allow African countries to be both producers and consumers of their products. In other words, the continent wanted to take advantage of its huge market rather than produce what it did not consume for the external market and consume what it did not produce.

This strategy became formalized in 1980 when 50 African heads of state met in Lagos under the auspices of the Organization for African Unity. At the end of the conference, the leaders signed the Lagos Plan of Action (LPA), aimed at focusing on internally driven strategies for development and collective self reliance. The plan called on the continent to "use its extensive resource base primarily for its own development rather than for export, to expand its industry primarily for home consumption and only secondarily for export" (Browne, 1984: 803). It was however short-lived because of the debt crisis and the consequent involvement of the Bretton Woods institutions in African economies. In the midst of the expanding neoliberal orthodoxy there emerged a new global discourse on ICTs and development.

III. Theories of ICT and development

There are no explicit theories of ICTs in the context of development. The literature consists of accounts of prescriptive statements on the impacts of ICTs on socio-economic development. In recent years there is a budding body of evaluative research on the utilization of ICTs in various sectors of the society. (Examples include Ciborra and Navarra, 2005 and Thioune, 2003.) The closest to a systematic theory of ICT and development is framed around five indicators of development proposed by the United Nations Commission on Science and

Technology in collaboration with the Canadian International Development for Research Center (IDRC): education, health, income, governance and technology (Crede and Mansell, 1998).

Howkins and Valantin (1997) present a method of examining the relationship between ICTs and development through scenario modelling. They identify four scenarios – march of follies, the cargo cult, net blocs and networld – which represent the directions that countries are likely to take in the adoption of ICTs for development.

In the march of follies, the global community is exclusive and fragmented and most developing countries tend to "respond only partially and reactively to the use and acquisition of ICTs." (Howkins and Valantin, 1997: 29) The market is competitive and cooperation manifests only in mergers and concentration to maximize profits. In the cargo cult, most developing countries assume that the global community is inclusive and supportive, but they respond only partially and reactively to the acquisition and use of ICTs. In net blocs, the world slides into regional blocs such that the global system becomes exclusive and fragmented, prompting "developing countries (to) take an active approach to the acquisition and use of ICTs and develop a complete set of policies." (Ibid., p. 38) But these policies lead to a world of regional blocs based on shared cultures and languages with each bloc pursuing competitive economic goals without much cooperation with other blocs. The final scenario, Net world, approximates the ideal end point because the global community is perceived by all to be inclusive and supportive. "Developing countries have a complete and proactive set of policies toward the acquisition and use of ICTs." (Ibid., p.41) They treat information and communication as the starting point for development.

Net blocs and net world represent current realities where countries struggle between the simultaneous imperatives to become fully engaged with the global community and to forge closer regional ties to secure their positions in a globalized world. For instance, the EU has expanded even as it is becoming more integrated socially, legislatively, politically and economically. African countries are seeking closer relationships with each other through the reconstituted African Union, while the regional blocs are becoming stronger and more integrated. In South America regional trading blocs exist alongside bilateral and multilateral agreements with the United States and other developed countries. The ultimate goal is economic development, or economic security in the case of regions where "development" (in its connotation as an initial stage in the journey to industrialization) has since been achieved.

IV. Toward a theory of integration, development and ICTs

The increasing imperative to cooperate in the pursuit of economic objectives calls for a closer examination of the relationship between regional integration and cooperation, development, and ICTs. The technologies have become a key variable because all regions, including the industrialized EU, are deepening their integration through these technologies as well as using them as tools for economic growth. Indeed, ICTs have facilitated closer linkages in unprecedented ways. As a result, it is no longer possible (or indeed useful) to approach the questions of regional integration, economic development and ICTs as discrete research fields. An integrated theory that fuses these areas becomes a useful tool for understanding the impacts of each on the other. In other words, in the context of Sub-Saharan Africa and South America, we must see the increasing integration and adoption of ICTs as processes toward a single goal: economic growth. These processes mutually impact each other: ICTs facilitate regional integration and together they promote national and regional economic development.

Furthermore, an integrated theoretical framework of regional cooperation, development and ICTs assists in the understanding of the various programs and projects of ICTs on one hand, and regional cooperation and integration on the other in South America and Africa. It integrates theorization in each field in recognition of the well-researched argument that lack of regional cooperation and poor communications infrastructure are part of the problems of underdevelopment in the two regions. Thus, it advances research in the field, as well as facilitates a more purposeful policymaking in the regions.

A brief model illustrates how these three theoretical perspectives intersect and guide future research. The bullet points below suggest the main research questions for each theoretical element of the model. The diagram shows how the processes of regional integration and ICT adoption in Africa and South America are expected to ultimately promote socioeconomic development. There are also overlaps in these processes that reject the analysis of the different domains as discrete fields of theory, research and practice.

- *Functionalism* as integration theory: closer cooperation among countries in each region; integration as means to economic growth through regional trade; development of technological infrastructure and uses of this system by various groups for societal needs; what are the needs and are they being met?
- *ICTs for development*: utilization of ICTs as tools for the achievement of the five indicators of development; ICTs as means of communication and information sharing to enhance regional integration and cooperation; are development and integration needs being met?
- *Development theory*: socio-economic development fosters local development, reduces dependencies but also expands national and regional opportunities, connecting people, countries and regions with the global community; are development indicators improving?
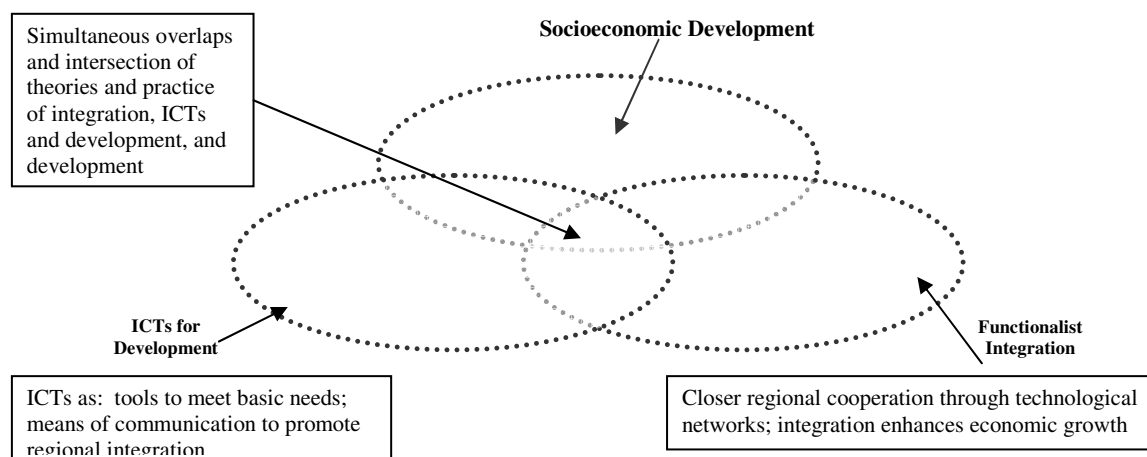
Diagram 1: An integrated theoretical model representing the interrelationships between regional integration, ICTs and development, socioeconomic development

B. Integration and Development in Africa and South America

In the this section, we employ this theoretical model in examining and identifying some of the processes currently underway to pursue goals of integration, particularly using the first part of the model, functionalism, to build regional capacity and implement integrated development

strategies with ICTs in Africa and South America. We address each region and its unique challenges separately.

I. Regional integration and ICTs as tools for development in Africa

African countries continue to face enormous development problems resulting from various factors. The 1980s, generally referred to as the "lost decade," were characterized by the oil shocks and debt crisis which threw many African countries into abject poverty. This opened the door for the Bretton Woods Institutions to intervene in their economies leading to a new era of intensive neo-liberal internationalism, thus scuttling the Lagos Plan of Action, a program of self-reliance and cooperation. However, the LPA was not completely sidetracked in the lost decade. African leaders rallied back, picked up the document and reworked it in Abuja, Nigeria in 1991 at another meeting of African heads of state. The blueprint of the earlier plan of action provided the framework for the establishment of the African Economic Community (AEC) which became effective in 1994. (AEC) The AEC is a conglomerate of all the regional blocs in Africa. It aims at facilitating the creation of free trade areas, a single market and common currency, and the overarching objective of promoting economic integration and cooperation among African countries. The African Union (formerly Organization of African Unity) also stresses the need for closer economic ties between and among African countries. The AU specifically works to facilitate the acceleration of the political and socioeconomic integration of the continent. It also coordinates and harmonizes policies between existing and future regional economic communities (E-Africa Commission).

A major first step to achieving integration and cooperation in Africa is infrastructural development. Therefore in the following section, we explore current initiatives in Africa aimed at creating a communication infrastructure conducive for achieving the continental goals of increased integration and cooperation. Many of these initiatives occur within various frameworks such as UNECA's African Information Society Initiative (AISI), but we will focus on those implemented by the New Partnership for African Development (NEPAD) as expressed through its e-Africa Commission. We will therefore consider two specific projects that the e-Africa Commission is undertaking under the auspices of NEPAD to connect Africa through the development of continental and regional information and communication infrastructures.

The emphasis on communications infrastructure as a strategy for development arises from the fact that the sector has always been problematic especially posing major obstacles in efforts at continental integration and cooperation. The telecommunications infrastructure in Africa was historically developed in a colonial context where communication was not considered a tool for the socioeconomic development of the colonies. Rather, communication infrastructure facilitated the administration of the colony and extraction of colonial resources to the colonizer's country. They were therefore developed skeletally for this basic utilitarian purpose. While many African countries have been politically independent for several decades, those colonial networks remain the backbones of telecommunications in many parts of the continent.

> There are even places where telephone communications still must be routed via Europe, despite relative proximity of the caller and the called. Such clumsy linkages are not only expensive and time consuming (but) they constitute a palpable barrier to the development of any meaningful business relationships among neighboring countries (E-Africa Commission).

This pattern also prevails even with the "new" ICTs. In the first place, many of the mobile telephone networks in African countries rarely interconnect with one another even within the same region. Thus, in highly populated countries with multi-service providers, individuals simultaneously subscribe to different mobile telephone carriers and carry around between two and three cellular phones. The choice of what phone to use for each call depends on what network the other party subscribes to. Each initiated call is routed out of the country before terminating locally. E-mail exchanges follow similar patterns: a sent e-mail travels out of the continent before being routed back to perhaps someone next door. This increases bandwidth cost and time.

Networks of integration

NEPAD, through the e-Africa Commission, has therefore devoted much of its resources to tackling these connectivity issues. The 2001 NEPAD document includes a section on the digital divide, and ICT development has since become a priority action area to promote conditions suitable not only for national socioeconomic development but also to facilitate regional integration, cooperation and trade.

In 2003, at a meeting of NEPAD heads of state in Abuja, Nigeria, a resolution was reached to build an open access broadband network to connect African countries with each other as well as with the global society. In August 2006, a protocol to build one of those networks was approved in Kigali, Rwanda. The network derived its legal mandate from the African Union constitutive Act. It becomes a NEPAD flagship project and there are plans to build similar networks in other parts of the continent.

The ICT broadband will be operated as a "public good" and charged on a cost-recovery basis. It will lease network capacity to other operators in the region, thus becoming a "carrier's carrier" (E-Africa Commission). Construction of the broadband began in the last quarter of 2006 and was expected to be completed early 2008.

Eassy is a terrestrial cable project with a similar purpose but facilitates information and communication infrastructure for countries along the eastern and southern coast of Africa. Sponsored by 22 "licensed telecommunications operators in Eastern and Southern African region," the project in March 2007 contracted Alcatel-Lucent to build 10,000 kilometers of 320 Gigabits submarine cable to link eight countries between Sudan and South Africa (Optical Networks Daily, 2007).

Different countries are also working on developing local internet exchange points (IXPs) to further facilitate domestic and regional connectivity. For instance, in 2006, about 30 internet service providers (ISPs) in Mali met to discuss the possibilities of setting up a domestic IXP in the country. Also in 2006, the Nigerian Communications Commission hired a consultant to begin work on the construction of an IXP in Lagos (Ovia, 2006). A national IXP is crucial to reducing cost and improving the communication process because in its absence, an ISP must send all outbound traffic through its international links, most commonly via satellite (E-Africa Commission).

Beyond infrastructure

The inadequacy of transportation and communication infrastructure is usually cited as a major hindrance to effective integration and cooperation among African countries. Insufficient integration and cooperation is in turn considered as significant factors in African

underdevelopment. The prevailing assumption is that African countries have a better chance of non-dependent development if they focus more on economic integration and cooperation rather than compete with each other to produce the same kinds of commodities for a raw-material saturated global market. Infrastructural development in different regions and continent provides a break in this vicious cycle.

While we agree with this proposition, we however argue that this position ignores the political and cultural barriers to integration and cooperation in postcolonial countries. The mandates of the African Economic Community and the reconstitution of the Organization of African Unity as African Union are similar to the European Economic Community and the European Union. Africans may be deliberately or unwittingly attempting to replicate the results of the deeply integrated European initiatives. We argue that an integration of this nature goes beyond the building of communication infrastructure. In this section therefore, we highlight social and political factors that may reduce the capacity of a developed ICT infrastructure to increase integration and cooperation.

Socially, many Africans suffer from "colonial mentality" – the idea that only products and services "imported from abroad" are good enough. And "abroad" is anywhere outside Africa. In the years before the rise of multinational corporations and export-processing zones, only Made-in-England or Made-in-France products were good enough. In Nigeria, "Made-in-Taiwan" was synonymous with low-quality goods while Made-in-Aba referred to all locally made products and these were "touch-nots," especially by the newly rich of the oil-boom years. With structural adjustment programs and the attendant economic hardships, the intensification of globalization and globalized production and outsourcing, many Africans now know that many Made-in-England products are actually produced in factories in Taiwan and other Asian countries. However, Made-in-Aba remains a metaphor for locally-made products and services that must be shunned by the rich.

This colonial consumption pattern surfaces in the societal usage of ICTs as acceptance and usage are still considered in relations with the external world – outside Africa. This may be an outcome of the fact that the technologies – both as physical and cultural objects – are imported from elsewhere. Perhaps then NEPAD's efforts and those of some countries to develop national IXPs and local content would create a sense of ownership of the technologies and therefore generate internally-oriented imperatives.

Politically, many African countries still struggle with ethnic conflicts and rivalries. Nearly all of these countries are amalgams of different nationalities and ethnicities that were "artificially" integrated and mandated to "become" nation states by the structures of colonialism. These artificial constructs have been the roots of many internal and cross-border conflicts on the continent as different groups of people view each other with suspicion and hostility. Recent conflicts on the continent have arisen from the inability of the different groups that constitute each country to find common grounds and goals. Also, there are many regional blocs on the continents with different dynamics of suspicion and hostility.

In West Africa, the Economic Community of West African States (ECOWAS) has been relatively cohesive, but many of the most violent conflicts on the continent in recent decades have occurred in this region (Liberia and Sierra Leone). Economically, Nigeria, the largest country in the region, is perceived as an overbearing, albeit incompetent, giant by other countries. South Africa is similarly viewed by its land-locked neighbors in the Southern African Development Community (SADC). At a different level, North Africans ally themselves more politically and culturally with the Middle East than with Africa, and there is now a distinction between "sub-Saharan Africa" and "Africa" as research and policy

concepts. Within and between countries, within and between regional blocs and within Africa, there are divisions and formations that are conceptually resistant to cooperation and integration. Given the expansive land mass, the number of countries and people, getting Africa integrated appears a challenge that ICTs may not adequately mediate without the intervention of other processes.

We argue that a developed ICT infrastructure will not by itself create continental integration and cooperation in Africa given these social and political impediments. However, we do not suggest that NEPAD's ICT broadband projects and other national projects in ICT self-sufficiency are futile. If the infrastructural communication barriers in Africa are removed, then the continent has one less problem to deal with. But more importantly, we argue that these issues cannot be examined in isolation of each other. A vigorous analysis of the integration of issues of regional cooperation, development and ICT will provide a more nuanced understanding of the complexities of the processes through which African countries and others in the developing world will promote their economies via integration, regional cooperation and ICTs.

II. Integration and Development in South America

Current issues in South American regional integration and development must also be understood within the context of colonization of the region and its historical relationship with Europe and North America. In the early centuries of conquest, as in Africa and other regions, development consisted of transportation and technologies for the extraction of natural resources and military control. Brazil, for example, was developed along its coastline with sugar plantations for the export of cash crops to Europe. Colonial development and geographical features including mountains and dense jungle in the interior all contributed to the lack of regional infrastructure development. Independence movements resulted in the establishment of individual nation-states, most of whom had stronger socioeconomic ties to Europe, and later the United States, than to each other. This colonial and postcolonial legacy of resource extraction for export to the North created a dependence upon these markets and a vulnerability to changes in demand and price. This was made dramatically clear in the 1930s when the global economic depression curtailed demand from the developed countries for South American primary commodities (Chasteen, 2006: 229).

Economic nationalism prevailed during the 1930s, and throughout much of the 20th century, in part as a reaction to this reliance on foreign markets, and foreign control of much of the region's natural resources. Dependency theory itself was influenced and developed within this context, created by South Americans such as Prebisch, Frank, and Cardoso. Economic nationalism was manifested in the political economy of the region in varying forms, from Marxism to state capitalism, but a common theme was development via greater self sufficiency to break dependent economic relationships. The prevailing policy for economic development in the latter half of the 20th century of Import Substitution Industrialization (ISI), in which states invested heavily in the manufacturing of consumer goods, was a resistance to the reliance on imported manufactured goods from the developed countries.

The current era of globalization and the neoliberal policies of Bretton Woods Institutions over the past fifteen years have presented some challenges for South America. There have been policy shifts away from government directed development and towards freer markets, institutionalized by the so-called Washington Consensus (consisting of the IMF, the World Bank, and the United States). The debt crisis in South America underscored the region's dependency on capital from the developed countries, and at the same time reinforced the

Consensus' policies towards the region: privatization of industries, de-regulation of the economy, removal of subsidies and trade barriers, and budget-tightening (Gwynne and Kay, 2004, p. 12).

International integration initiatives and agreements in South America have been influenced by both of these tendencies. Dependency theorists recommended "de-linking" from the global economy to eliminate reliance, influencing policies of ISI, but also suggesting that closer economic ties within the region would be a way to develop self-sufficiency. Neoliberalism, with its faith in free market economics, advocates international integration to remove barriers to the flow of trade and investment. The earliest and arguably the most significant effort in the region, the Mercado Comun del Sur (MERCOSUR/MERCOSUL), which includes all the Southern Cone countries, was founded to facilitate trade in the continent, with the goal of "desarollo economico con justicia social en la region, afrontando con urgencia el desafio que plantea la pobreza, la desigualdad, el desamparo y la exclusion social" [economic development with social justice in the region, urgently confronting the challenge posed by poverty, inequity, marginalization, and social exclusion] (Comunicado).

Information communications technologies (ICTs) are now, as in Africa, considered an integral tool for socioeconomic and political development in South America. There are national, international and multinational plans and projects on paper and in process to bridge the digital divide, improve citizens' access to ICTs, and utilize the technologies in improving the region's global competitiveness as well as solve persistent problems of poverty and income inequality. Thus, regional integration and ICTs are both pursued as in the quest to bring South America along the path of development. Moreover, ICTs are viewed as a necessity for integration, particularly in a region characterized by weak infrastructure in transportation and communication (Malkin, 2006).

Networks of integration

This development of infrastructure for ICTs is a critical necessity for the region, which currently only has three IXPs, compared to 38 in the United States. In comparison to Africa, there have not been any significant region-wide efforts to build ICT infrastructure at the governmental level. Also, efforts to implement major infrastructure improvements for connectivity, such as broadband and wireless capabilities are still in the early stages and not widespread. (See, for example, Malkin, 2006: 53 and New Models for Universal Access) There have, however, been a growing number of ICT development projects within countries, initiated by outside multilateral organizations and the private sector. Regional ICT development for integration depends upon the growth of national information systems and connectivity within countries, as well as international integration of systems. The World Bank's *infoDEV* program, for example, has funded "incubator" projects in eight South American countries, with the goal to enhance research and development by local companies in ICT development (Incubator Network).

Connectivity within countries is vital to avoid integrating urban areas at the expense of rural areas, deepening the digital divide and reinforcing dual economies in the region. An Inter-American Development Bank report in 2005 warns of the dangers of "asymmetries" in all facets of development with the tendencies of global capitalism to further polarize socioeconomic conditions, one cause of which is uneven infrastructure development, including ICTs (Giordano, 2005). In fact, careful simultaneous national and international ICT capability is required in order to create a system that integrates the various sectors in a way which contributes to regional development. The IBD report suggests "bottom-up approaches that build upon the efforts of civil society organizations and local governments to

forge new international networks that facilitate regional and global integration" (Giordano, 2005: vi).

Beyond Infrastructure

As we saw in Africa, the social and political barriers are as significant as the lack of physical infrastructure. In 2000 the Iniciativa para la Integracion de la Infraestructura Region Suramericana (IIRSA) (Initiative for the Integration of Regional Infrastructure in South America) was established as a regional multinational organization to enhance the development and interregional connections in the areas of transportation, energy and communication. For the latter, it was noted in a report to IIRSA by the Inter-American Development Bank in 2003 that "the formation of public-private-civil society alliances is a key element in any strategy that aims to provide for universal access and ICT development in South America." In the same report it was also noted that despite many conferences and forums, to date, "not much has been accomplished" (Information and Communications Technologies in Support of South American Competitiveness and Integration).

Accomplishments, however, are perhaps more easily assessed by considering the varying levels and sectors at which integration takes place, as recommended by Nye (1968). For instance, another South American initiative, the Institute for Connectivity in the Americas (ICA), states as its focus the connecting of citizens between different countries, but its projects do so by identifying varying layers of society. In 2006 ICA reports the creation of La Red Sudamericana de Portales Educativos (South American System of Education Portals), connecting educators, as well as a similar system connecting government leaders (Institute for Connectivity in the Americas).

Another regional organization exists which focuses on specific areas of integration. The Associacion Latinoamericana de Integracion (ALADI), established in 1980 with membership of most of the region, has as its main goal the establishment of a regional common market (free flow of trade, capital and labor). To this end, it sponsors technical conferences and workshops in ICT application to issues of intraregional trade and commerce, bringing together experts in specialized areas. For example, in 2006 a technical conference was organized on the creation of a regional statistical information system for the purposes of tracking and making available trade and commerce data, with participants from national banks and government data offices (ALADI). The Latin American Forum on Telecommunications Bodies was founded in 2005 and now contains most of the countries in South America, for the purpose of harmonizing national regulations in telecommunications (Regulatel).

A 2004 agreement to connect MERCOSUR and the Andean Community, which would join the Andean countries with the Southern Cone countries (Argentina, Uruguay, Brazil, Paraguay, Bolivia, Peru, Chile, Ecuador, Colombia and Venezuela) focuses on "the convergence of economic complementation agreements among countries of South America" (Andean Community). The South American Community of Nations (SACNA), as it is called, recognizes the need for a coherent policy on infrastructure development and integration. And while initiating this effort at the ministerial level of government, it has called for the establishment of:

> A technical work group with the participation of government agencies responsible for formulating the policies, rules and regulations governing communications and Internet services, with a view to examining the possibility of stimulating the development of an infrastructure network, which is an indispensable feature of a regional information society, that includes Internet exchange points, regional networks and primary servers,

while taking into account the specific situation and needs of the region. (Andean Community)

Canada's International Development Research Centre (IDRC) has funded an information network to facilitate the sharing of economic indicators, trade and investment regulations, and other data pertinent to international trade and investment within MERCOSUR (MERCOSUR).

It is clear from this review and sampling of ICT and integration policies in the region that there are projects in different sectors in South America, and many of them seem to be top and middle level efforts, to encourage ICT development nationally and create regional information systems. Two of the most pressing issues for ICT development and regional integration are the lack of technological infrastructure and severe socioeconomic disparity, which tends to fall along ethnic and rural/urban lines. Both must be addressed in order to achieve the "universal access" that is a requisite for regional development and integration.

Conclusion

It is evident from both cases of Africa and South America that there is a complexity of factors, issues, and systems in the application of ICTs for regional integration as a pathway to socioeconomic development. It is useful to distinguish between technological factors and sociopolitical factors, as either one can present a significant barrier to integration. The international integration theory of functionalism could be a useful tool with which to examine the development of the ICT infrastructure and the attendant social and policy interactions. The functional interaction of technologists and mid-level policymakers is descriptive of some of the integrative efforts we have seen in both regions – governmental agreements on infrastructure, harmonization efforts between regulatory bodies, information sharing among academic institutions, and technical groups working on Internet connectivity. In fact, integration takes place via many different political, social and economic layers. The framework suggested in this paper, for example, could be utilized to analyze evidence of integration by sector, or interest area: state ministers, state regulators, technical groups, private businesses, education, health, etc. This type of analysis could help to explore the results for development of these efforts. For example, state-level agreements might hold little significance if integrative processes do not take place below that level. Thus how these sectors, or layers of integration, interact with each other is critical for understanding the process through which ICTs can foster integration in Africa and South America in ways that promote socioeconomic development in the two regions.

Furthermore, a significant point for both cases of ICTs and development is the expansion and integration of these technologies within countries in the two continents. For if this does not occur, integration between countries will be at a stratum of elites in the urban areas of Buenos Aires and Sao Paolo, Nairobi and Lagos, risking the further marginalization of the unconnected areas. Thus, for meaningful regional development to occur there must also be ICT diffusion and integration within countries, including rural and poorer regions.

In conclusion, we argue that the integrated theoretical approach that is suggested for conducting much needed research in this area of ICTs and development helps us to focus on the construction of technological systems, and specifically, the interactions of the people implementing and utilizing the systems. By using this framework, research can be conducted on the integrative efforts briefly reviewed above, as well as projects on many different levels, that link the development of the regional ICT infrastructure with socioeconomic development

of the citizens. Further research must identify development indicators utilizing the concept of development most associated currently with the United Nations, often called the "people-based approach" to development. This approach calls on regions to develop their own national and regional "information societies" (Mansel and Wehn, 1998) to meet the needs of their own people. The ICT-for-development model that the UN recommends fits with this notion as well, both offering regions the possibilities of technological adaptation and innovation to meet regional needs and reduce external dependency. Given the concept of networking that ICTs connote, research in the ways that the technologies enhance regional integration and together promote socioeconomic development is equally vital to a holistic understanding of the processes and as well as generating useful policy recommendations.

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Information and Communication Technologies in Development: Contextuality and Promise

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Abstract

Implementation of projects aimed at harnessing information and communication technologies (ICTs) for socio-economic development in Africa are inevitably affected by the state of basic infrastructure. This explains the mixed results of ICT adoption as emerging evaluative research indicates. However, through recurrent practices, users of ICTs in many places have devised coping mechanisms to navigate through existing infrastructural constraints. These processes have significantly altered the nature and functionalities of some ICTs in ways that differ from the initial conceptualization and design. The outcomes produce new ways of thinking and practice. This paper adopts an integrated model of contextualist and structurational analyses to show how the unintended outcomes represent interesting new sites for research and analysis. It suggests the need to examine the nature of the reconstituted products and functionalities and how they evolve into distinct ontological realities. The analysis is demonstrated by a case study of the patterns of usage and conceptions of some ICTs and processes in Nigeria.

Information and Communication Technologies in Development: Contextuality and Promise

> The significance of considering the context of IS innovation in developing countries cannot be over emphasized. Invariably IS innovation in developing countries involves the transfer of technologies and organizational practices which were originally designed and proved useful in other socio-organizational contexts Their potential value, their fit in the local socio-organizational conditions and feasibility of use cannot be taken for granted. (Avgerou, 2001: 44)

Introduction

The potential of information and communication technologies (ICTs) to drive socioeconomic growth in developing countries is perhaps the most significant discourse in development theory and practice in the last two decades. The discussion is structured around two imperatives: the urgency to achieve socioeconomic growth within the countries, and the necessity to integrate into an increasingly networked global economy. The assumptions are that the technologies of information and communication such as the Internet, telephone and computers would help developing countries to leapfrog several stages of development thereby catching up with, or at least closing the gap between them and, the postindustrial world.

These assumptions link into the general discourse on globalization and the notion of an integrated and interdependent world (Keohane and Nye, 2003; Held et al, 2003). For instance, Castells (1996) argues that a combination of the new ICTs and the processes of globalization has created a global network society where the mode of production is informational, thus replacing the industrial-age mode of production. He further argues that countries that fail to integrate the technologies into their national economic strategies will be excluded from the global network society. Indeed, he links the underdevelopment of Africa to its dismal level of technological development.

Much of the theorizing on ICTs and development emerge from the perspective of the potential impact of the technologies on the economies of developing countries. Assumptions are made about the utility of ICTs as tools for socioeconomic development in language that often implies a technological determinism. Many developing countries have responded to the global discourse on what has become known as ICT4Dev by formulating polices and implementing projects and programs to facilitate the utilization of these technologies as core development strategy. In particular, African countries are embracing ICTs as viable tools for economic development. Also, International development agencies such as the Canadian International Development Research Center (IDRC) have funded ICT-centered research and projects.

Toward the end of the 1990s, the discourse drove the programmatic agenda of the World Bank (Knowledge for Development Program) and the G8 (Digital Opportunities Taskforce). It remains an integral part of the United Nations Millennium Development Goals initiative. These ICT-centered programs and initiatives proceed from the mostly utopian conception of the capacities of the technologies in promoting independently, or in concert with other variables, the development goals of organizations, countries or regions. However, recent evaluation research indicates that results of adoption and implementation of ICTs are mixed. These mixed results prompt a number of questions about the efficacy of new technologies in settings outside the sites of production, renewing research interest in the significance of contextuality in the adoption and application of technologies. Essentially, the extent to which

context determines the outcome of technological infusion remains a matter of interest. This paper engages this question through a case study of patterns of usage of certain ICTs in Nigeria. It adopts an integrated model that builds from contextualist and structurational analyses.

A contextualist approach provides a useful framework for understanding the promise and the realities of ICT utilization within the context of a developing country such as Nigeria. A structurational approach extends the analysis to highlight the significance of unintended outcomes. A model drawn from this analytical framework proceeds from the assumption that while different contexts will intervene in the application of ICTs in organizations, the unintended outcomes produced by such interactions are also vital and ultimately shapes the design, production and usage of ICTs.

This integrated model has useful implications for understanding ICT outcomes in several countries, particularly those in the developing world. It shows how contextuality shapes the usage of specific technologies while iterative practices produce new forms, uses, behavior of and discourse around the technologies. The interaction between context and practice drastically changes the form and nature of the technologies from their conceptualization at the point of design and production.

This paper is therefore aimed at showing how an analysis of some of the unintended outcomes provides a more robust understanding of both the nature of the technologies. It also raises the need for a more nuanced and contextualized analysis of the ICT4Dev discourse in ways that inform policy formulation and implementation. It is divided into four main sections including this introduction. In the following section, I present an overview of the literature on contextual and structurational analyses as used in the field of information systems and ICT for development. I then show how the elements of the two analytical perspectives can help in the construction of an integrated model that more effectively addresses and acknowledges the new realities that are created in the interaction of context and practice.

In the third section, I present a case study of patterns of ICT usage in Nigeria indicating how ICT users navigate through numerous structural constraints in their engagement with the technologies. The constraints, such as poor electricity, are referred to as potholes, a metaphor that draws from the perennial poor road conditions in the country. The strategies of circumventing the potholes are referred to as detours, which capture the detours and surface measures used in evading the potholes on the physical roads especially during the rainy season in Southern Nigeria. I conclude in the last section with policy recommendations and suggestions for further research.

The case study was conducted in Nigeria during three research trips the most recent being in January 2007. The research techniques were interviews, content analysis of relevant policy documents, observation and anecdotes. The interviews were conducted with key principals in the public and private sectors as well as users of some of the technologies. The bulk of the research was however conducted through observations of ICT usage in Lagos (the most populous city in the country), Abuja (the country's capital region), Port Harcourt (a major city in the oil-mining southeastern region) and Uyo, a fast-growing ICT-city and capital of 20-year-old Akwa Ibom State.

Theoretical framework: An integrated model of contextualist and structurational analyses

As Avgerou has noted, much of the discussion of ICTs in developing countries is "directed toward developing general knowledge for the implementation of information technology

innovation without considering in a systematic way variations of the organizational and the broader context within which the innovation is embedded." (2001: 43). In reality, she argues, the extent to which any organization achieves increased production through information systems (IS) innovation will be determined by its context. Indeed evaluative research of ICT-centered strategies for development implemented in and by developing countries and development agencies in the height of the ICT4Dev discourse show differing outcomes (Thioune, 2003). The explanation of some of this diversity is often framed in terms of the argument that it is too early to evaluate projects of ICTs in development (ITU, 2006). However, it is clear that a contextualist approach provides a more accurate explanation for these ambiguities.

Avgerou, adopting a contextualist analysis compares the IS innovations in Cyprus with the Emilia Romagna region in Italy showing how the same strategies produced different outcomes. She argues that innovations should not be implemented without attention to the specific context. The thrust of her argument is that the context of IS innovation in developing countries is very significant because it "involves the transfer of technologies and organizational practices which were originally designed and proved useful in other socio-organizational contexts" (Avgerou, 1996, 2001). In turn, Guittierez (1995: 27) contributes to the discourse by drawing attention to the ways a contextualist approach allows for the articulation of a particular phenomenon in a complex environment where historical precedents have a pivotal role in the "development of understanding and the qualitative confirmation of hypotheses."

The notion that technologies adopt different forms when applied outside their context of production is not new. Jacques Ellul's *Technological Society* (1964) changed the way one looked at technology especially at a time when technology intersected with development theory of modernization and decolonization. Many others in recent times have also argued that technology embodies socio-cultural and ideological symbols and meanings. (See for instance, Kalu, 2000 and Akpan-Obong, 2004).

Indeed, this was the major criticism of the "technology transfer" rhetoric of the 1970s in development theory. Critics, such as Makinde (1986), argued that technology cannot be transferred from one domain to the other with the expectation that its applications will produce the same outcomes. Thioune (2003) equally argues that while ICTs "are credited with the ability to transform, and deep and significant changes are expected from their widespread use in Africa," there are challenges such as "adapting ICTs to local conditions and uses in developing countries, and allowing each country to understand these innovations and adjust them to their own development needs" (2003: 2-3). Many developing countries are already doing this as Thioune's case study of four African countries' utilization of ICTs in poverty reduction programs show (Ibid). The case study of patterns of ICTs usage in Nigeria presented below is an important contribution to research in this area.

One acknowledges extant research on contextuality. This is therefore not a re-inventing of the wheel. However, one extends some of the current analyses in two ways. For instance, while Avgerou's analysis concentrates on information systems adoption in organizations, this paper concentrates on societal adoption and usage of ICTs, premised on the understanding that just as context matters in organizations, they matter even more so in countries as units of analysis. This is even more so in developing countries, geographically and symbolically removed from the context of production. This distance inevitably propels them to "translate" the technologies differently from the original intentions. A discussion of how context alters outcomes in the adoption of technological innovations is interesting by itself. However, such analysis is akin to driving into a dead end without a resolution.

This is where an integrated model of contextualist and structurational analyses extends the discussion by facilitating an examination of the outcomes of contextual application of innovations. One makes the assumption that the unintended outcomes lead to new forms of realities and utility in the harnessing of ICTs either as tools for socio-economic development or simply as means of communication and information gathering. The process – actions, reactions and interactions of actors and iterative practices – within various contexts – creates new technological forms that have new functionalities to meet the specific needs of users.

Structurational analysis is rooted in Gidden's body of work on the "relationship between human agency or action and the creation of order and social institutions" (Stillman, 2006: 113). It highlights "the processes through which ICTs are shaped under the influence of and at the same time contribute to the shaping of the social relations of the organizations within which they are introduced." (Avgerou, 2001). It refers to iterative and recurrent practices which eventually become new forms of existence or social order. It bridges the binarity between human agency and structure by elaborating ways in which the interaction between agency and structure create new realities.

An integrated model that captures both elements of the two analytical approaches highlights two major issues in the case study which follows. First, it shows how the context shapes usage of certain ICTs in Nigeria. This context includes not only the infrastructural constrains but also the policy framework. The policies created the environment for ICT usage primarily by deregulating the ICT sector through the establishment of institutional mechanisms. They also raised the priority level of ICT acquisition and usage as tools in the achievement of macro socioeconomic goals. It can be argued that while Nigeria's ICT sector is mainly private-driven, it would not have developed as rapidly as it has done without a clear and intentional policy framework. Secondly, an integrated model highlights the new realities in usage and technologies and how these change the nature of the technologies. The conceptualized model is represented by the diagram below.
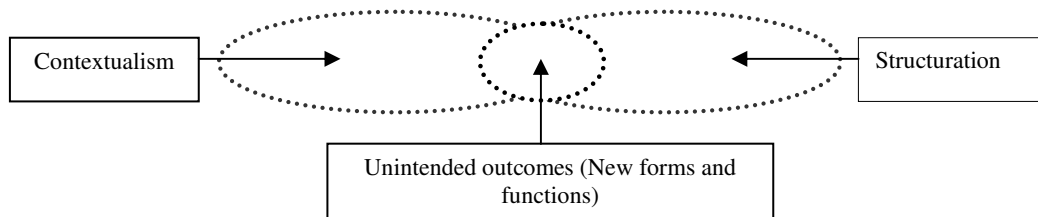
Fig. 1: Integrative model of contextualist and structurational analyses

ICTs and the Nigerian context

I. **The Policy/Institutional Framework**

For much of Nigeria's history, there wasn't a deliberate policy on ICTs. Indeed, there wasn't much of "ICT activity" occurring prior to the 1990s. The Nigerian Policy on Telecommunications (NPT) was promulgated in 2000 and it immediately opened up the telecommunications sector by breaking the monopoly of the state telecommunications operator, Nigerian Telecommunications Limited (Nitel). Nitel, like many public telecommunications operators in Africa, emerged from the colonial construct called Post and Telecommunications (P&T) which, as the name implies, was responsible for telecommunications and postal communications in the country. It was split into two separate

semi-autonomous units of the Ministry of Communications. (The other unit is the Nigerian Postal Services – Nipost.) The NPT, through the Nigerian Communications Commission (NCC), enabled the licensing of private operators (PTOs) to provide fixed telephone lines and cellular phone services to Nigerians. With the entry of the PTOs into the telecommunications sector, Nigeria's telephone penetration, stagnated at below 400,000 main lines, gradually increased even as newer means of communication were also becoming available to the general public.

One of these newer means of communication was the Internet (or specifically e-mail). While the Internet had been introduced in Nigeria as "early" as 1991, its usage was skeletal and confined to a few institutions of higher learning, oil companies and embassies. As at 1994, very few people in Nigeria had heard about this technology and many of those who did were uncertain about its meaning and implications. However, as Internet and computer usage spread in the country toward the end of the 1990s, there was pressure from the private sector to create a policy milieu to facilitate the growth of these technologies. Series of workshops and consultations among interest groups were held to articulate policy directions for the sector, and these culminated in the promulgation of the Nigerian Policy on Information Technology (NPIT) in 2001. This policy had similar goals as the NPT. However it went beyond merely creating a policy framework conducive for the development of the ICT sector: it outlined the country's plans to integrate ICTs into the national strategies for macro-economic growth.

The policy acknowledged the factors that were likely to hinder the achievement of the development objectives. Indeed the constraining factors, referred to in this paper as potholes, seemed daunting. Poor state of roads is a common feature on the Nigerian landscape. This is especially so in the southern parts of the country where the heavy rainfall combines with awkward road networking and poor construction to make physical travel a grueling task. It was clear from a policy perspective that just as the Nigerian road is filled with potholes and barriers, so is the virtual highway – at least the Nigerian access route to the information superhighway. These hurdles presented interesting challenges for the prospects that Nigeria's journey on the information superhighway would be smooth and fast (thus enabling leapfrogging from the country's peripheral capitalist economy to post-industrialization). But as we see below, Nigerians have devised coping mechanisms, referred to as detours in this paper, to bypass these potholes and stake out a position in the global information society – even if only for a small minority of the ICT-savvy urbanites.

II**. The structural framework: Potholes on Nigeria's information superhighway**

A. **The telecommunications landscape:** The state of the infrastructure – especially telecommunications infrastructure – poses a major hindrance to the use of ICTs in Nigeria, with Nigeria having one of the lowest teledensity in sub-Saharan Africa even as the rate increased exponentially between 2002 and 2006. In 2001 there were 0.43 main telephone lines for every 100 inhabitants, with a total cellular phone subscriber base of 330,000 (or 0.28 per 100 inhabitants). By August 2006, there were more than 1.5 million connected fixed lines and almost 27 million cellular phone lines in the country raising the teledensity to 23.29 in a five-year period (Nigerian Communications Commission, 2006).

Proponents of the "digital revolution" have argued that the state of telecommunications infrastructure in Nigeria can be an advantage as the country can leapfrog to the new technologies without the cost of effacing old ones. In this context, the cellular phone is considered the technology of choice that is affordable and accessible to everyone who previously had no access to a telephone. And the technology adopted in Nigeria – global

system of mobile technology – makes this objective particularly achievable. The rate of cell phone diffusion in the country affirms this.

However, the cellular phone technology does not completely transcend the infrastructural concerns. For instance, providers of mobile telephone services complain of problems such as the "inadequate transmission backbone and poor level of power generation" (Okonedo, 2005). One of the service providers, MTN, spent "unbudgeted $120 million on the construction of its own microwave transmission backbone" (Okonedo, 2005) Nigeria does not have its own international telephone circuits (ITU 2006) thus severely handicapping international telephone traffic. For Nigerians in the Diaspora, calling family and friends back home can be such torture. For one thing, the calls are more expensive than calls to other countries. And secondly, the circuits are always busy.

B. **Electricity constraints:** ICTs generally operate on electricity. But according to the United States Energy Information Administration, only 10% of the rural households in Nigeria are connected to the national electricity grid. Over all, just about 40% of Nigerians have access to electricity (United States Energy Information Administration, 2006). In the towns and cities where there is electricity, its presence is felt more in its absence leading to the nicknaming of the National Electric Power Authority (NEPA) as Never Expect Power Always.

Electricity generation and distribution therefore negatively affect the diffusion levels of ICTs in the country. The competition among the PTOs has drastically reduced the cost of GSM mobile phone services. However, at 28 cents per minute (or 26 cents off-peak rate) for local calls, cellular phone costs are still very expensive relative to the income of the average wage earner in the country (the national per capita income was $1,000 in 2005). The GSM operators attribute the high tariff structure to the extremely high overhead costs of doing business in the country especially given the infamously epileptic nature of power supply. One of the major cellular phone providers in the country spends about ₦21 billion annually on electricity generation at its base stations" (Okonedo, 2005). This cost is passed on to the cell phone user.

C. **Technology dependency:** Another source of infrastructural obstacle in Nigeria is the absence of locally manufactured ICTs. There is some local production and improvisation but the bulk of ICTs are imported as finished products. This creates a technological dependency for the actual technologies and services. A principal actor in the sector in Nigeria said "undue reliance on foreign companies" will severely "upset the successful implementation of the (digital) revolution." Another ICT actor in the Federal Ministry of Information in Abuja, the federal capital, agreed that the lack of basic infrastructure as well as the over-reliance on imports will negatively impact on the country's ability to achieve its ICT-related goals. But this does not have to be so, she argued, because Nigeria has the capacity to locally produce ICTs.

III.   **Interaction of context and structure: Detours**

Many Nigerians echo this optimism about the national capacity to scale the infrastructural hurdles and potholes in the country. Different detours provide a relatively unfettered access and short cuts to the global information society. For this paper, I focus on how cell phones and alternative sources of power have presented possibilities for scaling some infrastructural hurdles. I also highlight the ways that the cultural and structural context shapes notions ICT access and ownership in ways that capture the essence of Ellul's concept of global practices in a local context (1964). I must note that due to the nature of ICTs as integrated technologies, these detours are not isolated developments. Rather, they affect and are affected by other coping mechanisms. There are therefore inevitable overlaps in developments in the different areas.

A. **Cell phone as a multifunctional gadget:** The award of the digital mobile licenses (DMLs) to three operators, and the subsequent roll-out in 2001 of cellular phone services on the GSM platform transformed the communication landscape in the country. Cellular phone lines increased dramatically from less than 100,000 in August 2001 to nearly 30 million in at the end of 2006. This growth outstripped that of fixed telephone lines which moved from less than 400,000 in 2001 to more than 1.5 million in August 2006 (Nigerian Communications Commission, 2006). In this way, mobile telephony becomes the detour to the problem of low density and poor infrastructure. At the same time, it spurns off new functionalities such as usage as e-mail access and illumination at night when the there is no power supply. The integrated analytical model adopted for this paper clearly captures the versatility of the cell phone in Nigeria and the ways the context reshapes its primary design and function as gadget for voice communication.

The growth of both mobile telephony and fixed lines has, unsurprisingly surpassed that of Internet subscription in the country. Access to cell phones is relatively cheaper and easier. Waiting period for a cell phone line moved from two years to ten minutes, and from the equivalent of US$1,000.00 to US$50.00. But more importantly, it is a standalone technology (even though it still requires electricity to charge the battery). The Internet, on the other hand, relies on electricity, computer, modem and telephone connectivity. While broadband wireless connection to the Internet bypasses the telephone infrastructure, it also depends on electricity and is mostly available in large business organizations and cyber cafés. Not many Nigerians can afford dial-up access to the Internet from home and fewer still can afford wireless Internet access or a computer.

Besides its relative affordability and accessibility, the cell phone does not depend on any level of literacy – a major hindering factor to wider diffusion of the Internet in the country. Indeed, some of the cell phones available in Nigeria have been customized such that even those who cannot read or dial numbers can use them. For instance, stored phone numbers have images that are linked to individuals so that when the phone rings, a user can recognize the image and know who the caller is even if s/he cannot read the numbers. One of the principal actors in Nigeria's ICT industry said at an interview in January 2007 that his company was beta-testing a product that would allow actual photos of family members and friends to be linked to phone numbers. When a call comes in, the photo of the caller pops up on the screen. To dial, the user can press a button and a list of the photos comes up and s/he pushes another button that dials the selected person. He said the product would be commercially available by April 2007. There are also voice-activated phones that again provide a detour for literacy constraints.

The cell phone is further attractive because there are no charges on incoming calls. This has itself given rise to the phenomenon known as "flashing" where someone dials another person's number but quickly hangs up right after the first ring. That call is free but a user succeeds in alerting the other party who then can choose to call back – or not. This makes it possible for younger people, especially students, to have cell phones without paying for the cost of every communication. This is also why the most popular cellular service plans are the pay-as-you-go or prepaid packages. As much as 95% of cell phone subscriptions in the country are prepaid plans (ITU, 2006). Also, the networks enable automatic text messaging (unlike in the US where users have to subscribe to SMS or pay much higher costs to send and receive text messages). To make it more attractive, it is cheaper to send text messages than to make voice calls, and all incoming messages are free. (For further analysis, see Akpan-Obong and Foster, 2007.)

While much of the diffusion is occurring in the cities and among the fairly wealthy and ICT-aware individuals, cellular phone usage has also spread to the rural areas for one important reason, besides PTOs' need to expand customer base. Indeed if they had the option, PTOs

would not operate in the rural areas because of the added overhead costs. However, the digital mobile licenses (DMLs) were issued to PTOs on a condition of national and rural spread, failure of which would attract penalties. As a result, besides six northern states, cellular phone coverage has spread beyond the state capitals into at least one other town in each state (Nigerian Communications Commission, 2006). While this geographical spread brings the technology to more people, the poor interconnectivity between the networks still constrains the level of penetration into the rural areas. Each network builds and operates its own base stations and facilities are not shared with other networks. Despite these problems, it is clear that the context – more Nigerians living in the rural areas, and policy framework that deregulates while retaining much control – has led to the diffusion of this technology outside the cities.

B. **Detours in power supply:** One of the priorities of the Obasanjo Administration was the provision of stable and regular electricity supply. In March 2000, the president "replaced the NEPA management with a nine-member technical committee to run the utility with the mandate of ending power cuts by December 2001" (US Energy Information Administration, 2006). This was the first step in the achievement of this goal. The government also explored the prospects of privatizing, inviting foreign participation and encouraging other groups to get into the electricity supply market. Years of military governments impervious to the needs of the people stiffened Nigerians against expectations that the government would solve their problems. Indeed several years afterward, the government continues to seek ways of solving the electricity supply problem in the country. The electricity situation has not improved and NEPA remains "Never Expect Power Always."

Nigerians – at least those who can afford it – have since gotten used to providing alternative sources of energy supply for themselves. As a result, manufacturing and sale of generators and their parts and services, power back-ups and uninterrupted power supply (UPS) systems are among the fastest growing businesses in Lagos and some other big cities in the country.

In Nigeria's ICT business, when someone says he (infrequently she) wants to buy a computer system, what he means is a computer, printer and UPS. In all the places visited during this research, there was not a "system" that did not include a UPS on the floor under the computer desk. The average would be two and in some places – depending on what the system was being used for – there might be three UPS units, with each providing back up for the others. At cyber cafés, all the computer terminals have at least one UPS that might provide up to 20 minutes of power when the public power supply is gone.

In every office (besides government offices), there is at least one high-capacity generator, often with switches that automatically turn them on only seconds after the public power supply is gone. In many of the cyber cafés and business centers, customers are charged higher for services if a generator is providing the power. This is very common in cities that have few of the businesses, therefore leaving the customer with fewer options. But then the customer is glad that she can find a cyber café that has both connection and electricity. Oftentimes a customer is told "there is no connection." This can last for a week in an entire town especially outside the big cities. A generation of Nigerians now believes that power support is an integral part, or at least a major peripheral, of computer "systems." The detour – the interactions between context and practice – has spawned a new nature of the technologies. In other contexts, people don't automatically think of electricity when making the decision to acquire a computer.

The cellular phone and alternative sources of electricity provide detours to the obstacles of the poor telecommunications and electricity infrastructure in the country. The cell phone technology is relatively cheaper and scalable and therefore the absence of efficient

telecommunications infrastructure does not deter the ability of Nigerians to connect to the global information society. For a cell phone user, the world and all it brings is only a dial away. Similarly, many Nigerians, especially those, in big metropolitan cities have sidestepped NEPA by providing electricity for themselves. These detours build on each other and open other avenues for Nigerians to manage the challenges of reaping the benefits of ICTs. They also create spin-off businesses that interestingly depend on the constraints of the Nigerian context for their existence and success. These are the products of the interaction between context, technology and practice. The following section presents an analysis of some these issues.

IV. Local practices in a global context or Unintended consequences

Sophisticated cell phones equipped with web application protocol (WAP) grants users access to the Internet without requiring a computer, telephone, modem or electricity (though electricity is still required to charge cell phone batteries). Cell phone marketers (usually representing their offices in Europe) promote the utility of the latest generation of phones as a solution to infrastructural constraints such as access to the Internet and interconnectivity among the providers of GSM services. It is now common to find people owning four cell phones with each subscribed to the four digital mobile phone providers. (The number of providers went up to 12 at the beginning of 2007.) That way, they can easily make in-network calls without having to deal with the hassles of interconnectivity between the networks. Incidentally, when GSM providers tally up the number of subscribers the duplication and triplication of subscriptions is not accounted for. The number of people who own cell phones in Nigeria may actually be less than the statistics. And the number of those with access to the technology may actually be higher than the official numbers indicate.

Access is a concept that has become redefined in a local context, as seen through the ubiquity of business centers and cyber cafés as public access points. This redefinition presents a detour by itself. For instance, while a few of these centers use dial-up connections, most, especially in cities such as Lagos, Port Harcourt and Abuja, have wireless access to the Internet and offer e-mailing, instant chat and VOIP services, such as Skype and Yahoo! Internet Call. These places allow many people access to various forms of ICTs without owning any. But in a society where ownership is usually defined in communal terms, public access to ICTs is synonymous with personal ownership especially because of the relational dynamics that are observed in cyber cafés and business centers across the country.

First, the use of center staff to type up e-mail messages as well as perform other services for clients bypasses the need for anyone to be IT-literate or literate at all. In offices (both public and private), it is common to find workers who do nothing else but "operate e-mail" for their organizations or paying members of the public. There is "ownership" in this process because the operator becomes part of the communication as he or she (often she) types deeply personal information for the client. The client usually sits on a chair or stool and reads out the hand-written letter (or dictates if s/he came without written material) to the staff. As the staff types, the client is reading on the screen and pointing out any errors that might have occurred (if s/he is literate, otherwise accepts that whatever is typed is accurate). While this goes on, the two have a conversation about whatever the issue of the day is – or the client explains the background of the e-mail, and his or her relationship with the recipient. In this context, there is no separation between the client and staff regarding who is doing the work and who owns the access.

At one of the centers during this research, a middle-aged couple came in to send e-mail to their daughter in the United States. There was something about their comportment signifying the importance of the occasion. There was a sense of ceremony around them, starting with the

clothes they wore (all dressed up) and spoke in a hushed and reverential tone to the receptionist at the centre. They had written up the message on a lined paper, which they held as if of great value. Their inability to use the technology or lack of access from their home did not appear to pose any obstacle in their perception of the momentousness of the event. Rather, they appeared to perceive their ability to pay for the service, and more importantly, their being the parents of someone who lives in the United States and has Internet access as setting them apart from "ordinary" people on the street.

Second, the prevalence of ICT usage at cyber cafés shows an important development in the ways Nigerians engage with ICTs and emerging class cleavages. In the cyber cafés, people perceive their access to and use of these technologies as functions of either equality or entrance into a higher internally constituted socio-economic class. Given the cost of access to these technologies and the geographical locations, only the fairly wealthy and urban dwellers can use them. During the research for this paper, it was observed that this economic, social and geographical disparity may lead to new class cleavages though it is too early to know if the new class formation would break away with earlier indices of class distinctions such as education and property, reinforce them or create new ones.

Among the "e-mail operators" themselves, their knowledge of the technologies sets them above the level of those who come in to pay for their services. The relationship dynamics changes depending on the location of the cyber cafés and the class of the clientele. In one centre opposite the only university in the state, most of the clientele were university students and faculty. Their membership in the university community across the street defined the terms of the relationship between them and the staff. In some cases, this relationship was adversarial (like when the client refused to pay for services, complaining that the connection was too slow and he did not complete his transaction) or servile/domineering (when the client was a professor). In bigger cities such as Lagos where the clients were more affluent and educated, they related to centre staff with the superiority that their socio-economic class privileges them in other situations. However, the reverence shown the client by center staff was mediated by their knowledge that a "real Oga" was more likely to send out his/her personal assistant, secretary or messenger to do whatever needed to be done in a cyber café (such as e-mailing and web search) to avoid mingling with the masses. A "super real Oga" would have the facilities in his office with his personal assistant running their operations.

Conclusion

Stakeholders in Nigeria echo the global discourse on the role of ICTs in the processes of socio-economic development. At various levels they acknowledge that the context – the potholes – is likely to hinder the achievement of ICT-centered economic goals in the country. However, overwhelming optimism persists among those interviewed during this research that detours and the resourcefulness of Nigerians will lead to a successful completion of the journey to the global network society. Many insisted that the Nigerian ICT landscape would continue to expand and transform the society and economy as well as produce new nature and functions for the technologies. One principal stakeholder said in the near future all the local government areas in the country would have access to the Internet because of the number of applications for licenses to provide telecommunications services pending at the NCC. The Commission, he added, gives priority attention to providers willing to invest in the rural areas. He, like many others, are positive that the technologies will multiply with usage and spin off other applications and economic activities.

The evidence so far supports this optimism. At the same time, it is apparent that how much ICTs can achieve as agents of socioeconomic development in the country remains unclear. The "potholes" presented by the Nigerian context are a discounting mechanism. For instance,

the various measures to ease the public power supply problem have generally worked for those who can afford power generating sets and UPS. But these private solutions are obviously very temporary and geographically limiting. As indicated earlier, 60% of the Nigerian population lacks access to electricity. The use of UPS and generators presupposes an occasional presence of public power supply. Until the general power supply is stabilized, as well as expanded to the rural areas, electricity is likely to remain a key hindering factor in the development and diffusion of ICTs in Nigeria.

Great strides have been made particularly in the area of mobile telephony in the seven years since the policy on telecommunications was released. Flashing as a detour for the high call rates and the use of the cell phone for illumination at night are effective coping mechanisms that were not anticipated at the point of design and production of these technologies. However, the journey ahead is as difficult and the terrain as treacherous as that on physical roads in Nigeria.

Often, at the onset of the rainy season, public works departments fill over the potholes with gravels. At a more extensive level, government contracts are awarded for road repairs and constructions only for the contractors to compound the problems by littering the roads with mounds of laterite, gravels, sand and construction equipment which remain just long enough for the contractors to be paid their money. Further work is abandoned and the roads are left in a worse state than before. On many roads in southern Nigeria, it is common to find young jobless men digging up sand from the roadside to cover the potholes, giving a false sense of repair. It usually takes one downpour to wash out all these surface measures.

The state of the physical roads in Nigeria requires fundamental and structural solutions that can survive seasons and political leaderships. Similarly, the Nigerian axis of the information superhighway requires sustainable solutions. Detours and surface measures may serve for a season, but the ICT-for-development project is billed as a long-term one. For the country to achieve the goals articulated in both the NTP and NITP, policy makers and other stakeholders must equally focus on the development of primary infrastructure such as electricity, and creation of the enabling environment for local manufacturing of ICTs. Contextuality is as important at the point of design and production as it is at the point of usage. Locally designed and produced technologies are likely to address the unique context of usage. For instance, cell phones will have batteries with longer life since they also serve illumination purposes.

At the research level, an integrated analytical model such as applied here in the Nigerian case study can help to explain the unique evolution of technology usage in other countries, especially in the sub-Saharan African region. Further research can examine how different ICTs morph at the site of usage and what new forms and functions are created. It will also be interesting to see what potholes other African countries have and what new forms their own detours create. For instance, what is the equivalent of "flashing" in Kenya?

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INSTITUTIONALIZATION OF AN INFORMATION SYSTEM THROUGH THE EXERCISE OF POWER

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Abstract: *The institutionalisation of an information system is possible only if it is sustained and*

legitimated by organizational actors and individuals. The system reviewed in this study, the SIAFEM – Integrated System for State Financial Administration, is a large governmental system adopted by the State of Sao Paulo as an accounting and cash management system. Once implemented, it became institutionalized and, subsequently, underwent an expansion as a result of new requirements and following the intervention of powerful actors who made use of it as a control and surveillance tool, thus sustaining its expansion.
This study intends to provide a better understanding of the process through which an information system can become institutionalised and subsequently expanded as a consequence of the exercise of power. The expansion of an information system sustained by actors who use it as an instrument to increase their power is a theme underdeveloped in the literature. Therefore, this study could represent a step further in the analysis of an institutionalised system.

Keywords: Information systems, Institutionalization, Exercise of power

INSTITUTIONALIZATION OF AN INFORMATION SYSTEM THROUGH THE EXERCISE OF POWER

1. INTRODUCTION

The institutionalisation of an information system is possible only if it is sustained and legitimated by organizational actors and individuals. The system reviewed in this study, the SIAFEM – Integrated System for State Financial Administration, is a large governmental system adopted by the State of São Paulo as its accounting and cash management system. After being implemented and becoming institutionalised, it underwent an expansion due to new requirements and also the intervention of powerful actors who made use of it as a control and a surveillance tool, thus sustaining its expansion. The institutionalization and the sustained expansion of the system were based on an institutional discourse of efficiency and transparency. In the beginning, this discourse was used to implement and institutionalise the system, and later on, it was used by some actors to expand the system and develop new tools for establishment of an increased control over other actors' acts. Therefore, the system surpassed its initial envisioned use, becoming an empowering tool.

This study intends to provide a better understanding of the process through which an information system can become institutionalised and subsequently expanded as a consequence of the exercise of power by knowledgeable actors.

2. LITERATURE REVIEW

2.1. New Institutionalism

According to Scott (2001),

> Institutions consist of cognitive, normative and regulative structures and activities that provide stability and meaning to social behavior. Institutions are transported by various carriers – cultures, structures and routines – and they operate at multiple levels of jurisdiction. (p. 33). The cognitive elements include widely held beliefs and taken-for-granted assumptions that provide a framework for everyday routines. The normative elements incorporate habits and informally sanctioned social obligations including rulings of legislatures and enforcement mechanisms of the regulatory agencies.

According to DiMaggio and Powell (1991) the new institutionalism in organizational analysis emphasizes the ways in which action is structured and order is made possible by shared systems of rules that both constrain and privilege certain groups whose interests are guaranteed by prevailing rewards and sanctions. It is a theory of stability and it is concerned with "persistence rather than change and the legitimacy imperative acts as a source of inertia" (YANG, 2003). Thus, Yang (2003) points out the "neoinstitutionalism's immaturity and ambiguity in accounting for institutional change." Neoinstitutionalism has a relative inattention to institutional change and its process, which remains a "black box" (Zucker, 1983). According to Hasselbladh and Kallinikos (2000), the theoretical formulations of neoinstitutionalism are often too idealistic and broad to direct empirical research. In spite of this, the theory is still relevant to explain the institutionalization of an information system and will be adopted as a basic framework for our analysis.

The new institutionalism does not consider the individual actor, who can only participate in an action enacted by more ample entities. In an example given by Scott (1994) an individual can only vote if an election process is established. Therefore, for the new institutionalists, the behaviour of an individual has to be analysed as part of a broader phenomenon as in the cited example. Consequently, the new institutionalism gives no voice to the individual actor and considers interest groups, organizations and associations as collective actors. Social processes and changes result from actions and interactions between actors on a larger scale.

Institutional theory became particularly relevant for IT studies by contributing with a new perspective for the interaction between human beings and the technology, as well as the form by which this interaction acquires legitimacy and becomes institutionalized requiring, however, additional models to study the relationship between power and agency of individual actors.

2.2. Power and Information Systems

Jasperson et al. (2002), after analyzing the published papers related to power and information technology concluded that "power is clearly a complex phenomenon that can be viewed and best understood from multiple layers." Concerning power relations, "IT can be used to reinforce current power structures or to mold altered structures."

Silva and Backhouse (2003) integrated different conceptions of power into a theoretical framework for the study of the institutionalization of information systems. According to these authors, the exercise of power is necessary to institutionalize an information system, which, once in place, becomes itself a source of power.

According to Scott (1992), institutional research cannot be confined to the organization, but has to take into account other themes, such as power and control, stratification and inequality, the social construction of meaning and reality and also the external environment.

3. RESEARCH QUESTION

The change from the initial sponsor's exercise of power for the implementation and institutionalization of the system to the intervention of new knowledgeable and powerful actors for the system's expansion and sustenance triggers the paper's research question:

Which processes and agents can favour the expansion and sustenance of an information system?

4. METHODOLOGY

The study was conducted as an exploratory interpretive case study research. According to Walsham (1993):

> … Interpretive methods of research start from the position that our knowledge of reality, including the domain of human action, is a social construction by human actors [...]. Thus there is no objective reality which can be discovered by researchers and replicated by others.

Orlikowski and Baroudi (1991) add that interpretive studies "[…] try to understand phenomena through accessing the meanings that participants assign to them." Such studies thus seek a relativistic and shared understanding of phenomena.

According to Klein & Myers (1999), interpretive research assumed that our knowledge of reality is gained only through social constructions such as language, consciousness, shared meanings, documents, tools and other artefacts.

4.1. Data Collection

The information sources used in this study are historical documents (academic theses, books, newspapers and magazines), as well as governmental laws that imposed the implementation of the system and related organizational changes. Additionally, twenty-seven semi-structured interviews were conducted with managers responsible for the implementation, with users, the support staff and the helpdesk team. Each interview lasted at least two hours, was recorded and then transcribed. Inconsistencies or misunderstandings were discussed over the phone with the interviewees. The historical documents and the interviews were analysed using hermeneutics as a theoretical perspective.

The principles of the hermeneutic circle, described by Klein and Myers (1999), were applied to this case study in order to build an understanding of the phenomenon.

5. THE CASE STUDY

5.1. The Political and Economic Context

After years of high inflation, the Country's economic stabilization in 1994 provided the possibility for effective government planning, budgeting, financial management and control.

In this line the São Paulo State government implemented SIAFEM, a new accounting and cash management system, as part of a broader administrative and financial reform, as a response to the existing chaotic public administration situation and the lack of reliable information for decision-making.

In fact, until 1995, governmental planning and budgeting process and the State's cash flow management had been very imprecise. Prodesp, the São Paulo State data processing company, operated an outdated mainframe-based accounting system that could not provide timely management information. As a rule, departments were hampered by the lack of decision-support systems and their staff had poor computer literacy. Extremely high inflation rates in Brazil before 1994 also had made forecasts almost useless.

In 1995, the new elected Governor perceived the importance of information technology for the modernization of the State's administration. Therefore, he and requested the Secretary of Finance to set up a budget and financial control system, resulting in the option for SIAFEM, a system developed by the Federal Government for use by States and Municipalities, that had been in successful operation for two years in a medium-sized city.

5.2. The Implementation of SIAFEM

The Department of Finance's team responsible for implementing SIAFEM concluded that itwould also require significant organizational changes. The adoption of the SIAFEM throughout the State Administration was imposed by law and the Governor expected the system to be implemented in mere 45 days in 684 major governmental entities. Prodesp became responsible for acquiring and installing microcomputer and the leased phone lines that would link all Departments to a central computer system. The high cost and low quality of the telecommunications became an additional challenge to the project.

In the beginning, Prodesp had been opposed to SIAFEM, because it was not based on its preferred client-server architecture, but had to follow the Governor's decision. An

international funding agency and the State Government provided the required resources for the project.

The former accounting system had been centralized, and only accountants were familiar with its workings. The implementation of the new system changed the tasks in all financial sectors since it required the direct recording of all Departments transactions in the system. As a result, clerks had to learn both how to operate microcomputers and how to interact with SIAFEM. Additionally, they would become personally responsible for the data recorded into the system. Some officials became very dissatisfied with the new system because part of their knowledge would be inscribed into the SIAFEM processes and they would be left to carry out only unskilled routine tasks.

In some Departments, there were clerks who refused to work with the new system. Those who were near retirement age decided to retire. However, they would not have to be replaced due to the new system's level of automation.

After the implementation, the Governor's constant demands for more control led to the in-house development of a new system, called SIAFISICO (the Registry of Materials, Services and Vendors, and a Price Databank). This system contained data about prices and quantities of all goods and services acquired by the State Administration. With this system, the Department of Finance began to make statistical analyses of all prices paid by governmental agencies, inducing them to become much more careful in their acquisitions.

Once SIAFISICO had become operational, the implementation of BEC (the Electronic Procurement Exchange) became feasible. This system changed significantly the relationship between government and its suppliers. Governmental agencies frequently delayed payments to suppliers, leading these to become less interested in dealing with the government. This had reduced the number of suppliers and the level of competition. The implementation of BEC reverted this situation by increasing the number of potential suppliers and permitting the government to negotiate lower prices for goods and services in return for prompt payment. The availability of all purchase history data on SIAFISICO brought transparency to the process, allowing a better control of competition and prices paid.

SIAFEM is basically a transaction processing system, with limited management tools. Therefore, the government decided to develop a new Executive Information System (SIGEO) that would allow data mining and customized management reporting. Data recorded in SIAFEM and in SIAFISICO are regularly replicated into SIGEO and are available to all Departments over the governmental Intranet.

Integrated with the SIAFEM, the State's Department of Planning developed various other systems, used for planning, budgeting and cash flow control, historical analyses and the preparation of law proposals for budget amendments, financial and physical control of projects and contracts.

Two years after its implementation, SIAFEM could be considered stabilized and institutionalised, as the outcome of a two-staged process:

- Imposition of the system, with the de-institutionalization of old bureaucratic administrative practices and the disempowerment of officials whose power was based on those practices.

- wide-spread use of the system; its institutionalization triggering organizational and cultural changes; empowerment of knowledgeable officials through the availability of information; increased surveillance over the acts of the civil service staff, modernization of public administration and the expansion of the system, through the development of other centralized and local applications.

The dual process of the de-institutionalization of old practices and the institutionalization of SIAFEM is analyzed using the lens of the new institutionalism theory.

The process engendered organizational and cultural changes triggered by officials' cognition and awareness about information availability. For some Departments, SIAFEM was just a replacement for the old accountancy system and therefore they did not in principle oppose the new system. It had for a long time been institutionalized that government entities had to work with the State's former centralized accountancy system.

For other Departments power played a fundamental role in the process of institutionalization of the SIAFEM and its further expansion.

5.3. The Change Process

a) *Imposition of a system that would be responsible for de-institutionalizing old bureaucratic administrative practices and the disempowerment of officials whose power was based on those practices.*

SIAFEM was imposed on all Departments by a State law. Due to the short period of time between the initial decision and its effective implementation, a chaotic situation developed at all Departments of the State Administration since in some of them there were no microcomputers or network connection available. Most civil servants were computer illiterate and had to learn how to work with computers in general and with the new system specifically.

The Department of Finance set up a Help Desk Centre available to all users. In the early stages, however, according to the interviewees, it was almost impossible to get any help from them because their phone lines were always busy. Moreover, the transmission rate of the leased lines was very slow and the system was unstable, contributing to the chaotic process of implementation. Due to operational problems, several transactions had to be corrected after the system was made available. In fact, in some cases, the users had even to re-submit all their transactions.

The implementation process required cultural changes not only within the Department of Finance, but also in all other Departments. Given the generalized computer illiteracy and the change in the functions to be carried out by the staff members of the financial sectors, some of them developed a huge resistance to the use of the new system. Their very skilled work before the implementation of SIAFEM was now replaced by unskilled clerical tasks, since all their knowledge about public finances had been inscribed into SIAFEM's transactions.

In some Departments, officials began to resist the system because they felt that it would lead to their disempowerment and also to staff reduction.

According to Meyer and Rowan (1977), any organizational change has to deal with "rational myths", defined by the authors as powerful rules, understanding and significance related to social institutionalized structures. According to these authors, people believe in institutionalised myths, rules and procedures that are then capable of shaping organizational arrangements independently of the flow of resources and their technical requirements.

Some radical measures were taken in order to face the rejection process. The project manager at the Department of Finance mandated that all typewriters of its Accounting Division be donated and that paper-based documents would no longer be accepted. At some Secretaries, resisting officials or those unable to solve their local problems that occurred during the implementation process had to be replaced before the system could be adequately implemented.

SIAFEM came to replace the old and well established accountancy system, with strongly institutionalized work practices. According to Berger and Luckmann (1967),

"institutionalization occurs whenever there is a reciprocal typification of habitualised actions by types of actors… they cannot be created instantaneously. Institutions always have a history, of which they are the products." (p.72-73).

A system is institutionalized when it becomes an obligatory passage point. For SIAFEM's implementation it was necessary to reinstitutionalize the governmental accountancy system. According to Jepperson (1991), "reinstitutionalization represents an exit from one institutionalization and entry into another institutional form, organized around different principles or rules". (p. 145).

Special SIAFEM training courses were developed for the Departments' staff. The Department of Finance informed all other Departments that the new system would definitely be implemented, and without this training their staff would not be able to access their budget resources. For these servants this was a radical change in their work practices. Their knowledge would no longer be needed. In some cases it led to staff being dismissed or relocated to other sectors.

As emphasized by Barley and Tolbert (1997), "organizations and individuals who populate them, are suspended in a web of values, norms, rules, beliefs, and taken-for-granted assumptions that are at least partially of their own making". In fact, the implementation of a system that would demand a radical organizational change is supposed to deal with internal resistances. The de-establishing of old rules and practices becomes a complex task due to the taken-for-granted assumptions about the old system and/or old practices.

Almost all interviewees complained about the new system. According to one financial manager, the training program was insufficient, the system was unstable in the beginning , the leased lines very slow and the number of available computers insufficient.

Managers, whose power derived from bureaucratic practices, were particularly affected by SIAFEM, since the new system deprived them of their power. Transparency was the new discourse used by the Governor to impose the system; but people were well aware that a new tool for continuous surveillance was being implemented. The system's survival was guaranteed by coercive power characterizing the moral legitimacy that, according to Suchman (1995) "reflects a positive normative evaluation of the organization and its activities", resting on judgments about whether the activity is "the right thing to do"

In the Department of Planning there was no resistance to the new system since it was understood that once the SIAFEM became fully operational that department would play a more powerful role in governmental decisions. Therefore, its maintenance was guaranteed by pragmatic legitimacy, defined by Suchman (1995) as being provided by constituents that "support the organization, not necessarily because they believe that it provides specific favourable exchanges, but rather because they see it as being responsive to their larger interests".

Therefore, the maintenance of the system was guaranteed by coercive power and supported by powerful actors. The Governor provided support to the Department of Finance which was capable of imposing norms and furthering changes within the State's Departments. The availability of information also originated a "second wave of power", since some managers acquired power thanks to the development of their own autonomous systems, based on SIAFEM data. The development of these systems was fundamental for the consolidation of this type of power.

b) Wide-spread use and expansion of the system triggering organizational and cultural changes; empowerment of knowledgeable managers through the availability of

information; increased surveillance over the acts of civil servants and modernization of public administration

The constant demands by the Governor for more control and a constant concern with cost led the Department of Finance to implement in 1998 the systems SIAFISICO and SIGEO, after SIAFEM had been stabilized and legitimized by the governmental entities, i.e., after its institutionalization. Thanks to SIAFEM and SIAFISICO, it was possible to build BEC, the Electronic Procurement Exchange.

The Department of Planning developed various performance indexes based on SIGEO, which are used for auditing the expenses of the Departments.

The generalized legitimization of SIAFEM led the Department of Planning and other State agencies to continuously add new management and transactional applications, e.g.:

- The financial manager of the Department for Environmental Affairs began to build indices based on SIAFEM data, which helped convince his divisions to make a good use of their budget or to redistribute the remaining budget among other divisions as a way of better managing their available budget.

- Another application at the Department for Environmental Affairs uses data gathered from SIAFEM, SIAFISICO and SIGEO to create indicators, which keep track of expenses (prices and quantities) incurred by the Department.

- The financial officer of the Department of Health uses data available from the SIGEO to manage the departmental budget. An application was developed to build historical series of hospitals expenses, to monitor these expenses and detect anomalies. He has no power over the directors of the hospitals but by putting the available data to good use the financial officer was empowered and became an essential actor within the structure of the Department.

The financial officer of the Department of Public Security had always been a powerful actor, even before SIAFEM. In his Department, the system became an administrative surveillance tool, used to control staff and decentralized purchases (price histories and comparisons).

In general, the Secretary of Finance now wields increased power over the Departments by auditing more effectively their expenses.

Each one of the systems developed by the Department of Planning and by the Department of Finance increases the surveillance over public expenses. The Departments are also frequently audited by: the Department of Planning, the Department of Finance and the State Audit Court. The discourse used by the Governor was "transparency" but the system unveiled the power differences among several Departments. In fact, the increased knowledge about the expenses of the Departments turned the Secretary of Planning into a powerful actor. Knowledgeable actors continuously refine their control over other servants' acts based on institutional discourses perpetuating the empowerment cycle. However, this control refinement and empowerment based on the expansion of the system was only possible after the system's institutionalisation. Some Departments were capable of building systems based on SIAFEM and SIGEO and can now count on good management tools. Others complained that SIGEO is extremely complex and that they need special training to make use of it and had to ask the Department of Planning whenever they needed a special report. This fact confirms the stated by Kallinikos (2006) that information combinability is conditioned by a variety of social factors that can shape the work patterns within which information processes are developed.

In some Departments servants interested in using SIGEO, could not use it because their managers did not want to acquire new SIGEO licenses in order to retain control over information, perceived by them as a basis of power.

Cultural change in the Departments required more time than adoption of the system. The information available through the SIAFEM took a long time to be used, although many servants working with budget control quickly saw the new possibilities of the new system. Departments' managers, however, took longer to recognize them.

From a cognitive perspective, Scott (2001) emphasizes that "institutions are not so much a bundle of regulations or collections of norms, but knowledge systems" where "people don't discover reality; they create it".

Some Departments were capable of making good use of resources and developed systems to automate their work, thus collaborating with the expansion of the SIAFEM. In spite of the initial resistance offered by some public servants, it is now widely acknowledged that they cannot live without SIAFEM. Analyzing the differences in knowledge triggered by the system it is possible to confirm Scott's (1994) statement: "institutionalization is primarily a cognitive process that gives rise to distinctive conceptions of social reality."

After SIAFEM had been in use for some time, old practices were progressively de-institutionalized while the new system became institutionalized and acquired legitimacy. As stated by Avgerou (2000):

> …Through institutionalization, an innovation is adopted and maintained because of its acquired legitimacy, irrespective of whether or not it produces its promised technical value, and without having to rely continuously on powerful personalities.

The institutionalization of SIAFEM can be classified as "acquiescence" according to Oliver's conceptualization (Oliver, 1991) since acquiescence may include habit, imitation or compliance.

> Habit refers to unconscious or blind adherence to preconscious or taken-for-granted rules or values…organizations reproduce actions and practices of the institutional environment that have become historically repeated, customary, conventional, or taken-for-granted (OLIVER, 1991).

After this legitimization, the expansion of the system continued to be sustained by interested powerful actors (specially the Secretary of Finance, the Secretary of Planning and the Governor) and it enabled these actors to develop new systems. Some Departments, especially Health and Environmental Affairs, were empowered by using SIGEO and SIAFEM for refining their analyses. In contrast, some other powerful actors use the system more as an instrument of surveillance to audit the expenses of their Departments. Knowledge was the base of power for them. Through the combination and use of the available data, these actors were capable of structuring their actions in order to become powerful through the knowledge derived from the information available.

According to DiMaggio (1991), institutionalization is a process through which organizational actors, when making their rational decisions, build around themselves an environment that limits their future ability to implement change. Additionally, as stated by the same author, organizational structures and practices are maintained by the active efforts of those who benefit from the change.

Once a system is institutionalized, it becomes ingrained in the practices and roles of individuals, and tends to be sustained and perpetuated by them. From then on, other alternative systems become unthinkable, and institutional inertia is created. Berger and Luckmann (1967) explain the process of institutionalization based on peoples' perceptions about facts and practices: "individuals in their interaction with human beings build cognitive systems. However, as time passes by, these cognitive systems are taken as external and objective structures that enable and define their social reality."

The officers who had introduced SIAFEM left Government in 2001, after an organizational change in the Department of Finance that dismantled the sector responsible for the innovations. Even the training programs were discontinued. The system survived this crisis, proving that it had become institutionalized. As stated by Avgerou (2000), "a system can be considered institutionalized when its existence is not depending anymore of powerful actors".

The Department of Planning is still improving control and modernizing services. There is a good integration of this Department with the Department of Finance and they are working together to modernize the administration of the system.

At present, there is no provision for technological changes in the SIAFEM. It is a user-unfriendly system with a mainframe-based interface. In the future, any upgrade trying to integrate this system with other governmental systems will become a difficult task.

6. CONCLUSIONS

SIAFEM has enabled an organizational change in all Departments and expansions of the system. These expansions, however, did not occur in all Departments. This fact can be attributed to the lack of vision of some Departments that interpreted the system only as an operational tool and did not visualize the importance of the information gathering tools provided by the system.

Power has played a fundamental role for SIAFEM's legitimization and its institutionalization. Initially, coercive power was used to impose the system. Later on, it was expanded and sustained by powerful actors that made use of institutional discourses to develop new systems and impose them for refining their control and surveillance over Secretaries and servants' acts. Therefore, the institutionalization of the system was promoted by the exercise of power by the Governor. However, its further expansion was also based on the exercise of power, but by other individual agents capable of imposing new rules based on institutional discourses. These knowledgeable agents played a fundamental role in the expansion and sustenance of the system, since they used the governmental discourse to develop their systems and enhance their power over other actors' or agencies.

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THE IMPLEMENTATION OF INSTITUTIONAL ICT POLICY THROUGH THE EXPERIENCE OF MAKERERE UNIVERSITY

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Abstract: The paper provides an insight to the managers of tertiary educational institutions from developing countries on the importance and the effects of an institutional Information Communication Technology Policy and its significance for national development. The experience that has actually transformed Makerere University in Uganda into a model university in the Sub-Saharan Africa illustrates the overall benefits of well thought and implemented ICT policy. The focus in the paper is on the process of policy formulation, prioritization of objectives, solicitation of funds, as well as issues and challenges faced during implementation of one principal goal termed as "information access".

Keywords: ICT, policy, portals, Sub-Saharan Africa, development, information access, tertiary educational institutions

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THE IMPLEMENTATION OF INSTITUTIONAL ICT POLICY THROUGH THE EXPERIENCE OF MAKERERE UNIVERSITY

1. INTRODUCTION

Makerere University, formally referred to as the "Harvard of Africa" during the sixties in the XXth century, plunged into obscurity due to the political turmoil in Uganda, which devastated majority of the national sectors during the nineteen seventies to early eighties (Kvalvaag, 2003). The potential of the University was also affected by the change in the national education policy to fund the Universal Primary Education (UPE), which decreased the funds that the government allocated to the higher education (Musisi, N. B., and Nansozi K. M, 2001).

However, the growth in primary and secondary enrolment generated much higher demand for tertiary education forcing the University to increase its admissions on limited government and donor resources. To cope with the new challenges, the University had to adopt a new admission policy which enabled qualifying private sponsored students achieve university education. This was a departure from the old polices when the enrollment was limited to the recipients of the government scholarships only. The new admission policy has proved to be one of the turning in the recent history of the University, which appears to be on a reform journey in order to regain the part of the former glory and create new opportunities for the future.

The significant surge in the students' population has been in part behind the decline in quality of the academic and administrative delivery of services (such as the overwhelming of the traditional manual systems (Musisi, N. B., and Nansozi K. M, 2001)). In order to stop the downward trend and anticipate future developments, one of strategic decisions on the road to recovery has been to integrate Information Communication Technology (ICT) in all academic and administrative functions so that it can enhance innovations in areas of curriculum development, knowledge and management services within local, regional and global domains.

The authors have been in the forefront of the ICT policy development and implementation since its inception in Makerere University. Therefore, paper reflects the experiences of how a clear ICT policy with grassroots acceptance brings benefits that go beyond institutions and organizations that adopt it.

Section two presents the policy formulation and prioritization process, and the methodology. In section three we discuss status, issues and challenges of implementing information access policy statements. The conclusion and the summary of lessons learned are in the last section.

2. ICT POLICY FORMULATION

2.1. Background

In March 2000, the University published a five year strategic plan (Makerere University, 2000a) that highlighted how Information Technology (IT) was being adopted for teaching and research in a few scattered departments. It acknowledged departments like the Library, Forestry, Institute of Social Research, etc. which had establish computer laboratories, though uncoordinated to give a great service to the university community. It further noted with regret the private hosting of the university web page which also lacked information quality control mechanisms and timely updates.

The overall goal of the strategic plan was to establish an effective and sustainable information network system that would support the academic and administrative functions such as admissions, registration, delivery of instructions and examining, management of academic

records, human resource, financial records, easy and timely access to local and international scholarly literature and information dissemination, among others. It further noted the need of establishing an administrative unit to spearhead the development and unifying the fragmented ICT initiatives in different departments.

By all means the strategic framework was so ambitious to implement without gaining a proper consensus within the university community. Consequently, key individuals were nominated to lead the civic education process. The process generated self-binding information democratically, from which the University ICT policy was developed. The term "self-binding" is used in the sense that the university community democratically developed the rules to govern them in the ICT implementation process. These later became a rule of thumb for streamlining ICT management from fragmented units to a well coordinated centralized system. However, as a set of new rules, in some cases they conflicted with a few individuals' interests surprisingly those who formulated them. In the sprit of institutional development, these individuals had to forego their egos. We regard this process of involving the masses in formulating the ICT policy guidelines, and letting a few administrators at the top of the pillar to implement it as a bottom-up approach.

The lesson learned from this approach is that, it makes policy implementation easily acceptable to the community hence quicker realization of institutional ICT goals.

2.2. Chronological Development Processes

Starting from the late 1990s the university has had several development partners supported initiatives. One of these was a collaborative research programme between Makerere University and Swedish Universities with funding from the department for Research Co-operation within the Swedish International Development Agency (Sida/SAREC). Sida/SAREC agreed to co-fund a workshop with the university (Makerere University, 2000b) that would map the way forward in ICT integration. This workshop is regarded as "a milestone" in all the later developments of ICTs in Makerere University. It recommended and resolved; a) the development of ICT Policy (ICTP) and ICT Master Plan (ICTMP) as the first step forall ICT activities, b) an immediate establishment of a university-wide support unit charged with the responsibility of planning, management and maintenance of ICT services, and c) adoption of an approach model based on Geers' presentation[1] in the workshop as the way-forward, hereby outlined in brief:

- Make available institutional data
- Document priority areas for the application of ICT
- Document existing technical Infrastructure
- Document existing ICT expertise and resources
- Identify areas to be supported by Swedish International Development Agency (Sida)
- Formulate global ICT services development plan
- Draft ICT Policy Document and ICT master plan
- Formulate approval and acceptance of the report by the Makerere University
- Formulate Sida proposal
- Formulate approval and acceptance of the report by the of Sida

It was noted in the workshop that ICTP and ICTMP were a priority, and that the university had no capacity to develop them, neither was there an academic institution in Uganda that had integrated ICT in her functions. Therefore it was necessary to engage external consultancy services to expedite the process of realizing the ICTP and ICTMP. Consequentially, the

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[1] Connecting Makerere University into the Global Information Infrastructure, 2000

university developed a project proposal whose main objective was to solicit for funding towards the development of an ICTP and ICTMP. The proposal was funded by Sida.

2.2.1 Methodology: ICTP and ICTMP development

The project proposal recommended a methodology of engaging an ICT consortium rather than an individual firm or a consultant. The ICT consortium had to consist of higher education and research institutions with proven experience of comprehensive ICT projects implementation and recommendable working relations with Sida. It also included an approach for delivering services and the role for each member of the consortium.

The successful ICT consortium comprised of a) The Delft University of Technology, Netherlands b) The University of Dar-es-Salaam, Tanzania and c) The University of Uppsala, Sweden (Makerere University, 2000c).

Concurrent with the development of ICTP and ICTMP, the university set-up an ICT initiative task force to gather institutional data. The Sida Quick Scan Survey (QSS) tools where used for data collection. The QSS comprised of four main parts;

a)   General Institutional data (General Information – Address and location, Organizational structure: management, administration and service support, Organizational structure: Education and research, Physical accommodation)

b)   Priority areas for development

c)   Inventory of existing ICT infrastructure

d)   Inventory of existing ICT expertise in the University

The QSS benefits were numerous. It was the first time in the record of the university to achieve comprehensive and accurate data of her assets. The data collected was used to finalize the development of ICTP and ICTMP and also became a basis for subsequent university planning.

2.2.2 Broad components of ICTP and ICTMP

The ICTP and ICTMP were finalized and submitted by end of September 2000. The ICTP contained policy statements on ICT services and information systems that were of strategic importance to the University. They were elaborative with concise descriptions of the essential functional requirements and indicating their relationship with other systems and services (Makerere University, 2001). The broad categories covered in the ICTP were:

- Common data services and office automation policy
- Information systems policy:
- Library information systems
- Academic records information system
- Financial information systems
- Human resource information systems
- End user skills development policy
- End user skills development policy
- Data communication infrastructure policy
- ICT management policy.

The ICTMP gave a detailed functional description of the most essential resources and implementation strategies.

2.3. ICT Policy Implementation

This paper only discusses the implementation process of information access policy statement executed by the library information systems under the broad category of information systems policy of the ICTP. We use a two-fold approach discussion of the implementation: Policy translation into actions and actions' implementation.

2.3.1 Policy translation into actions

Policy statements have to be translated into actions that can be implemented within the institutional framework. The objectives of such actions must meet the aims and goals of the institutions. The actions are implemented in form of projects. Therefore it is necessary that an ICTP and ICTMP must be elaborative but with concise descriptions of the essential functional requirements such that the generated project proposals are well focused and bounded. Also such descriptions streamline project development and implementation phases towards the fulfillment of the institution's objectives.

The development of the ICT and ICTMP clearly indicated the University's areas of priority. In addition to Sida/SAREC support, it became clear to other willing development partners to identify areas of development in the university's ICT initiative. The university advised departments to develop project proposals geared towards the implementation of the ICTP in the framework of ICTMP.

The library wrote a project proposal to implement the information access policy statement. The overall project goal was to make significant contributions towards the equitable improvement of the academic and research standards, with specific objectives of:

- Improve access to electronic information resources.
- Enhance Research and publications.
- Upgrade staff skills and competencies in ICT through training
- Strengthen ICT network infrastructure and end user training
- Improve security of library holding.

2.3.2 Actions implementation

Considering the priority ranking of the information access policy statement in the ICTP and ICTMP and support from the university central administration, the library's proposal was present to different development partners soliciting for funding. It attracted recommendable financial support from Sida/SAREC and other university development partners as indicated in table 1 below. With that funding, a Local Area Network (LAN) with 171 data points was installed at the main library, an integrated library application system was procured and installed, and subscription of 8,000 electronic journals was paid for a period 3 years. The library became a hub of electronic resources in the whole nation. Noting the difficulties of information access within the nation, Sida/SAREC further gave additional subscription that enabled all institutions of higher learning and research centers in Uganda to access the electronic journals through the Makerere university gateway. Further, Sida/SAREC funded capacity-build of the library staff.

The Carnegie Corporation of New York funding to the library was geared towards the establishment of an Electronic Document Delivery Service (EDDS), aiming at increasing the book stock in scientific subject areas, gender studies and suitable materials for the blind and visually impaired university students and staff. It also supported the purchase of two book-check security systems that minimized the loss of books through outright thefts in the satellite libraries. The establishment of EDDS supplemented the electronic journal services to totally outcome the shortage of information access mainly for researchers.

What's more the Library project was also a beneficiary of the Norwegian Agency for Development Cooperation (NORAD) funding to the university administration towards strengthening administrative computing. The library obtained 36 computers, training of three members of staff in specialized fields of library ICT, and a contribution to the expansion of the LAN in the main library.

The impressive success in the implementation of the information access ICT policy statement earned the library an opportunity to participate in the Association of African Universities' (AAU) theses index database pilot project with 10 other African Universities. The project was funded by Ford and Rockfeller Foundations aiming at the creation of an index database for African Theses and Dissertations. The library contributed more than 2,000 records in the database of Makerere University theses and dissertations.

#	Major Development Partner	Area of Development	Funding Level (US$ Million)	Duration
1.	ADB	Basic ICT infrastructure	0.11	Ended 2001
2.	Sida/SAREC	Core ICT Infrastructure, ILS Enrichment of information resources (Local and International) ICT Capacity building	0.94 1.10	2001–2005 2005–2009
3.	NORAD	Administrative component of the system Specialized training	0.20	2001–2005
4.	Carnegie of NY	EDDS Book restocking for science, gender subjects and suitable materials for the blind and visually impaired Book security equipment Capacity building	0.65 0.40	2001–2004 2004–2007

Table 1: Summary of development partner contributions towards information access policy development (yr 2000-2009)2

3. INFORMATION ACCESS: STATUS AND CHALLENGES

3.1. Status

The University Library and Directorate for ICT support (DICTS) with support from the University and development partners have worked together in implementing the information access policy. Though met with challenges highlighted later, there are several achievements discussed herein in the framework of the access policy objectives stipulated in section 2.3.1.

3.1.1 Access to electronic information resources

The increase in university connectivity and demand to access electronic information has forced the university to subscribe for more bandwidth. Table 2 and graph 1 show the bandwidth increase trends of the since 2000.

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[2] Source: Data analyzed from different project reports

Mugasha, J. (2004)

Musoke, M.G.N. (2005)

Makerere University Library Services, (2004)

Makerere University Library Services, (2005)

Year	Bandwidth (Mbps)	Service Provider	Use
2000	0.192	MTN	Internet/email for a few dial up clients mainly University management
2001	0.768	MTN	Internet/email for a few networked computers on the University
2002/ 03	2.3	MTN & UTL	Access to 3,000 online journals, 1,300 networked computers, research and general use, etc
2004	3.84	MTN & UTL	Access to 5,000 online journals, 2,000 networked computers, inter-university collaborations, research and general use, etc
2005	21	MTN & UTL	Access to 8,000 online journals, 3,000 networked computers, E-learning courses, inter-university collaborations, research and general use, etc
2006	24	MTN, UTL & AVU	Access to 8,000 online journals, 3,000 networked computers, E-learning courses, inter-university collaborations, research and general use, etc

Table 2: Summary of the increase in bandwidth subscriptions over the period 2000-2006[3]
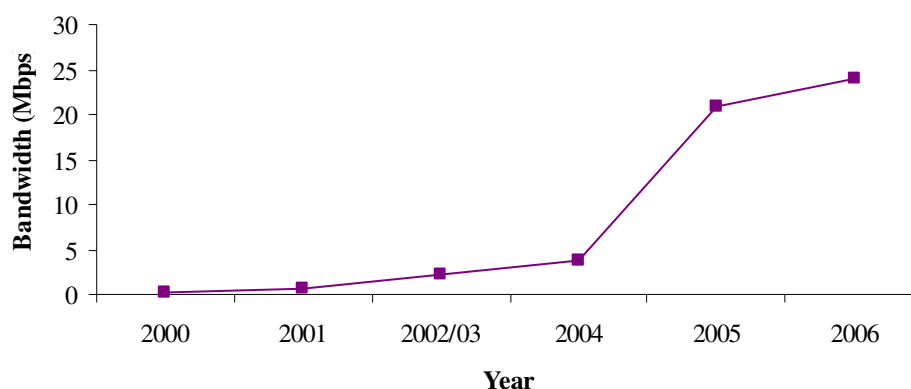
Graph 1: Bandwidth Subscription Increases

Despite the high level of subscription to bandwidth, the capacity is not yet satisfactory. This capacity as illustrated by graph 2 below of one of the service providers whose gateway is dedicated to specific portal access. To encourage academic utilization, the systems have been configured with filters that deny access to certain traffic and schedule others during off-peak hours.

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[3] Compiled from various internal reports
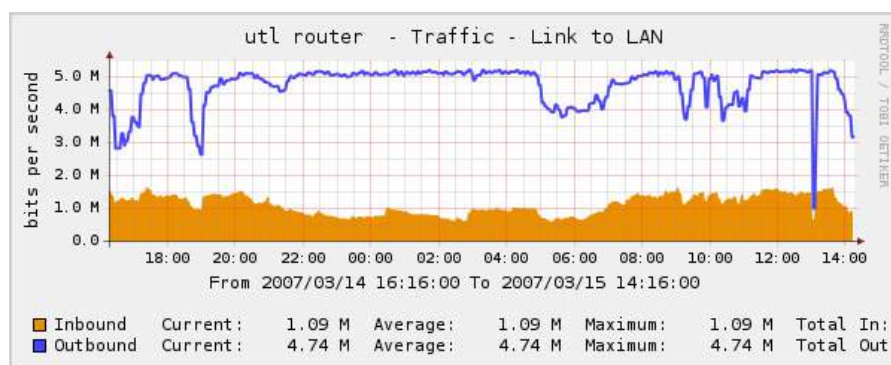
Graph 2: A five days typical bandwidth utilization graph – showing maximum utilization especially during the day (traffic is mainly out bound & the assumption is that users are accessing academic relevant resources)

Several university units have developed web portals for information dissemination and data collection. In addition the private sector can easily access this information and make their contributions by advising the university in realizing industry tailored programmes for the envisaged workforce. This has led to the development of professional short and long term courses in fields of computing, engineering, environmental and business management. The availability of portals has further enhanced distance and adult learning. More so the portals provide information to prospective foreign students interested in attending the university.

Worth noting too is that the use of and access to email has tremendously increased to more than 20,000 out of a total approximated population of 30,000 students and 3000 staff.

3.1.2 Enhance Research and Publications

Prior to the development of the ICTP, academics and researchers in Makerere University and Uganda in general lacked access to current literature due to inability of the concerned institutions to pay for periodical subscriptions. This seriously affected the research output of the country. In collaboration with International Network for the Availability of Scientific Publications (INASP) and funding from Sida/SAREC, eight electronic journal databases were subscribed to consisting of over 8,000 journal titles at a heavily discounted rate. The availability of such resources has uplifted the entire national research performance. The University provides a gateway to these resources for both on and off campus users. In addition, Sida/SAREC funds a country wide research project in Uganda whose theme is "Lake Victoria and other water resources" where a number of collaborating institutions in Uganda and Sweden are actively involved. These researchers use the Makerere University gateway to access the electronic resources in conducting their research. The user statistics for respective years are indicated in graph 3.
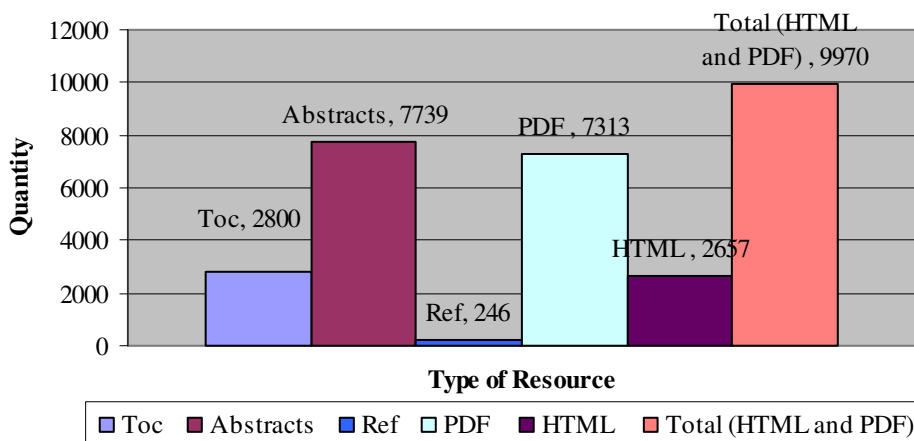
Graph 3: E-resources Access (Jan - June 2006)

As an intervention to ICT literacy in the public and insufficient Internet bandwidth; in collaboration with Lund University Makerere has set up an Electronic Library Information Navigator (ELIN) that harmonizes the interfaces of different databases into a single interface. This simplifies and helps users perform effective searches through a single interface. ELIN performs recursive searches in all the subscribed databases and schedules download at a later time especially in the night when bandwidth is sufficient to download the item. The user statistics for year 2006 are indicated in graph 4[4] below.
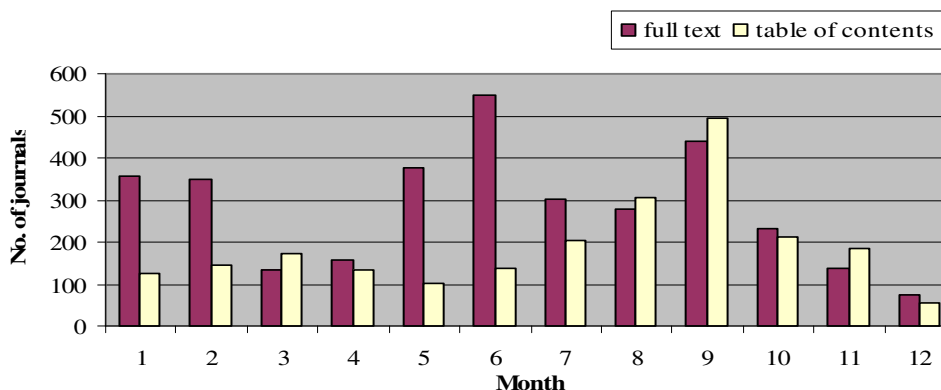
Graph 4: Elin Usage in 2006

Through the library and the school of graduate school, there have been several efforts to ensure that the university intellectual output in terms of scientific publications is collected and electronically published. A pilot project is under-way in which the library is collecting scientific research and publishing it into an online repository hosted at the University and accessible both locally and internationally.

The demand for access to electronic resources has also led to the extension of the university backbone to the present 16kms of gigabit fiber backbone that includes off-site campuses. In addition to the information portals, the University also boasts of the existence of improved local area networks in the faculties and schools, all these intended to facilitate the access to information.

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[4] Data from system access log

3.2. Explaining Improve Catchment

The university enrollment has increased from 6,000 to 30,000 students over a period of less than ten years. This could be attributed to so many things but our premise is that this is highly attributed to the availability and resultant implementation of the information access policy. From graph below we see the increase in the private student admissions. From this graph we notice that the increase in the private students' admission on average rose up about 85% of the total admission for the period 2000 to 2005 in which the use of ICTs was introduced compared to the 45% increase in the years before the University embraced ICTs.

It is important to note though that the increase in private students' admission may not be entirely explained by the introduction of ICTs and championing of the information access policy. We however reiterate that these developments have highly contributed to the increase in admissions. Though the introduction of ICTs was intended to curb the increased numbers when the University introduced the private students scheme (Tusubira, 2005), it has also facilitated the increased admission through providing information easily accessible both locally. This is for instance evident from graph 6 which demonstrates the trend in increased foreign students' admissions.
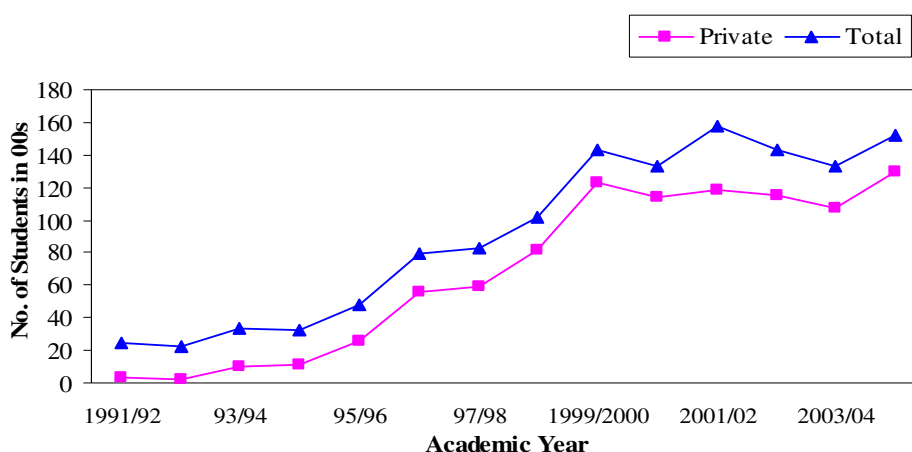
Graph 5: University Students Admissions (1991 - 2005)
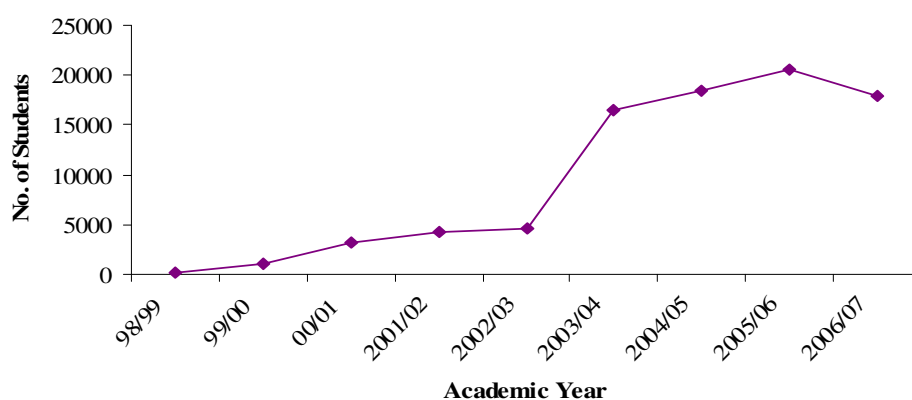
Graph 6: Foreign Students Admissions (1998 - 2006)

3.3. Challenges and Lessons Learned

Despite the registered success, the implementation of the information access policy statement is still faced with some challenges including sustainability, staff retention, and access to online resources, uplifting of user ICT literacy and localization of the content. We further

share experience on how the University is addressing some of the challenges faced in this implementation process.

Operational and financial sustainability were highlighted in the ICT policy and master plan as vital for the continued availability and relevance of ICTs to the University functions. Given that this has mainly been a development partner supported implementation process, a lot of unforeseen running costs have arisen. The greatest financial challenge to date has been the cost of bandwidth. The expansion of the infrastructure and increase in electronic resources has resulted in the full consumption of the available bandwidth as illustrated in graph 2 above. This not only frustrates but it poses extra social costs (MacKie-Mason J.K and Varian H.R, 1993) to users. Other related challenges include maintenance, spare parts, software renewal and electronic journal subscriptions.

Basic ICT skills are vital in a university community specifically in as far as searching for and finding relevant information is concerned. The university has found it necessary to regularly train information consumers and producers, which appears to be yet another source of recurrent costs.

To address especially the financial sustainability issues, the ICT policy and master plan proposed the payment of a technology fee by each student which was approved by University management but has not yet been implemented. However to ensure sustainability a few measures have been taken, for instance the university has spearheaded the use of open source software where applicable to avoid recurring software license renewal costs.

Publications of the research findings have not been localized to benefit the public, which makes them relevant to the research community only. There is need for the university to localize the content for all cross section of people it serves.

The creation of academic information portals without localization of the content has not been enough in empower both the university and the public to befit from the knowledge generated by academics/from research finds. The University is supposed to localize the content for all cross section of people it serves. This is still one of the most out standing challenges.

Like any other organization, the University has to compete with the private sector which normally offers better pay for ICT expertise. The university attempts to address this challenge through the employment of students who are always eager to explore thus greatly contributing to offering innovative solutions to the University's ICT needs.

The passed a policy of introducing a basic ICT course to every university entrant to foster ICT literacy to every graduate. Also computer based training was introduced for every university staff, to upgrade their ICT skills.

In addressing the bandwidth insufficiency challenge, several measures have been taken such as filtering traffic, scheduling non-academic downloads in the off-peak hours, and ELIN systems that give researchers a one-stop search point and scheduling of the unavailable downloads. The university has joined a consortium of other African universities under the African Virtual University (AVU) umbrella in which bandwidth is provided at a subsidized rate, a project funded by a partnership of foundations including Ford, Carnegie, Rockefeller and McArthur.

4. CONCLUSIONS

Makerere University took a strategic position to introduce, develop, foster and propagate the use of ICT, first as an instrument to recover its unique position within Uganda and the region, and second as a generator of ICT know-how for the benefit of the whole society. Indeed, through ICT the University has reaffirmed its role of pioneering and innovative institution to lead the country in the Digital Age.

This has been attained through well-thought and comprehensive ICT policy, grassroots support that involved all of the stakeholders, and a set of strategies that facilitated the implementation process despite numerous challenges. The approach has also enabled the University to attract partners for development.

It is evident from the Makerere experience that profound and lasting changes based on ICT across all of the sectors need clear and forceful strategic decisions, and a political will translated into concrete actions that produce wide range of benefits from the automatization of trivial and purely administrative university functions up to high-end research venues and environments. These undertakings may very well prove to be among the crucial factors for the development and the progress of both Makerere and Uganda.

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THE NATURE OF THE EMERGING C2C ELECTRONIC MARKET IN CHINA: A CASE STUDY FROM SOCIAL NETWORK THEORY AND CRM PERSPECTIVES

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Abstract: China's C2C electronic market has been growing very rapidly. Eachnet, which had been the largest Chinese online auction company, after merging with eBay, quickly lost its market share to a newly-launched Chinese company, Taobao. What is the nature of the market? What strategy is the most suitable to the current Chinese market and likely to lead to success? Based on the CRM process model, we conduct a case study to find out answers. By comparing eBay and Taobao in the customer relationship initiation stage and termination stage, we find out that the C2C market in China is a young and experience-seeking marketplace whose customers are willing to try new services and new vendors. By comparing eBay and Taobao in the customer relationship maintenance stage, we find out that the market is a social environment where customers' loyalty to a vendor can be built more easily by vendor's social relation management service than by transaction service. These findings suggest that vendors in China's C2C market should provide functional service to acquire customers as well as develop social marketing strategy to retain customer's loyalty. The social marketing design should be tailored to Chinese culture.

THE NATURE OF THE EMERGING C2C ELECTRONIC MARKET IN CHINA: A CASE STUDY FROM SOCIAL NETWORK THEORY AND CRM PERSPECTIVES

1. INTRODUCTION

In the past five years, China's C2C electronic market has been growing rapidly. The number of online consumers reached 22.5 million in 2005, which was eight times larger than what it had been in 2001. The total transaction volume in China C2C electronic market rose from 0.4 billion RMB in 2001 to 13.7 billion RMB in 2005 (iResearch, 2006).

China's C2C online auction market was created by Eachnet. Launched in September, 1999, Eachnet (http://www.eachnet.com) quickly attracted more than 870,000 registered users and became the most popular auction site in China. By merging with Eachnet in 2003, eBay launched its C2C business in China. Taobao.com was a Chinese C2C vendor, founded by Alibaba.com Corporation in 2003. By 2006, eBay had invested 2.2 billion RMB in Chinese businesses, while Alibaba had invested 0.45 billion RMB in Taobao.com and announces plans to invest another billion.

While the growing market attracts large volumes of capital, the market competition is intense. To compete with eBay, Taobao used free-service strategy to enter the market when it launched its C2C business and decided to keep transactions free of charge until 2008. As a defense, eBay (China) significantly lowered its fees. As a result, no vendor had announced positive financial returns in 2006.

After heavy price competition, vendors now pay more attention to customer service. It is a common belief that the large loyal customer base will be vendors' core competence in China's future C2C business. To win and retain customers, vendors applied distinctive customer relation management (CRM) strategies, and got different outcomes. Based on 71396 valid questionnaires, iResearch (2006) indicates that, in 2005, Taobao's transaction volume reached 58.6% of the total C2C market transaction volume, compared to 36.4% for eBay. The two companies account for more than 95% of all transactions in China. However, in 2003, Taobao's market share was only 7.8% while eBay's was 72.4% (iResearch, 2006). The ratio of Taobao's market share to eBay's rose from approximately 1:10 to 2:1 in only 2 years. The most worthwhile questions are: What is the nature of this market? How could Eachnet, after being purchased by eBay, have lost so much market share to Taobao? What strategy can help to win customers in Chinese C2C market? The on-going competition and actions in the emerging market provide plentiful research materials to explore the fast-developing electronic marketplace, particularly emerging C2C businesses in China.

This paper will contribute insightful sights to understand China's flourishing e-business market. Firstly, we introduce a research framework to explain vendors' CRM-related marketing strategies. Then we use the framework to compare and analyze Taobao and eBay's actions. Finally we discuss how the outcomes reflect the characteristics of the emerging market, and predict the direction in which the market will develop. Since the sum of Taobao's and eBay' transaction volume accounts for 95% of China's entire C2C market, the observation of the two companies can provide a good overview of the market.

2. THEORETICAL FRAMEWORK

Customer Relationship Management (CRM) theory contends that the optimal long-term tactic for firms is to build and manage strong relationships and to develop loyalty with target

customers through creations of dual value (Boulding, Staelin, Ehret, & Johnston, 2005; Payne, 2005). The concept was formulated by Levitt (1960), who argued that firms stay in business by meeting a need, not by selling a product. Berry (1983) elaborated in this concept, shifting the emphasis from the actual exchange process to the relationship between the company and the customers. In practice, CRM has helped firms to serve their customers better and obtain core competence in the market (Boulding et al., 2005). CRM processes are longitudinal phenomena, and can be decomposed into three stages: initiation, maintenance, and termination (Reinartz, Krafft, & Hoyer, 2004). A CRM process model and strategy framework is proposed as Figure 1 shows.
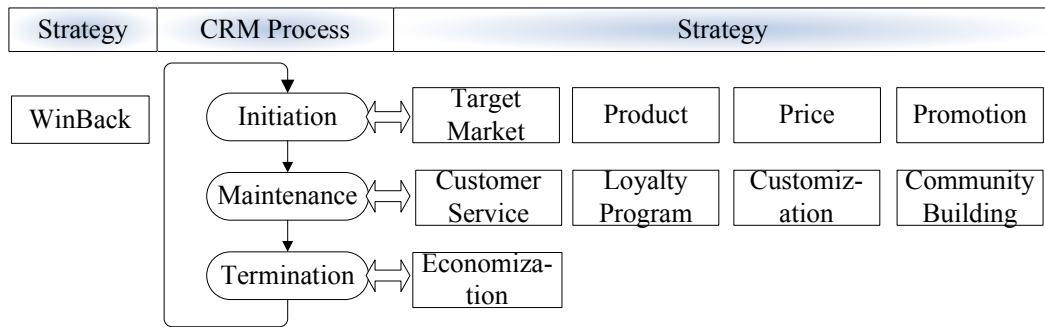
Figure 1. CRM Process Model and Strategy Framework

The objective of the initiation stage is to acquire and regain customers (Reinartz et al., 2004). The objective of the maintenance stage is to retain customers by maintaining good relationships with them (Reinartz et al., 2004), thus delivering a higher level of customer satisfaction than competitors do (Winer, 2001). The objective of the termination stage is to economize on unprofitable or marginally profitable customers (Reinartz et al., 2004). On the premise of the three-stage CRM process model, the study compares the strategies of Taobao and eBay and uses empirical data to verify the outcomes of their respective strategies.

3. METHODOLOGY

This study employs case study method and qualitative data analysis following Robert K. Yin (2003). Since the issue of the C2C electronic market in China concerns 'how' and 'why' questions within some real-life context, case study method is well suited.

Data collection lasted from January to August 2006. The data collected in this study consist of documentation, interviews and direct observations. We use not only third-party search engines, such as Google.com, but also search engines provided by Taobao and eBay to collect documentation. For the first round, we used 16 Chinese keywords: "Taobao," "eBay each," "Ma Yun," "Sun Tongyu," "Wu Shixiong," "C2C market share," "C2C price," "C2C promotion," "C2C advertisement," "preferring eBay," "preferring Taobao," "C2C community," "C2C customer loyalty," "C2C customization," "C2C buyers," and "C2C sellers." For the second round, we combined several of these keywords to narrow down the search scope and obtain more accurate evidence. 310 useful web pages have been found, including news, magazine articles and third-party research reports. We also used video records on TV-shows and interview records. Since Taobao and eBay are doing business online, we recorded companies' web content and traced their changes by direct longitudinal observations. Two researchers independently analyzed the web content and recorded websites' design style, interfaces, functions, and business processes. Then, they described what they observed and what the observations meant. Finally, they formed up a unified understanding of companies' CRM operations and strategies and summarized evidence into tables for further analysis.

The data analysis consists of two phases. Firstly, publicly available documentation, transcripts of interviews and observation results were used to draw a whole picture of the electronic market and to depict a detailed narrative history of the two vendors in China, condensing the large volume of data into more within-case evidence. We created a chronological event listing which can provide insight into "what led to what, and when" (Miles & Huberman, 1984). In these processes, we created what Yin (2003) calls a "chain of evidence" that allows others to "follow the derivation of any evidence from initial research questions to ultimate case study conclusions." Such an approach increased the reliability of the entire study.

Secondly, a variation on qualitative pattern matching between theory and data was conducted (Campbell, 1975; Yin, 2003). Documentation and direct observations that appeared to have influenced outcomes were compared and contrasted with the three-stage CRM process model. Interview records were cross-checked to verify that each outcome was supported by at least two sources of evidence. Then the sequence of evidence was mapped according to the theoretical framework.

4. THE CASE

4.1. Initiation

Before appealing customers to a company' e-business platform, the company should firstly select its target markets, then apply marketing strategy to get target customers.

4.1.1. Select target customers

In 2005, eBay segmented its Chinese market of 17 million users and identified its mainstream customers as well-educated, familiar with the Internet, earning a monthly income in excess of 3,000 RMB, and between 20 and 40 years old. As Wu Shixiong, CEO of eBay, says, "These mainstream buyers and sellers are very important to eBay" (ChinaBusiness, 2006c). eBay encourages mainstream customers to join global C2C transactions.

In 2003, Taobao took four months to analyze China's C2C market and decided to target everyone from 20 to 30 years old. As Sun Tongyu, CEO of Taobao, says, "the majority of potential customers are those who live outside developed cities" (Sohu.com, 2005). In 2005, Taobao added older people to its target customer base.

It is clear that eBay and Taobao have tried to focus on different segments of the market. Although both target the young generation, eBay's target customers are professionals, while Taobao's target is more locally-based and broad.

4.1.2. Acquire customers

To get target customers, both Taobao and eBay provide online transaction services as their major products, and use marketing strategies such as pricing and promotion to convert prospects into first-time customers and to win back dissatisfied customers (Kotler, 1994). Table 1 compares acts between eBay and Taobao in the initiation stage.

Aspect	eBay	Taobao
Product/Service	. Professional style · Canceled user payment account verification after September 2004 · No security active control · 2000 RMB Loss payable · 2006, importing Skype · No offline store · 2006, mobile shopping platform	· Vibrant style · User can verify his bank account to get higher credit · Free online anti-virus/hacking service · Full loss payable . 2003, providing an online messager · 2006, setting up offline store · No mobile business
Price	. Started charging in 2001	· Free service in the first 3 years

	· Lowing down charges from 2004 to 2006 · Only list fee now	· Announcing another 3 years for free-of- charge in 2005 · No charges now
Promotion	. Advertised on mainstream websites and CCTV · The first one to promote in charity events · Direct mail marketing for sellers	. Advertised on small websites and newspapers · The first one to promote in entertainments · Setting up seller's alliance

Table 1. Comparison in the initiation stage

During the product/service development, the two companies provide nearly the same products or services, e.g. user ID verification, credit assessment system, guideline, search engine and store assistance tools. However, eBay highlights its professional, standardized and internationalized products to meet mainstream customers' demands, while Taobao develops localized, practical and vibrant products to meet local customers' demands. For example, the website interface of eBay is text-rich, mostly consisting of rectangles, against a green and blue background, so that eBay looks reliable and trustworthy; while the website interface of Taobao is picture-rich, mostly consisting of smooth rectangles against an orange background, so that Taobao looks friendly. Moreover, eBay encourages customers to do global online trading, at which Taobao is not good. As Wu Shixiong says, "eBay will be known as online Wal-Mart" (ChinaBusiness, 2006c; Talentsmag.com, 2006). However, Taobao encourages customers to make product design and service suggestions, which acts are not advocated by eBay. As Taobao states, "the will of Taobao people determines Taobao's development" (Taobao.com, 2003). In addition, when Taobao discovered that most local customers are willing to negotiate with sellers before purchasing, it developed an online messager which was 2 years ahead of eBay's Skype. Taobao's online payment system was also launched 1 year ahead of eBay's version to promote an online trust and payment system.

During the pricing process, the two companies adopted different strategies before, but now they are almost the same. eBay used service charges to guarantee high service quality, while Taobao insisted that the market in China is not mature enough to accept service charges. Shao Yibo, the CEO of Eachnet before eBay merged with it, said, "Service charge is a filter of the market." (ChinaByte, 2004). As a result, in 2001 eBay began to charge customers a transaction service fee, product list fee and promotion fee. When Taobao went online in 2003, it promised free online transactions for the first three years. As Sun Tongyu says, "Now, it is more important to nurture the market than to charge customers service fee." Taobao is "waiting for a more suitable timing to charge service fees" (ChinaBusiness, 2005). From 2004, facing price competition from Taobao, eBay kept reducing its product list fee, product promotion fee and store fee. It also canceled transaction fees, which were the foundation of online business service charges. eBay conceded that "a lot of market surveys indicate that the Chinese buyers and sellers are indeed sensitive to charge programs and pricing policy" (EBAY EMPLOYEE 1 Anonym). Meanwhile, Taobao decided to continue its free-of-charge service until 2008. In 2006, Taobao temporarily charged a key-word promotion service, allowing sellers to buy a recommendation position in product search result. Thousands of sellers and buyers immediately protested this new service. Taobao polled Taobao users on the new policy. 61% of 200,000 thousand voters objected to the new program and it stopped at once.

During the promotion tactics, two companies used to be different, now have few discrepancies. eBay's promotion strategy is to use mainstream media. For example, eBay paid over 2 million RMB to advertised for just 5 seconds on several national channels during Spring Festival Evening, the largest celebration in China. eBay asserts that online promotion is the most

direct and effective tool to recruit new members (EBAY EMPLOYEE 2 Anonym), and chose portal websites, such as Sina.com, to promote its service. eBay also underlines the significant profit made via mail promotion (EBAY EMPLOYEE 2 Anonym). On the other hand, Taobao's promotion strategy relies on small websites and traditional media. One major reason is that at the end of 2003, eBay signed one-year exclusive advertisement contracts with almost every portal website in China to force out other C2C vendors. As a result, Taobao had to advertise only on small and personal websites until June 2005. However, the result was beyond all expectations, as Sun Tongyu said (Sina.com, 2006a). What is unique is that Taobao is the first C2C vendor to employ product placement marketing in movies.

4.1.3. Outcomes

The different customer targets cause eBay and Taobao to apply different strategies to acquire customers. eBay focus on modern and professional mainstream customers who are supposed to be willing to pay a premium for high-quality service. It is said that eBay has more professional sellers and more earnest buyers than Taobao has. (EBAY USER1 Anonym, EBAY USER2 Anonym, EBAY USER3 Anonym). On the other hand, Taobao is determined to attract all young customers in China, especially those in developing regions. A seller recalls that the market on Taobao was so hot that his first transaction was finished immediately after he logged the product into Taobao's system (TAOBAO USER1 Anonym). Taobao's online communication tool and payment system make transactions dramatically easier (TAOBAO USER2 Anonym, TAOBAO USER3 Anonym, TAOBAO USER4 Anonym). The ratio of products selling on Taobao to those on eBay is 24:1 (TAOBAO EMPLOYEE 1 Anonym).

CNNIC(2006) revealed that buyers on eBay are most satisfied with "the search engine," "the stable systems," "the diversity of merchandises" and "the payment protection tools," while buyers on Taobao are most satisfied with "the payment protection tools," "the immediate communications tools," "the diversity of merchandises" and "the interfaces". The result is consistent with users' feedback.

This summary leads to the following observation:

User-friendly and vibrant interface design, informal promotion channel and price promotion attract more potential users to experience e-business, while concise and serious interface design, formal information channel, and powerful functional service appeal to professional users. However, the largest portion of current C2C markets users is experience-seeking.

4.2. Maintenance

4.2.1. Relationship Maintenance Programs

A comprehensive set of relationship programs consists of customer service, loyalty programs, customization, and community building (Winer, 2001). Table 2 compares acts between eBay and Taobao in the initiation stage.

Aspect	eBay	Taobao
Customer Service	. All kinds of reactive services · Few proactive services	· All kinds of reactive services · Many proactive services
Loyalty Program	. Coupon and club · No member card	· Coupon and club · Member card
Customization	. Direct mailing marketing · Not inviting users to design eBay · Price can not be changed after the deal is made · Forbidding price negotiation and customization	· No direct mailing marketing · Inviting users to design Taobao · Price can be changed after the deal is made · Allowing price negotiation and customization

	. 15 subject channels	. 35 subject channels
Community	. Frequent community activities, usually sponsored by eBay official organizations	. Frequent community activities, usually initiated by members spontaneously
	· Less postings, e.g. up to 2006.8.8, in 'My store at eBay' channel, altogether 7 postings	· Much more postings, e.g. up to 2006.8.8, in 'My store at Taobao' channel, altogether 90147 postings
	· No local user meeting	· holding local user meeting annually

Table 2. Comparison in the initiation stage

Customer service, which refers to any contact or "touch points" between a customer and a firm, can be reactive or proactive (Winer, 2001). eBay's and Taobao both set up customer service center. Taobao's proactive service is better than eBay's. Top management executives in Taobao, including Ma, Yun and Sun, Tongyu, chat with customers through forums and online messages. As Sun Tongyu says, "Our customer service cannot be duplicated easily by competitors" (BusinessWatch, 2006).

Loyalty programs reward customers for repeat purchasing. eBay offers buyers coupons and discounts, and encourages sellers to organize their own super-seller clubs (Winer, 2001). Besides coupons and clubs, Taobao give buyers member cards by which accumulated transaction volume is recorded, so that customer can upgrade their level of membership and enjoy higher discounts.

Customization turns customers from product/service takers into product/service makers (Winer, 2001). eBay provides professional customized management tool to sellers, such as customized mail promotion. According to an eBay executive, "We can segment customers accurately by their purchase behavior and online profiles, and provide targeted email promotion service" (EBAY EMPLOYEE 2 Anonym). Most customization services provided by eBay are for sellers. Taobao doesn't have such mail promotion, but it often invites customers to design its website and service function. As Sun Tongyu says, "Our Taobao is customized for Chinese users" (Alibaba.com, 2005). Taobao allows sellers to adjust price after negotiation with buyers. In contrast, eBay forbids such behaviors. What's more, Taobao also allows sellers to negotiate with buyers before making a deal or before paying through the vendor's payment platform. Such price negotiation and customization is strictly forbidden at eBay. Differences also exist between eBay's discount system and Taobao's: sellers on Taobao can design coupons for every transaction, while on eBay, the coupon is only issued by eBay officials.

Community building programs create a network of customers that exchanges product-related information and creates relationships between the customers and the company or brand (Winer, 2001). eBay actively organizes and sponsors online and offline community activities. The members of the eBay community are more willing to share information than emotional experiences. Taobao also underlines the importance of community building, because, as Sun Tongyu explains, "when running business, Chinese people care about not only how much they could earn, but also how they feel" (XinhuaNet, 2005). Taobao provides a more powerful community and encourages customers to share their knowledge, personal stories and feelings. Most of the activities in the Taobao community are initiated and organized by the members themselves.

4.2.2. Outcomes

eBay provides global customer service systems, discounts, and sponsored community activities. Some users think that eBay members are more reliable than Taobao members (EBAY USER4 Anonym, EBAY USER5 Anonym, and EBAY USER6 Anonym). However,

some sellers argue that eBay's ban on negotiation between sellers and buyers is too rigid and that "Taobao does better in this field" (EBAY USER7 Anonym, EBAY USER8 Anonym). Some customers think that eBay's community lacks interaction and "warm feelings," while Taobao's community is more active. (EBAY USER9 Anonym, EBAY USER10 Anonym, and EBAY USER11 Anonym).

Taobao provides a more localized service, such as flexible discount systems, negotiation policy and emotional sharing in communities. The discount system and negotiation policy at Taobao is a typical localized design that suits the purchase habits of local consumers. Since the negotiation can be carried out via telephone, online messager, and postings, the service helps customers increase contact and product knowledge before transaction. Furthermore, many users believe that they are esteemed by others because their articles receive a lot of replies, even from Taobao's top management team. "[Taobao] brings me a sense of host for the first time and encouraging me to involve more, I really feel that I am a member of the community" (TAOBAO USER5 Anonym, TAOBAO USER6 Anonym, and TAOBAO USER7 Anonym) and that members treat each other honestly (TAOBAO USER8 Anonym).

CNNIC (2006) found that "community" ranked as the third most unsatisfying service provided by eBay. In contrast, the "community" did not rank as unsatisfying service on Taobao. 22.5% of eBay respondents were frequent buyers while the comparable percentage at Taobao was 55.4% (the "frequent" is defined as more than 12 purchases in 2005). More than a third of respondents (38.2%) reported that they planned to increase their shopping at eBay, while the number is about two thirds (62.9%) at Taobao. When asked about business plan, 63.2% of eBay respondents intended expanding business on eBay while 75.7% of Taobao respondents did on Taobao.

From this summary, we arrive at the following observation：

Customer involvement in online community helps vendors retain customers. The Internet is a new way for the top management team to get in touch with customers, which is an efficient way to increase customers' loyalty.

4.3. Termination

eBay is confident in the growth of global electronic commerce. Wu Shixiong predicts that the China's C2C e-business market will have a more than 60% annual growth for the next three years and consumer's annual spending online will exceed 30 billion US dollars (ChinaBusiness, 2006b).

Recently, Ma Yun announced that the number of registered members on Taobao has exceeded 22 million, the number of online products has exceeded 30 million, and the highest daily spending on Taobao has exceeded 47 million RMB (ChinaBusiness, 2006a). Ma Yun says that Taobao will focus on helping customers, particularly those aged between 23 and 28 (Sina.com, 2006b), to realize profit and will keep "retaining customers, including those from competitors" (Xu, 2004).

This summary leads to the following observation：

China's C2C market is a young and attractive market with a potentially huge customer base. The market is far from mature at present. With the rapid addition of new customers, vendors' focus is now on acquiring and retaining customers.

5. DISCUSSION AND CONCLUSION

The paper uses a case study method to explore the emerging C2C market in China. We collected case materials from multiple sources and adopted a three-stage CRM theoretical model as an analytical framework. Following the framework, detailed comparisons between

the largest two vendors are conducted, with case evidence mapped according to the theoretical framework. Finally, important observations about the market are drawn.

Firstly, the C2C market in China is a price-sensitive, experience-seeking young market.

The fast development of eBay and Taobao clearly reveals a large potential customer base. Since C2C is still new to most Chinese users, customers are more willing to test any emerging services before committing to them. By comparing the customer relation initiation strategies used by eBay and Taobao, it is clear that Taobao's free service with localized design provides more chances for customers to experience the new business and, therefore, is significantly more appealing to Chinese customers. The market is far from mature.

Furthermore, potential customers are open to new vendors. One important background issue is that, when Taobao launched in 2003, the market was not aware of Taobao' affiliation with Alibaba. Ma Yun kept the affiliation confidential until Taobao achieved great success in acquiring customers (Yang, 2005b) (also stated by Ma Yun on several TV shows). Even Taobao's initial marketing advertisements were blocked by eBay's exclusive contract and Taobao was forced to use small websites as promotion channel, more than 100,000 customers were still attracted by the new vendor and quickly gravitated to its service (Sina.com, 2006a). Given this background, it is clear that customers did not come to Taobao for its reputation. From Taobao's quick success, it is clear that Chinese customers are willing to experience new service. Although eBay is a global reputable vendor and had mastered C2C for quite a long time before Taobao entered, it didn't prevent customers from switching to new vendors. The finding may encourage vendors to think more about marketing strategy when developing a new business service. Experience, not reputation or history, has a greater chance to predict a future success.

Secondly, the market is socially-oriented. Social relation plays a crucial role in online transactions in China.

Taobao's customer service strategies, like allowing online communication and price negotiations among users, and providing a more emotion-oriented virtual community, are more embraced by Chinese customers. A survey has found that these strategies affect customers' purchase decision and increase their will to engage in transactions on Taobao (CNNIC, 2006).

When Eachnet started its C2C business in 1999, it sponsored many activities to boost the market (Yuan and Shen, 2000). However, after merging with eBay, its practice became less competitive in comparison to the Chinese style of Taobao. After Taobao, two more famous vendors entered the market, all supported by big and well-funded companies. In September 2005, Dangdang.com, the leading online retailing vendor in China, and QQ.com, the largest Internet community service vendor in China, both announced to launch C2C business. They follow Taobao's free-service strategy. However, Taobao's customers do not switch to new vendors as many as eBay's customers switched to Taobao before. On the contrary, Taobao's market share keeps growing. Given the same price competition, Taobao's efficient social relationship management service, which is well-tailored to China's culture, may provide a reasonable answer. In the social market, customers can stay with a vendor more easily when the vendor has a social relation management service, not a transaction service.

Why does the localization approach encourage transactions? Factors from social network theory and institution theory are part of the answer. In the social literature, the Chinese network is formed as some concentric circles (Fei, 1948). Chinese people experience themselves as situated at the center of this network. The extent of intimacy with another is reflected by the relative position of that other person within the concentric circles of one's psychological field (Hwang, 2000). Moreover, "the Chinese people tend to adopt multiple

standards of behavior for interacting with different persons around them" (Hwang, 1987). Kinship and interactions will influence people's position in this hierarchical social network (Yang, 2005a). For two strangers, the more social communications, like chatting, occur, the more intimate they will be. The close relation will cultivate trust between them. As Sun Tongyu says, "Chinese businessmen are used to building relation with partners through meeting, chatting, or having dinner together before making a deal. The tradition is inherent" (Sun, 2005). Tools for immediate communication, provided by C2C vendors can quickly establish such relations between two online strangers. After chatting or negotiating, they are no longer strangers. This kind of relation helps build trust between buyers and sellers, and culminates in transactions. Executives of C2C vendors can establish similar relationships with users by using the online communications technology to converse with them. This kind of chatting will reinforce the users' trust in the executives, and in turn to trust the C2C vendor.

Furthermore, "open" networks, with weak ties and social connections are more likely to offer access to a wider range of information and opportunities than "closed" networks (Granovetter, 1973). These "open" networks provide ways for users to gather information. Since Taobao's vibrant virtual community enables customers to collect information about product and improve trust, customers are more willing to make transactions on Taobao.

From an institutional perspective, in an environment characterized by uncertainty, distorted information and a weak legal framework, information passed through social networks may be the richest, the most trustworthy, and the most useful (Borgatti & Cross, 2003; Luo, 2003). In light of the newness and immaturity of the market, the institutional environment of Taobao is different from that of eBay. The enforcement of contracts is less sophisticated, and markets for information are imperfect, especially in mainland China (Millington, Eberhardt, & Wilkinson, 2006). In such an environment, an electronic social network, supported by online messagers and virtual communities, can substitute for legal institutions and formal information sources in purchasing products, structuring relationships, and enforcing norms of behavior (Millington et al., 2006, Peng & Luo, 2000). The institutional theory may also help illuminate the distinct outcomes of eBay and Taobao's customer maintenance services.

These analyses lead to a new finding on China's C2C e-business market. It is a socially-oriented marketplace in which social relationships play a key role. Managing the social relation is the most important customer service. Vendors should take care to use the social property of the market and recognize its importance in influencing purchasing intentions. The strategies and outcomes of eBay and Taobao are worthwhile examples of China's evolving e-business market.

Finally, involvement in the community is a significant factor of loyalty building in China's C2C. The more involved the customers are in the community, the more loyal they are to the C2C vender.

The result can be also explained by social network theory. A social network can be an affective or an information one (Krackhardt, 1992). In an affective network, people share their feelings with others. This sharing offers them affective support and satisfaction. The social network also cultivates trust and social relationship among players. This kind of trust, reference trust, can be transferred to vendors (Sumeet, Kim, & Zheng, 2006). Therefore, if customers' involvement in the community is high, they will feel more loyal to the community, be reluctant to leave this network, and have greater purchase intent on vendors' websites (Sumeet et al., 2006).

Taking as its premise a three-phase CRM process model, the study has explored the distinctive characteristics of the Chinese electronic market. The phased framework also

provides insightful suggestions on strategies that can help to win customers in the emerging market. In light of price-sensitivity and experience-seeking, a free-service strategy, in conjunction with a trustworthy payment function, localized service, and social marketing promotion work well for vendors hoping to enter the market. Chinese customers are receptive to and curious about trying out new services and new vendors. Brand may not take priority over customers' will to experience new services in the situation.

However, customers' loyalty is accumulated while experiencing C2C services. As other new vendors offer free-service to knock on the door of the market, how can vendors retain customers? When Taobao is compared to eBay, the most obvious difference is their social marketing design. Taobao's social marketing approaches incorporate social community building, top management involvement, emotional-oriented activities, and a customized transaction negotiation system. The CRM strategies fit China's culture well and, therefore, are readily accepted by customers. The set of strategies provides meaningful suggestions on second-stage CRM and how to win the loyalty of customers in China. Vendors in China's C2C market should not only provide functional service to recruit customers, but also foster the development of social marketing to retain customer loyalty. The social marketing design should be tailored to Chinese culture and social interaction behavior. The emerging electronic market in China is an extension of real society, where social factors are still in play.

The ultimate objective for C2C vendors to foster a huge loyal-customer base is to become profitable. Since transaction service in China's electronic market is provided for free, it is still challenging for C2C vendors to generate profits. Following social relation development logic, maybe vendors can charge on new services. With social relation reinforced, customers' trust can be better transferred to the C2C vendor. After customers have fostered trust and loyalty with a specific C2C vendor, customers may commit more to support vendor's newly charged service and not switch to other vendors for the sake of security and trust.

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APPENDIX: INTERVIEWEES' CODING

Code	Position
EBAY EMPLOYEE 1 Anonym	eBay Public Relation Division President
EBAY EMPLOYEE 2 Anonym	eBay Marketing Division Vice President
EBAY USER1 Anonym	eBay supper seller
EBAY USER2 Anonym	eBay normal user
EBAY USER3 Anonym	eBay normal user
EBAY USER4 Anonym	eBay normal user
EBAY USER5 Anonym	eBay normal user
EBAY USER6 Anonym	eBay normal user
EBAY USER7 Anonym	eBay normal user
EBAY USER8 Anonym	eBay normal user
EBAY USER9 Anonym	eBay normal user
EBAY USER10 Anonym	eBay normal user
EBAY USER11 Anonym	eBay normal user
TAOBAO EMPLOYEE 1 Anonym	Taobao Public Relation Division President
TAOBAO USER1 Anonym	Taobao normal user
TAOBAO USER2 Anonym	Taobao normal user
TAOBAO USER3 Anonym	Taobao normal user
TAOBAO USER4 Anonym	Taobao supper seller
TAOBAO USER5 Anonym	Taobao normal user
TAOBAO USER6 Anonym	Taobao normal user
TAOBAO USER7 Anonym	Taobao normal user
TAOBAO USER8 Anonym	Taobao normal user

THE ARCHITECTURE OF GLOBAL ICT PROGRAMMES: A CASE STUDY OF E-GOVERNANCE IN JORDAN

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Abstract: Global ICT Programmes introduce new and universal modes of organising centered on innovation and technology initiatives and implemented through a novel mix of policy instruments, international institutions, business interests and techno/managerial concepts. In eGovernment initiatives, for instance, which include portals and other mechanisms to provide a single point of access for a set of services and interactive applications, Global ICT Programmes bring together the government, the private sector and a plethora of international institutions situated across various boundaries, territories and organizational domains. Jordan is an interesting case study of such an attempted transformation in government and public/private relationships. However, Global ICT Programmes are not neutral. Rather, they constitute the scene of new political conflicts over the regulation, appropriation, access and management of sensitive information and knowledge resources as well as critical infrastructure. We conclude that casting these issues as Global ICT Programmes could cater for a much broader inter-disciplinary significance and outline a programme to address the issues involved in the creation of the large scale information infrastructures and organisational designs implied by such projects.

Keywords: e-government, organisation, governance, large scale information infrastructures, development, Jordan

THE ARCHITECTURE OF GLOBAL ICT PROGRAMMES: A CASE STUDY OF E-GOVERNANCE IN JORDAN

1. INTRODUCTION

The paper introduces Global ICT Programmes, defined as new and universal modes of organising centered on innovation and technology initiatives and implemented through a novel mix of policy instruments, international institutions, business interests and techno/managerial concepts[1]. Thus, global ICT programmes are large scale informatisation programmes involving various dimensions, including the interconnection and reengineering of government and non-government institutions, in turn constituting a *new* architecture of governance seen in relation to:

- the creation of new, networked and distributed modes of organising mediated by technology and operating in the area of government, policy making, regulation and infrastructure development;
- the application of a 'toolbox' of policy instruments and guidelines to build such systems and identified with the general goal of promoting better (or good) governance;
- the presence of an expanded 'set' of institutional actors and/or characteristics operating across various contexts and domains, not least beyond conventional state boundaries.

This is an area largely unexplored in studies of innovation, technology, governance and organisation, but such programmes are interesting, not least because of their projected ability to promote social and economic development and achieve new mechanisms of governance. The case study of e-governance in Jordan presented here is of interest because of Jordan's advanced programs for the creation of an information society, including the launch of a world class software industry and the networking of the country. Jordan is also one of the rare countries in the Middle East with a history of commitment to good governance and ICT related initiatives and for its projected desire to implement and deploy powerful coordination technologies in its state and public administration. It is also a state where two of the most acute tensions of the present day Middle East converge: Palestine and Iraq. This research thus offers a unique perspective on the bringing into being of a new global architecture, which is redefining the nature of the state and driving its glocalisation[2].

The case of e-governance in Jordan studied here is indicative of such transformations, and portrays well the issues involved in the re-adjustment of the functions of government and its transition towards a 'networked state' as advocated by the Monterrey Consensus (UN 2003). At Monterrey, International Development Agencies (IDAs), governments, civil society members and non-government organisations agreed on a set of aid policies guidelines and development priorities, stressing the importance of good governance for achieving

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[1] Although it is single authored this paper is heavily based on my PhD thesis, which benefited from the wise steering, encouragement and ongoing support of my supervisor: Tony Cornford, to whom I am immensely grateful.

[2] The term 'glocalisation' is used in this paper to account for the supra-national significance of global ICT programmes, which are constituted by networks from the international down to the national, the regional, the urban and the local where 'the network's globality can function as a political support and resource for the localities that constitute that network' (Sassen , 2006: 339).

development, and this is concisely the primary statement of the contemporary global development agenda.

One of the key understandings reached by the consultations of the Monterrey Consensus was that poor governance is among the most important causes of state failure and underdevelopment. As a result e-government policy initiatives have gained international validity for the donor community as a catalyst of such reforms (Force 2001; DFID 2002; UNDP 2003; OECD 2003a). Hence innovations and reforms in the governmental and bureaucratic apparatus are seen as an important prerequisite for development (Ciborra & Navarra, 2005).

Various policy blueprints produced since the Monterrey Consensus argue that ICT is essential to increase transparency and accountability of government agencies, reduce transaction costs in service delivery and enhance participation of citizens, businesses and civil society in the workings of governments. Better accountability and improved transparency are the identified characteristics of good governance, and the latter becomes the *conditio sine qua non* for the rich states and international agencies to supply aid to developing states (UN 2001; UNDP 2001; UN 2002; UNDP 2002; UNDPEPA 2002; UN 2003; UNDP 2003; UNESA 2003; UNPAN 2004; UN 2005).

The Monterrey Consensus implies also the development of the organizational, managerial and technological capacities of less developed countries and introduces a new model of development finance and policy, as started by the creation of the Millennium Challenge Account in 2002[3]. The literature available about the social impact of such global programmes in the developing world is still in its origins and there are few comprehensive studies available on this subject (Mansell and Wehn 1998; Walsham 2000; Avgerou 2002; Braa, Monteiro et al. 2004; Sassen 2004; Sassen 2006).

The research questions motivating this paper therefore are: what are the assumptions upon which the evaluation of the recent trends of ICT for development (or e-development) initiatives should be based? What lessons can be learned from the experience of Jordan? And what are the alternatives for the conceptualization of analytical frameworks and policy direction for future related initiatives? The first section provides a literature review and a preliminary assessment of the cumulative body of knowledge in the area of e-governance and development. We then outline the methodology used for this research and present the case study. Discussion and conclusions follow.

2. LITERATURE REVIEW

Most countries, and in particular those with ambitions for development, see an imperative in the rapid diffusion and consolidation of ICT, a process that depends on a number of factors including establishing basic infrastructure, investment in research and development by the public and private sectors, sustaining centres of academic excellence, building local industrial and organisational capacity, and then intertwining each element to create dynamic and self-sustaining 'systems of innovation' (Nelson 1993). Such aspirations bring together a variety of diverse social and economic actors, including the governments of developed and less developed nations, powerful multinational corporations, international development agencies as well as transnational social movements (Held and McGrew, 1999).

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[3] This has proposed the largest increase in foreign assistance since the 1960s starting from 1.6 billion US$ for 2004, ramping up to US$ 5 billion by 2006 (Dobriansky 2003).

In such a context, the development objectives suggested by international organizations become the arena of great political struggles for the advancement of social well being and modernisation in the developing world. Since the Monterrey Consensus, development finance institutions are incentivising and supervising specific programs of government and government technologies across the developing world (Force 2001; DFID 2002; UNDP 2003). Similarly, the United Nations (UN) Millennium Development Goals and the good governance initiative of the Organisation for Economic Cooperation and Development (OECD) have set ambitious policy targets to deepen democracy, promote human development and economic growth among LDCs and both consider ICT as a facilitator for the achievement of these goals. These institutions not only stress the need to promote human development by increasing the level of education, reducing poverty and corruption and deepening democracy, but also embrace a political agenda which aims to restructure the role and functions of the state based on the minimal, service-delivery concepts inspired by the New Public Management approach.

In this spirit, a number of influential reports have been written by multi- and bilateral donor and international standard setting organisations, on the underlying rationale, effects and potential of ICT, information society and e-government initiatives to promote development and reform. These generally promote the *global* dimension of such programmes. For example, according to the First Annual Report of the Information and Communication Technologies Task Force of the United Nations: "while domestic policies are needed to harness ICT for development effectively, *international policies* forged in multilateral institutions will increasingly define the range of policy options available to developing countries" (UN 2003) [emphasis added]. Accordingly, "E-government initiatives should be measured by the degree to which they contribute to good governance" (UN 2002).

This rhetoric, which expresses global programmes, can be seen as recognition that policy and resource allocation processes need to be opened beyond the closed circles of elites at the state level. One aim is to devolve meaningful authority to local bodies, making them more accessible to citizens and to improve service provision, while channelling citizens' and civil society's voices and increasing the accountability of their representatives. Good governance, in this sense, involves the creation of effective institutions to smooth the operations of the market and allow free relationships of exchange to prosper.

This emergent architecture aims to decompose and distribute through networks what was previously monolithic or host-centric organisational designs for information and services provision (Foster, Kesselman et al. 2004). Examining such structures and assemblages is difficult without appreciating the role played by global networks, which is what gives texture to the innovative elements of global ICT programmes. We argue that the glocalisation of such flows of information, knowledge, people and resources involves various scales of interaction: local, regional and global.

As it was pointed out in the introduction, due to glocal character of global ICT programmes, the nation of Jordan taken alone represents a limited analytical category through which to understand the nature of the links between the various networks of actors involved in the deployment of global ICT programmes. Rather we need a network based understanding to encompass the nature of glocal institutional interactions. This requires us to move beyond the construct of the nation state as the main object of investigation and to analyse its networking with a set of commingled interests operating between the local and the global, what we can describe as networks, where the forces described above are reshaping its economic, demographic and cultural activities.

Following from this we argue that most of the contemporary research accounts in this area do not dwell on the challenges and difficulties of creating the synergy and dynamics needed for developing states to cope with the processes of political transition implied by global ICT programmes. It is thus possible to appreciate a movement towards, or at least many make a claim for, the introduction of programmes that shift from *government* as a characteristic of the unitary state, to *governance* by and through networks of institutions and individuals that extend well beyond any geographical boundary and act in partnerships held together by relations of trust (Bevir and Rhodes 2004). In this way, e-government can be considered in terms of government's definition and re-definition of traditional forms of authority, deciding which services should be provided electronically and how but also involving the re-structuring of the relations defining the modes of provision of government's goods or services. The shift to the term 'governance' thus signifies that deep changes are taking place, and e-governance leads to "a changed condition of recorded rule, a new process of governing, or a new method by which society is governed" (Rhodes 2000).

Global ICT programmes, understood in these terms, are implicated in processes of transforming relationships previously politically negotiated within the state and bureaucracy into transnational public-private networks. This may involve, for example, the marketisation of various functions of the state and a move towards a new regime based on contractual agreements, outsourcing of government services and a more overt role for the private sector (not just in terms of models or best practices) for service delivery. However, it cannot be said that such moves are without friction. For instance, attempts at developing such powerful and encompassing frameworks of governance face a fragile political balance in most of the developing world today. This result in part from the territorial fragmentation which global ICT programmes seek to coordinate and manage, not just in terms of tasks, processes and activities, but also for the difficult decision as to which values and ideology should drive these efforts.

3. RESEARCH DESIGN AND ANALYSIS

The field work for this case study was conducted between 2002 and 2005. The first research trip in Jordan was carried out between June and July 2002. Primary sources of data came from interviews with key people responsible for major ongoing projects. A brief covering letter stating the intentions and objectives of the research project was sent to the Chief Information Officer of the MoICT to obtain access to study the e-government policy initiatives. During the first visit, the people interviewed were selected so as to encounter a diverse set of actors working in different institutions. The interviewees (about 20 on that occasion) included professionals and officials working in the government, the private sector, external consultants, non-governmental and both local and foreign donor organisations. The frequency of the meetings and interviewing activity was high. Moreover, a few conferences and unplanned meetings happened *in loco* during the stay and provided opportunities for more interactive information gathering.

Additional documentation, such as organisational policies and procedures, media and journal articles and information retrieved from the Internet, was also used as supplementary material. The use of multiple-data collection methods allowed for a more thorough examination of the perspective of each individual and to reflect it to the wider processes that the meetings with other relevant individuals were developing for the researchers' to understand the overall institutional setting of the observation. This enabled the researcher to become deeply knowledgeable about each institution, thus allowing new insights about the topic to emerge.

During the interviews, open-ended questions were asked aimed at gathering an understanding of visions, strategies, models and methods being used; expected and actual organisational impacts; the influence of cultural factors in adopting standard solutions; and the major risks and challenges facing e-government initiatives and specific projects. Various other qualitative materials were collected to describe both the vision and the plans of e-government in Jordan and to gather elements of the current state of implementation. Documentation used for this research includes the final report of 'Launching E-government in Jordan' from the Ministry of Information and Communication Technology (MoICT), the draft of "A Strategic Framework for 'e-learning'" from the Minister of Education, the 'Master Plan 2002' from the Ministry of Industry and Trade, the presentation slides of the 'Donor/Lender informal meeting with the Minister of Industry and Trade', and the 'Work Plan 2002 for Implementing Jordan's Information and Communication Technology Strategies' from the MoICT.

Following the first trip, the process of data collection was ongoing and unstructured via the means of voice and electronic communication. A second research trip was conducted in Amman in May 2004. Thanks to the hospitality of the delegation of the Italian Ministry of Innovation and Technology visiting Jordan, it was possible for the researcher to participate in the unfolding of the early phases of project planning and implementation in a 'real life' context. The opportunity for constant interaction with the delegation allowed intensive reflection during the process of research and was essential to gathering knowledge and insight about the processes and structures involved in the deployment of the e-government initiatives, with special consideration for their difficulties and perceived challenges. Finally, after the field visit in Amman and during various visits at the Italian Ministry of Innovation and Technology in Rome, it was possible to continue the process of reflection and elaboration of the research material accumulated over the years by engaging in a series of discussions with the key individuals responsible for Italian Government funded programmes in Jordan.

4. THE CASE STUDY: GLOBAL ICT PROGRAMMES IN JORDAN

The case of e-government in Jordan offers a valid setting to evaluate the extent to which the architecture of good governance, as proposed by the 'Monterrey Consensus', can contribute to the ambitious targets set by the Millennium Development Goals. The relevance of studying Jordan as an interesting e-governance policy initiative is also confirmed by C. Barrett, (REACH 2001), Intel's former Chief Executive Officer. During a meeting in the region he declared:

"*Jordan has set a precedent for change in the Middle East region. It has demonstrated the achievements that can result from strong cooperation between the public and private sectors, particularly in the field of information and communications technology.*"

On the same occasion, the King (REACH 2001) declared:

"*It is time to widen the scope of our participation in the knowledge economy from being mere isolated islands on the periphery of progress, to becoming an oasis of technology that can offer the prospect of economies of scale for those who venture to invest in our young available talent.*"

Finally, according to a recent declaration made by Bilal Abuzeid, Int@j's[4] chief executive (Abdelrahman 2004):

"Strategic partnerships between countries are the obvious next step to competing effectively in the international marketplace".

Since 1999, Jordan has set a national strategy to be an active player in the global knowledge economy and society, broadening – among other things – access to ICT in rural communities, and introducing policies to support the aspiration of becoming the Singapore of the Middle East. E-government initiatives are ranked high in the country's agenda for the realisation of such an ambition, and have given international visibility to Jordan's efforts in such a direction. Typically, Jordan is 'showcased' as *the* best practice example on the implementation of reforms aimed at good governance and (more recently) also for e-governance and the information society (REACH 2001; Ciborra 2003; Int@j, 2003).

Among the most important steps made for the realisation of such a vision, in 1999 King Abdullah II launched the REACH initiative (Regulatory Framework; Estate; Advancement Programs; Capital; Human Resources Development), an all encompassing programme aimed at the creation of a knowledge economy based on an internationally competitive, Jordanian ICT industry. REACH also layed the basis for introducing reforms in relevant areas such as regulation and infrastructure development. Queen Rania is also supporting a number of initiatives sponsoring 'e-villages', working together with Cisco and UNIFEM, which aims to provide computer training and ICT awareness to women in rural villages.

ICT Program	Promoter	Partners	Objectives	Local Institutions	Status
REACH	*The King*	AMIR	Bolster Jordan's IT sector and maximise its ability to compete locally, regionally and globally	Int@j	Started 1999
Connecting Jordanians		Microsoft, UNDP	Awareness campaign, development of unique intellectual property, capacity building, bringing education systems and related services on-line	Ministry of Education (MoE)	Started in 1999
Jordan Information Technology Community Centres		MoP	Provide public access, capable of covering their operating costs with revenue from training fees	MoE, MoP	Started 2000, by 2002 20 centres had been established able to cover costs, 41 out of 67 already operational by 2005

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[4] Int@j is the trait d'union between the local private sector, the multinational companies involved at various levels in the e-government initiatives and the MoICT.

E-village	*The Queen*	Cisco, UNIFEM	Provide training and awareness of ICTs to women in rural villages	Local NGOs	Started 2003
Intel I-Lab	*Intel*	none	Serve as an incubator for internet and e-business start ups, evaluate new entreprenurial business models and assist their technical realisation	Jordan's University King Abdullah II School of IT	Started 2002
business incubator	*Sun Microsystems*	none	Select potential ICT start-ups, provide necessary training and equipment for a 6 months period, make a 2 week e-commerce training programme	Princess Sumaya University for Technology	Started 1999

Table 1: ICT Programs, promoters, goals, partners and status.

In addition, direct involvement from major multinational companies in the IT industry is regarded as an important sign of the potential that the country might unleash in the future. For instance, Intel's I-Lab initiative (in co-operation with Jordan University's 'King Abdullah II School of IT') is serving as an incubator for Internet and e-business start ups, to promote innovative business models and ideas and to assist students in their technical education. Similarly, Sun Microsystems is working with the Princess Sumaya University of Technology to select potential start-ups in the area of ICT, also providing training and equipment for their development (see table 1 above).

The e-government programme in particular is expected to be a major contributor to Jordan's socio-economic development "by providing access to government services and information for everyone in the kingdom irrespective of location, economic status, IT ability and education" (MoICT 2003). Jordan's e-government strategy is aimed first at introducing new technologies to facilitate inter and intra-agency communication and cooperation, and consequently to provide information and services to its citizens more effectively. The program relies on four foundations: education and training, infrastructure development, legal change and the introduction of e-services.

The main objectives are the creation of a shared vision about e-government and a government wide network infrastructure to enable the government to introduce knowledge management, empower and connect government staff (MoICT 2000; MoICT 2001). Fast Track projects requiring immediate attention were launched in 2001 and are at the core of the present e-government efforts. These include motoring services (at the Department of Driving Licenses and Motor Vehicles), taxation (income and sales) services and land registry. Next will be the Government-to-Business and Government-to-Customer portals and a Government Personnel Directory. Various ministries are involved in supervising and monitoring the projects: the Ministry of Planning (MoP) oversees the initial selection phase, then the Ministry of Industry and Trade takes charge of the review and implementation stages together with the Ministry of Information and Communication Technlogies (MoICT), the former Ministry of Posts and Telecommunications.

The MoICT has been designated as the focal point for co-ordinating the implementation of the e-government programme. The MoICT involvement with various other local and international stakeholders can be divided into three main areas of activity; the development and maintenance of the networking infrastructure, the creation of e-services and shared services and liaison with the private sector. The MoICT is the governmental entity in charge of monitoring e-government initiatives, and to manage network security and conduct quality checks and auditing. It provides technical expertise to the other Ministries and government entities involved in ICT programs. The MoICT's mission in respect of e-government is to provide support and the capability to coordinate the management, implementation, interoperability of the National e-Government Initiative.

These include the creation of a single point of access for citizens, businesses and other government agencies. Content managers have been identified in all the relevant government agencies and the goal is to provide services and information such as directories of government employees, collaborative tools and technical capacities across the various entities involved in the development of such services. Table 2 below summarises the partners, objectives and local interfaces for the three major objectives of the Jordanian e-government programme.

ICT Program	Partners	Objectives	Local Institutions	Status
Infrastructure Development (Secure Government Network)	Cisco, Oracle	Develop a secure government wide infrastructure for government-to-government operations	Ministries of: Finance, Industry and Trade, Planning; Municipality of Amman, Prime Minister's Office, National Information Technology Centre	Started in 2001: 6 Ministries connected by 2003, 12 more planned to be connected by 2005
E-services	Deloitte	Simplification of bureaucratic procedures, improve citizen convenience, decrease costs of providing services	Local Ministries, esp. Department for Motor Vehicles, Land Registry, Borders & Residency, Income Tax	Ongoing
Legal change	various IDAs	Promote a legal framework that is conducive to investment, taxation friendly, accessible to global markets and with an attractive environment for corporate investors	Int@j, REACH	Started in 2001 and ongoing

Education: Connecting Jordanians	Cisco, UNDP	Promote collaborative learning programmes, provide access, stimulating the development of a knowledge economy	Ministry of Education	Started 1999

Table 2: ICT Programs in government institutions, partners, goals and local institutions involved.

Reviewing this variety of projects and their diverse set of stakeholders, we see no single or coherent view of the structures of governance that emerge out of the diversity, complexity, but strongly totalising character of these programmes. Rather, the legitimisation of Jordan's aspirations, and their enactment through various international and transnational initiatives, is producing a variety of organisations, control structures, rules and codes of practice; in a sense a new (and not always fully coherent) architecture, which is itself constitutive of and constituted by global ICT programmes. Without exploring the political challenges that global ICT programmes confront, which are beyond the scope of this paper, it appears evident how governing in such circumstances renders progress difficult and slow rather than highly flexible, responsive, decentralised and pluralistic as IDAs, donors and leading consultancies often suggest.

5. DISCUSSION: GLOCALISATION AND POLITICAL TRANSITION

The deployment of global ICT programmes in e-Jordan and the expectations that these fuel for the country's development agenda is a challenging object of study. The procedures for the establishment and development of such global programmes involve highly elaborate networks of agencies for the promotion of any specific initiative. These require also the development of a technological and organistional capacity, which is typically transferred and then redeveloped locally. This process is, however, fragile and non-linear and it is likely that a number of unexpected events can bring it to a halt. Because a late developing state is typically in the process of *transformation*, *contestation* and *political transition*, the costs of changing or introducing new institutions are inflated by the bargaining process between state-led reforms and other agents in the economy (Ciborra and Navarra 2005).

The informational and cross-organisational interdependencies between the networks of agencies reported in tables 1 and 2, span across distant geographical regions, organizational domains and last, but certainly not least, also political ideologies, all add to the costs of political transition. Thus, it is not enough to describe what the institutional environment presents for analysis of e-government in a developing country without also addressing the power bargaining mechanisms necessarily involved in programmes of informatisation and institutional restructuring. The greatest risks and challenges we identify from this case study rest on the number of integration points that are required for e-government systems to scale up, combined with the proliferation of existing systems with various technologies and platforms making integration with the core/legacy systems a very delicate issue (Navarra 2006).

These issues do not seem to be recognised in the development agenda advanced by the Monterrey Consensus, but they are crucial if the implementation of global ICT programmes is to bring any benefit. International institutions and global networks are important political forces that need to be reflected in such studies and as more countries pursue the ambition to develop by using ICT programs to link their economic and industrial structure to global markets and to the international circuit of trade , transport, banking and finance, which are

tightly coupled with these initiatives. It then becomes appropriate to frame the development of e-government within a wider agenda and as essentially associated with the implementation of global ICT programmes. To be sure, foreign donors and international development agencies exert considerable influence over the specifications and overall coordination of the development of global ICT programmes. In the words of a leading expert from MIT, said during an informal dinner conversation in Amman in the summer of 2004:

"It is important to understand where the balance of power lies, and that is with the providers of development assistance more than within the local political constituencies."

It is therefore not surprising that the models adopted by Jordanian institutions with donor agencies focus on a standard set of applications aimed at transforming the state so as to increase its capacity as a minimal, efficient service delivery agency, and that the overall approach is well aligned with the current models of e-government in Western countries (Deloitte Research, 2001) and good governance. Nevertheless, the extent to which this conduct will be growth-enhancing, if compared with the exigencies of late developers, as opposed to a developed state, remains uncertain at this stage.

6. SUMMARY AND CONCLUSION

In conclusion, our contribution to the study and research on innovation, technology, governance and organisation is threefold. The first is identified with the object of study itself. Global ICT Programmes offer for analysis a rather different set of issues with respect to the technology initiatives studied in the discipline and at large. As Walsham has written, 'The mainstream IS community is notable for its almost total disregard of issues of technology transfer and implementation in Third World contexts' (Walsham 2000:207).

Second, we have showed that existing research in this domain has not yet explored nor produced an account of the complex dynamics governing the early phases of infrastructure development in developing countries beyond the focus of a single application or project. This points our attention to the subtle dynamics taking place within global ICT programmes including the endogenous institutional forces situated in the context of Jordan. It is possible to appreciate from the issues that emerge from the case study vis-à-vis the vision of the Monterrey Consensus, that the assumptions upon which the compact pursuing e-government initiatives rests need an extensive update in light of the practical difficulties encountered even before full scale deployment of the technological systems meant to promote good governance.

Third, the lessons that can be learned from Jordan's experience to date are then oriented towards a deeper understanding of the nature and role of technology for the design of organisations and institutions during the process of late development. Global ICT Programmes bring together the government, the private sector and a plethora of international institutional constellations, which are not situated only at the micro-institutional, national or regional level. Their environment is not delimited by clearly defined boundaries but by their global significance and effect, and institutional structures cannot be taken as given, but must be seen as in a very substantial process of change and transformation.

In conclusion, global ICT programmes imply a profound structural transformation to integrate technological platforms, information resources, expert systems, etc., and other fragmented infrastructures, across national boundaries with international institutions and business interests. Although the Monterrey Consensus suggestions are perhaps realistic, even

achievable, more attention should be paid to the organisational and governance challenges and to the costs of political transition that follow. Casting these issues as Global ICT Programmes can help to establish a much broader inter-disciplinary significance and interest in the issues involved in the governance of the large scale information infrastructures required for innovation and technology initiatives. This may also imply a useful shift in the traditional approach to the design of information infrastructures, away from considering each application in isolation, and towards a grid architecture which supports decentred concentration. In other words, the relocation, sharing and coordinated use of diverse resources (including organisational capacities) almost irrespective of their geographical, cultural or organisational context.

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TOWARDS INTEGRATED CAPACITY BUILDING EFFORTS FOR E-HEALTH: THE CASE OF HIS IN DEVELOPING COUNTRIES

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Abstract: Capacity building is a term used extensively in ICT related projects, especially involving donor funding for developing countries. While this emphasis on capacity building is indeed welcome and required, it is argued in this paper that the manner in which it is conceptualized and implemented is often highly inadequate. Drawing from empirical evidences from the ongoing e-health project called HISP in India and Ethiopia, the area of this inadequacy is elaborated upon this paper, and also some suggested strategies on how to address these gap. For successful implementation of e-health projects, the study identified three key areas of capacity; informatics, public health and use context. The conceptual notions of structure and integration are used to explore the challenges in developing an integrated view about capacity, and some practical strategies to address them.

TOWARDS INTEGRATED CAPACITY BUILDING EFFORTS FOR E-HEALTH: THE CASE OF HIS IN DEVELOPING COUNTRIES

1. INTRODUCTION

Capacity building in the context of Information and Communication Technology (ICT) projects in developing countries has been a subject of study and concern for researchers, practitioners and also international development project managers. In 2003, UNDP defined **'capacity building' as** follows

> "*The creation of an enabling environment with appropriate policy and legal frameworks, institutional development, including community participation (of women in particular), human resources development and strengthening of managerial systems*, adding that, *UNDP recognizes that capacity building is a long-term, continuing process, in which all stakeholders participate (ministries, local authorities, non-governmental organizations and water user groups, professional associations, academics and others*." (UNDP, 2003)

The above definition emphasizes the multi-faceted nature of capacity building, and the long term attention that it needs to be developed. In ICT related projects, the term capacity building has been used extensively especially in projects involving donor funding for developing countries. Project proposals, implementation plans typically have a significant component of capacity building inscribed in their descriptions (see for example Kimaro, 2006, Sahay and Walsham, 1996). While this emphasis on capacity building is indeed welcome and urgent, it is argued in this paper that the manner in which it is conceptualized and implemented is highly inadequate. In this paper, within the specific context of e-health, we elaborate on how the development of capacity requires the integration of different knowledge domains that are shaped by various structural conditions (for example, organizational hierarchy or public sector bureaucracy). Communication becomes a key mechanism for trying to address these structural barriers to knowledge integration.

The empirical settings for our analysis concern the cases of e-health implementation in Ethiopia and India of the District Health Information Software (DHIS) as a part of the Health Information System Project (HISP). The capacity building efforts in these two countries are challenged from two aspects. First, in using the Free and Open Source Software (FOSS) version of DHIS,, called DHIS2.0 based on Java frameworks. A key challenge arises from the lack of prior experience that the staff have in working with these new technologies. The second challenge comes from the inadequate knowledge gap of the public health domain, fundamental for the effective implementation of e-health systems. Finally, there is the challenge of integrating these two knowledge domains and their application within the respective use domains The cases of Ethiopia and India are contrasted and compared so as to analyze the different approaches adopted towards human capacity development. More specifically, the following two research questions are addressed:

- How can the notion of capacity development be conceptualized in a more holistic manner within the specific context of e-health?
- What strategies can be adopted to practically approach capacity building from this expanded perspective?

2. THEORETICAL PERSPECTIVE

The proposed theoretical perspective around capacity building is developed around two key notions of 'structure' and 'integration'. These are now discussed

Integration

In the context of HIS in developing countries, the concept of integration has also been gaining increasing importance. While the introduction of specific HIS is in itself problematic, another layer of complexity is added when attempts are made to "integrate" multiple and disparate HIS, which typically "belong" to different groups of people, and are products of varying material and social histories. As a result, their integration not only implies a technical coming together of the systems, but also of the actors, their operational procedures and institutional arrangements. Within public health, the need for integration is magnified because there are multiple vertically organised health programs; for example; for Malaria, TB, HIV/AIDS, Disease Surveillance (Chulundo 2004) each with their independent reporting systems. Furthermore, there are also multiplicities of systems within particular programs, such as originating from blood banks, VCT centres, hospital inpatients, sentinel surveys, and laboratory testing facilities within the framework of HIV/AIDS. Contributing to these problems, Chulundo (2004) identified structures relating to the diversified interests and multiple rationalities of the national level planners who propose the rhetoric of integration, which is divorce from the situation on the ground at the point of health delivery. In a similar vein, Shedende (2005) analyzed challenges within the HIV/AIDS reporting system arising from the lack of integration. In her analysis of the PMTCT (Pregnant Mother to Child Transmission) HIS in Tanzania, she identified various issues such as the use of an ineffective coding system that made it difficult to know whether the client is a male or female, who is the partner, whether the client is missing or not the periodic check ups, and to which clinic is the client seeking treatment. These inadequacies made it difficult to integrate this paper based system with other systems such as of Antenatal care.

We will like to move away from the largely technical bias with which the problem of integration has been framed, and take a broader view of integration as how within a particular institutional setting, various information systems, knowledge domains, standards, work practices, organizational structures and procedures 'speak to each other (see for example, Khoumbati et al 2006). In the context of this paper, we use the concept of integration more specifically to refer to the various knowledge systems that come into play during the course of Health Information Systems (HIS) capacity building efforts, and how these should be combined more effectively. While integration research and practice takes as the point of departure, the need to link different ISs systems, we focus on the issue of the multiplicities of knowledge that need to be integrated during capacity building efforts. This view of integration helps us to analyze how we can approach capacity building from a broader perspective of just the mere enhancing of training individuals to accomplish some task, towards a frame of how multiple domain knowledge domains and experiences can be integrated through the means of communication and structural change.

Typically, capacity building efforts around HIS focus primarily on issues of technical knowledge, while largely ignores issues of domain (public health) and the context of use. To make capacity building efforts more effective these multiple knowledge systems need to be integrated more meaningfully. A key related challenge then concerns understanding what are the impediments to this linking, and how these can be addressed For example, in a recent paper related to public HIS in developing countries, Braa et al (2006) argue for the need to

integrate the knowledge domains of public health and informatics so as to enable the software and public health people to understand issues related to the other, for example how public health people can formulate their needs in informational terms. Traditional capacity building efforts, Braa et al argue, have treated these domains in an independent and compartmentalized manner, contributing to knowledge asymmetries and consequent implementation failures. They outline various mechanisms to overcome these impediments, such as action research, redefining university curriculum, building south-south networks and creating cross-disciplinary teams of public health and informatics professionals to be engaged in implementation activities.

Structure

The second key concept helping to inform our approach to capacity building concerns the notion of structure, as drawn from Structuration theory (Giddens 1984). Giddens describes structure as the rules that human agents have in their minds about systems of power, legitimation and sanctions. It is these structures that human agents draw upon to articulate and perform action. Giddens describes structures as having the potential to both enable and constrain action. We want to use the notion of structure to understand what are the conditions shaping knowledge systems – how they are developed, articulated, shared – especially how do they shape the dynamics around the integration of disparate knowledge systems relevant to the issue of capacity building in public health informatics.

To understand how the notion of structure is operationalised we examine one published example. In a paper relating to Geographic Information Systems (GIS) implementation in India, Sahay and Walsham (1996) analyze the inadequacies of training and capacity building efforts included as a part of the USAID funded project in India. They point out that this inadequacy is partly due to the inability of planners to take in to account the 'structures' which the scientists (the trainers responsible for the capacity building efforts) have in their heads with respect to the trainees and their knowledge. Trainers see their roles as elite purveyors of knowledge, while the trainees see themselves as passive acceptors of knowledge, resembling the structures of hierarchy and status reflected in various social systems relevant in India concerning education, parent-child relationship and the caste and kinship system. These structures are constituted of various rules and resources that guides and shapes human actions, in our case of the trainers and trainees. The rules of respect associated with the scientists seen to have a superior hierarchical status in society, the trainees tend to be passive and unquestioning of what they are taught. As a result, the training programs consists of a one way flow of information from the scientists to the trainees, which does not get fully translated in to deep rooted knowledge in the heads of the trainees. This then contributes to the inadequacies in capacity of the trainees to handle implementation challenges. Sahay and Walsham go to argue that the solution to this knowledge gap does not lie in the typically proposed solutions of more technical training, but in trying to modify the deeply rooted structures that define the hierarchical relationship between the trainees and the trainers.

The notion of structure thus helps to go beyond the "what" of the problems to understand the "why" and how this may be addressed. In the context of HIS in developing countries, various structures shape the introduction, implementation and use of ICT. For example, Mosse (2005) describes how the structure of the colonial legacy of the Portuguese in Mozambique contributed to the focus on curative health care at the expense of preventive. Similarly, Nhampossa (2006) describes how the structure of donor funding towards vertical health programs contributes to a fragmentation of the HIS, and creates challenges in their integration. An implication of this to the argument relevant to this paper is that capacity building efforts might be influenced by the structure of bureaucracy and culture of the e-health implementers.

Proposed theoretical perspective

In summary, the notions of structure and integration provide the founding concepts of the proposed theoretical perspective to help understand both the need of expanding the scope of the capacity building problem and how can this be approached. Such an approach, we argue, helps to focus both on the *structure* and *process* of capacity building efforts and how they are mutually interlinked. Such a perspective can arguably help to develop a more holistic and long term approach to capacity building that goes beyond merely attempting to enhance skills through short term training efforts.

This theoretical perspective is applied to the analysis of capacity building efforts around HIS using comparative case studies from Ethiopia and India within the framework of the HISP (Health Information Systems Program) initiative. Before describing the case study, in the next section, we first provide an overview of the research contexts and methods employed.

3. RESEARCH CONTEXT AND METHODS

Both the cases described in this paper are within the framework of the HISP initiative which started in 1994 through a University of Oslo-University of Western Cape collaboration. The HISP initiative was constituted of three key inter-related components:

1. Software (Free and Open Source called DHIS) design, development and implementation.
2. Large scale capacity building efforts of health staff.
3. Research and education including doctoral and masters studies.

The first application developed in South Africa was DHIS 1.3 and over time there has been various transitions first to version 1.4 and then to 2.0. The transitions have also coincided with the expansion of the HISP initiative to other countries (India in 2000 and Ethiopia in 2003). DHIS 1.3 software is based on Microsoft technologies (MS Access and Visual Basic), and was guided by the development group in South Africa. After being used for more than 5 years in various field settings (South Africa, Mozambique, Ethiopia, Tanzania, and Malawi), two new versions of DHIS were created. DHIS 1.4 (also based on Microsoft technologies) sought to improve upon the 1.3 version based on various comments for improvement received from the field during the process of use, including upgrades in the design of the database and functionality offered.

Secondly, a group in Oslo, comprising mainly of Masters and Doctoral students using the DHIS 1.4 as the point of departure for defining the functional requirements, started to create in 2005, DHIS 2.0, based on Java technologies. Key distinctive features of it included it being web based and platform independent (of operating system and database). However, what was both an advantage and disadvantage, DHIS2 did not have the long history of empirical testing in field contexts like DHIS 1.3. .

HISP activities started in India in 2000, and initially the DHIS 1.3 software was customized and deployed in the state of Andhra Pradesh through the efforts of a local development group. Over the years, the functionality of the software was significantly enhanced, including the incorporation of GIS, making a state level web enabled database, integration with other software, and the development of a web based system for monitoring case wise infant and maternal deaths.

Initially the implementation efforts were carried out directly through Oslo faculty and students, and as the project grew, in 2003, an organization called HISP India was established as a not for profit NGO. Today, HISP India has a size of about 35 full time and 80 contract staff, primarily coming from an informatics background. In 2005**,** the Kerala state government

allowed HISP to conduct a pilot study, provided no licenses purchases were involved. Since this process broadly coincided with the development of DHIS 2.0, HISP India took the decision to pilot DHIS 2.0, even though it was not fully tested. This process of field implementation started in February 2006, and since then HISP India has engaged with various capacity building related issues which we outline in the case study.

HISP Ethiopia was initiated in 2003, following the signing of a collaborative agreement between the University of Oslo and Addis Ababa University (AAU). The implementation efforts were built around Doctoral and Master students from AAU who were enrolled for their respective Phd and MSc studies at Oslo, and funded through the Norwegian government. Starting from 2 Doctoral students, HISP Ethiopia has grown to a current size of 5 each of Doctoral and Masters students, and 3 full time HISP employees who completed their Masters studies in 2005. In addition, there are 4 computer science diploma holders who serve as system facilitators in the regions.

Given the relatively decentralized political and governance structure of Ethiopia, and the lack of national level support for HISP, Oslo and AAU directly signed joint agreements with 5 Regional Health Bureaus (Addis Ababa, Oromia, Amhara, Tigray, and BeniShangul Gumuz) for the implementation. The starting point was Addis Ababa region and the implementation of DHIS 1.3. A key feature in this process was the development of an additional Morbidity and Mortality Module that was based on recording disease patterns conforming to ICD (International Classification of Diseases) codes. In 2006, the focus shifted to make a transition from DHIS 1.3 to DHIS 2.0, an effort which has been fraught with challenges due to the inadequate internal capacity (such as in Java programming) and infrastructure constraints (such as internet connectivity). Comparing the capacity development approaches of the two countries, we discuss in the case study section the varying (and similar) challenges experienced and how they are attempted to be addressed.

The research has followed the principles of action research. Being, part of the larger global HISP network, the authors (an Indian and Ethiopian respectively) have participated in the HIS design, implementation and user training activities in their respective countries. A key focus of these efforts has been on capacity building, at both the internal and external levels. While internal refers to building capacity of the HISP implementation team, external refers to developing the capacity of the health services staff. Furthermore, internal capacity development takes place both within country and through the software group in Oslo where the core of the DHIS 2.0 is being developed. Capacity building thus involves the attempts to transfer some of this core knowledge to the respective countries. This process comes with its own costs and challenges, including of dependencies at the cost of local and sustainable capacity. Since both the countries operate under different structural conditions (one as a NGO and other as part of the university) and have employed varying processes to both internal and external capacity building efforts, the outcomes are different. We selected India and Ethiopia for our study since; firstly, we are highly involved in the two countries HISP implementation and secondly the varying capacity in terms of DHIS in these countries. Even if India and Ethiopia are both under the category of developing countries, it is very interesting to see the contextual difference in terms of the available human capacity to implement e-health initiatives in the respective countries. The comparative case study gave us a good insight of capacity building efforts in different context which will be useful for IS practitioners

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4. CAPACITY BUILDING IN E-HEALTH: ETHIOPIA AND INDIA

The two country cases are now discussed.

4.1 Ethiopia

The (internal) capacity building efforts in Ethiopia has been guided by the MOU between Oslo and AAU. Initially, 2 faculty members from AAU and 5 graduate students (3 in informatics and 2 in public health) were given scholarships from the Norwegian government for their doctoral and masters studies at Oslo respectively. As the masters students graduated in 2005, a new batch of 4 students was further enrolled. The graduated students have since been employed by AAU through EU funding and form the HISP Ethiopia team along with the system facilitators.. The team of 9 (5 graduates and 4 facilitators) has over time dwindled and today 5 remain (3 graduates and 2 facilitators). Furthermore 3 other faculty members from AAU have also started their Phd studies.

The aim of this relatively large scale student enrollment has been to develop capacity in public health informatics at the national university department, and it was expected that these students would contribute to the field implementation activities as a part of their thesis within an action research framework. Till date, both the research and practical outputs of the Phd students has remained marginal, with the students struggling to find the balance between the demands of research and field implementation. Furthermore, university related bureaucracies have also constrained field implementation activities as funds routed through the university are controlled by their administrators, and are not easily available in the quantum and time as demanded by the rhythm of the field implementation.

External capacity building efforts are regional focused starting in 2003 with DHIS 1.3 implementation in Addis Ababa and Oromia. Intensive capacity building efforts have been carried out by the HISP Ethiopia team in these two regions leading to a rapid uptake of DHIS 1.3, especially in Addis Ababa region where in about 12 months a full coverage (including all the sub cities and health centers) has been achieved. Capacity building efforts have focused on the health staff in the region training them on the basics of computers and the use of DHIS 1.3, and also engaging them in standardization workshops. Mechanisms for capacity building have included regular training programs at a regional location, and further field level support provided through the system facilitators.

In Addis Ababa, during the initial stages of implementation, capacity building efforts focused on data entry and report generation. With the accumulation of data and the consequent slowdown in system efficiency, there was the need for higher level skills at the software level. This problem became the motivating factor for the HISP Ethiopia team to look for other more efficient software. After considering the options of moving to either DHIS 1.4 or 2.0, a decision was taken for the latter due to two key reasons. One, the Federal Ministry of Health was in the process of restructuring the national HIS, and was interested in a web based system. Two, in June this year, HISP Ethiopia signed agreements with two regions (Tigray and Benishangul-Gumuz) to implement DHIS 2.0 by the end of 2006. These national and regional level conditions, in addition to system efficiency issues, contributed to the impetus to try and make the transition to DHIS 2.0.

Around July 2006, the HISP Ethiopia team started to join the DHIS 2.0 development activity centered in Oslo. The efforts started when the Oslo Master students (4 Ethiopians and one from Vietnam), together with their Professor came to Ethiopia as a part of their study. This team started to define the major functionalities needed in 2.0 based on the earlier 1.3 experience. Key requirements concerned the development of the Morbidity Mortality module tool and the customization of region specific reports. The Vietnamese student, who had been previously engaged in the core DHIS 2.0 development in Oslo, played a key role by teaching the Ethiopian team the process for report customization through an approach of "learning by doing." While this process was useful, it created a dependency on the Vietnamese student, and the team's capacity building activities primarily focused on report designing, and not on

understanding the foundational DHIS 2.0 frameworks, for example required for integrating the Morbidity and Mortality module within the core DHIS 2.0.

These issues of dependency and limited knowledge adversely affected the development process, because when the Vietnamese student left, the Ethiopians waited for him to integrate the new developments in Ethiopia with the new milestones (released monthly by Oslo) and electronically send back to Ethiopia. This problem of dependency was heightened due to the slow internet connectivity in AAU which made it very difficult to download new milestones and versions. The Ethiopians, who culturally prefer face to face communication as was also seen in our own interactions, also did not participate effectively in the electronic developer mailing lists, which contributed to their exclusion from direct access to DHIS 2.0 knowledge. The frequency of Ethiopian participants in the mailing list can be taken as an evidence for this argument. While there was definite progress in the customization of the local reports, a solution could not be found to the morbidity and mortality module which required knowledge about the core DHIS. In trying to address this knowledge gap, two Oslo developers came to Addis for 10 days, which was followed by a visit of an Ethiopian developer to South Africa where he had the opportunity to interact with other DHIS 2.0 developers. These interactions, plus local efforts to learn Java, have helped the Ethiopian team to understand the broader architecture of DHIS 2.0, and the different tools used for development. As compared to the earlier effort which was more mechanically output centered, these were largely capacity centered. However, for various reasons including the lack of time of the Oslo team to dedicate to follow through and develop the solution, the morbidity module could not be created and integrated into DHIS 2.0. This contributed to delays in implementation and in making the transition to DHIS 2.0.

4.2 India

In India, the implementation is organized through a NGO which currently has more than about 100 full time and part time staff, primarily with an informatics background. An advantage of the NGO structure has been that implementation activities are directly controlled by the HISP members and are not constrained by the bureaucracies of a university as is the case of AAU. A disadvantage however is that the NGO does not have the independent capacity or mandate to run educational programs, and over time they are trying to address this limitation by developing tripartite linkages with other Indian educational institutions (Public Health and Informatics) together with Oslo. Such a networked structure provides them with the independence of using the resources to suit their understanding of the field implementation demands while also developing linkages with institutions to support educational capacity development. However, till date, the focus of HISP India has been on developing external capacity of the health services staff rather than on formal (through degree programs) internal capacity building efforts of their own staff.

During the initial stages in Andhra Pradesh, the HISP India team, because of the large scale availability of Visual basic developers, created a strong capacity in DHIS 1.3, and largely independent of South Africa, developed various enhancements to the software such as the incorporation of GIS functionality, and export features from Access to MySql database. External capacity building activities were funded by the State health department, and the model employed was of one system facilitator being responsible for 2-3 Primary Health Centers (PHCs). This facilitator because of his/her local level presence was able to provide continuous on job and on-site support to the health staff. Through this intensive capacity development efforts, significant gains have been achieved with the health staff being made

capable of independently conducting their monthly entry of routine data, generating the required reports, and its transfer from the PHCs to the districts. However, a shortcoming of the entire effort has been the strong informatics bias at the expense of public health, and so topics such as the use of information have not been equally emphasized as learning about computers and DHIS. This is reflected by the fact that although large amounts of data have been accumulated there have been almost no attempts to analyze and use the data from a public health perspective.

Towards the end of 2004, as the implementation in Andhra became vulnerable due to political changes, HISP India started to explore the possibility of expanding its operations to the state of Kerala. Due to the requirements of the State for a license free implementation, HISP India started to press the Oslo team for a rapid release of the first version of the DHIS 2.0. Initially, due to delays from the Oslo end, two local developers were hired with the mandate of taking the DHIS 1.4 version as the point of departure for the requirements, and porting the same to a Java based platform. Seeing this move as a potential for a conflict with the DHIS 2.0 development, Oslo sent two of their developers to India to try and integrate the two sets of efforts, and come out with a first version of DHIS 2.0, which was released in February 2006. While most of the earlier work done by the Indian developers was discarded, the reporting functionalities with appropriate modifications were adopted. While there was a degree of disappointment amongst the Indians about the discarding of their development, their efforts had two key benefits. Firstly, it helped them to gain a thorough understanding of the user requirements, and secondly it spurred the development efforts of Oslo to create the first version, which otherwise was progressing at a very slow pace.

Even though the DHIS 2.0 in its first version was untested, HISP India decided to go ahead with the field implementation, as they felt that the only way to learn about the application was to place it in the field situation, get feedback about problems the users, and try to address the problems locally to the extent possible. The first version was tested on Linux environment with English language. The software was reviewed continually and inputs were given to the DHIS2 core development team for improvements. Later the implementation environment focus shifted to Windows as two more states were added on to the list of DHIS2 users, with varying needs, such as the local language of Hindi and Gujarati. This translation was done successfully after extensive and ongoing discussions with the Oslo and Indian teams. Due to the huge number of reports and formats required by the respective state health departments, significant efforts have been invested in developing reporting functionalities in the respective local languages. Now after having gone through this process of customization for 3 states, the Indian team has strong capacity to support the local application. In meanwhile, 5 subsequent versions of the DHIS 2.0 have been developed and the application has largely stabilized. With new additional requirements being placed by the different states (for example, systems for monitoring eligible couples, logistics, budgets, integration module etc), the HISP team has started on these developments. However, an urgent need at this point is for them to develop technical capacity on the core modules of the DHIS 2.0, with stronger local control over those efforts. These processes are however constrained by the need for more development resources, and recruiting experienced programmers at market rates competitive with what is being paid by the thriving private sector.

5. ANALYSIS AND DISCUSSIONS

This section is structured around answering the two research questions posed in the introduction of this thesis concerning the conceptualization of capacity development; and

strategies to address the capacity building challenge from this expanded perspective. The theoretical notions of structure and integration are weaved into this discussion.

5.1 Re-conceptualizing capacity building for e-health

Capacity building for e-health is analyzed to have 3 inter-related components: technical capacity; public health domain; and, the implementation and use context. In Table 1, we summarize these different components and types of capacity, and the guiding structures.

Capacity component	Types	Description	Guiding structures In India	Guiding structures In Ethiopia
Technical informatics	Software development related	Java programming, Java frameworks (eg Hibernate), database and server related; report customization	Private sector demands; local-Oslo relation; prior experience	University curriculum; local-Oslo relation; prior experience; poor electronic and physical infrastructure
	Software implementation related	Report customization; software installation, adding/deleting data elements, datasets, organization units	Easy availability of system facilitators; learning by doing	Easy availability of system facilitators
Public health domain	Epidemiology	Modelling disease patterns, and correlating with causal factors	Limited university curriculum	Limited university curriculum
	Use of information	Indicators, coverage, analysis techniques	Weak availability of medical doctors with informatics skills; local alliances; funding access	Weak availability of medical doctors with informatics skills; AAU structure; limited funding
Implementation and use context	Work practices	How do staff collect, register, analyze and transmit data	NGO structure which allows on-site, on-job continuous engagement	Restrictive university bureaucracy
	Organization structure, data flows	How the health department is organized	NGO structure which allows on-site, on-job continuous engagement	Restrictive university Bureaucracy

Table 1 Summary of the different components and types of capacity, and the guiding structures.

Technical informatics capacity: This capacity is described at two levels, one relating to Java application development and the other concerning the capacity to customize reports, conduct software installation, and to make minor changes to the database such as the addition or deletion of data elements, data sets, and organizational units. Application development skills are in short supply in both countries, whereas in India the private sector demands pulls away the Java experts, in Ethiopia the university curriculum is ill-equipped to meet these demands. The HISP India team structurally has the advantage of having access to short term Java courses offered by private institutions, something not available in Ethiopia. . While the capacity at this level is gradually being enhanced in both countries, there are some situations, such as concerning the morbidity and mortality module in Ethiopia, a strong roadblock is reached raising the need for core development knowledge available in Oslo.

To a certain extent, some of these skill shortages at both levels have been addressed in India through an approach of "learning by doing" and attempting to solve field problems locally as they arose, and taking the help of Oslo or the developers mailing list in other cases. For example, even though the Indian team did not have the experience of working with Linux, they could learn about it through their everyday engagement with the field problems. This learning by doing approach was not adopted in Ethiopia because of their decision to delay field implementation till the application was complete and mature. Furthermore, the poor internet connectivity and also the difficulties in physical accessing the district installations made it difficult to use a more experimental approach.

Public health domain: The higher level skills in this regard concerns epidemiology (modelling of disease patterns and causal factors) which is sadly largely absent in both countries. Lower level skills here concern the understanding of concepts relating to indicators, coverage, and the capacity to conduct analysis related to the use of information through Excel pivot tables. While the informatics skills are easily available in both countries, the absence of medical doctors with an informatics orientation is a serious impediment. The one medical doctor who was available in Ethiopia got pulled away by the lucrative international NGO sector. In India, a medical doctor doing her Phd on data quality issues has helped to develop (both internally and externally) to a certain degree this level of capacity.   Furthermore, in Kerala, HISP India has an alliance with a local public health institute which has greatly helped to develop a public health orientation in the team. In Ethiopia, it is difficult to forge such need based alliances because of the AAU control over resources. .More recently, due to access to State funding, HISP India has been able to hire 2 medical doctors as state coordinators which should further boost the public health capacity. The Oslo funding to Ethiopia currently focuses on informatics staff, and does not allow this freedom.

Implementation and use context: A higher level capacity here concerns the understanding of the work practices around how health staff collects, register, analyse, and use data. This understanding requires a deeper sociological orientation, and also continuous engagement with the field realities. In both countries, it can be argued that the involvement of the masters and doctoral students have helped to develop this capacity. The lower level skills concerns an understanding of how the health system works (organization structure, data flows etc), and this can be rather easily developed through appropriate training material and field engagement. Both countries appear well equipped in this regard.

In this section, we have identified the three key areas of capacity development with respect to e-health, and have tried to unpack the details of what this capacity is constituted off. Furthermore, we have also tried to identify some of the structures in both countries that are shaping the capacity development efforts. Since, our argument is that there is the need to develop a holistic perspective towards capacity development, and there is the need to integrate these different component, we come to the challenging question of how this can be done.

Till date, the Oslo-Ethiopia approach has been one of "tight integration" where through university collaborations and joint masters degrees between informatics and public health, the aim is and try and develop individuals with integrated capacity about informatics, public health and also the implementation and use context. We argue that this approach though ideologically praiseworthy, is very difficult to effectively practically implement. Contributing to these difficulties are structural conditions such as the indolent universities bureaucracies, outdated curriculum which contributes to a weak supply of students with higher level skills such as related to Epidemiology and Java, and the poor salary structure within HISP which cannot compete with the offerings from the private sector industry or international NGOs. These structural conditions are complex to change, and we argue that a more feasible approach may be one of a "loose integration" where the focus is to develop specializations within respective disciplines (say public health and informatics), and then try to create mechanisms to encourage cross-communication to the extent possible. In this regard, we outline two key strategies.

Decoupling implementation and education/research: Two reasons contribute to this suggestion. One, in Ethiopia, the driving mechanism for implementation are the Phd and Masters students who are expected to contribute to their field activities within an action research framework. This level of integration is poorly understood by the students, and they struggle to find the balance between action and research, and inevitably action suffers since the scholarships are seen to support their doctoral or masters research. Two, universities bureaucracies and mandates are difficult to change. While the European funding is routed through universities, the university does not see themselves as having the mandate to do implementation, but only research. As a result, funding is not made available in the right quantity and time to support implementation activities, which ultimately suffers. The Indian example shows the benefit of decoupling implementation and research, where the NGO structure is responsible primarily for implementation, and have the decision making autonomy (unconstrained by a university bureaucracy) to directly engage in activities responding to field level conditions. While this of course contributes to a weakness on the education front, they are trying to address that by developing three way linkages between Oslo-local universities-and themselves to try and strengthen the research and education component.

Let specialists be specialists: Developing higher level skills such as in epidemiology and Java requires specialist knowledge imparted through university education systems. Expecting informatics people to learn epidemiology or vice versa through casual interaction, we argue, is not a feasible task. Instead, we argue that domain specialists should remain that, and attempts should be made to encourage cross-communication through small term and focussed workshops, rather than longer term education programs. These focused workshops can serve the function of mutual sensitization, and help each group to understand the language of the other so that an effective communication can take place. Such a decoupling is especially relevant in a country like India (as compared to Ethiopia) where individuals with such specialists are already available through the university system, although attempts to develop such communication bridges are rare.

Unlike the ordinary capacity building efforts, the main argument here is to let the specialist remain specialist, however should be integrated through the means of communication. While this call for decoupling may be seen as being contradictory to our earlier argument for integration, we argue that is not the case. There is arguably a need for effective communication between the two domains, without trying to make people from one group to become experts in the other.

6. CONCLUSIONS

This paper has tried to tackle the important topic of capacity development in the context of e-health in developing countries. The motivation for this paper was that while there is an universal recognition of the importance of this topic, approaches to address them are typically simplistic focussing primarily on the quantity of the efforts (more training) rather than its contents and structure. While arguing for the need to develop a more holistic structure, it is acknowledged that there are tremendous challenges in developing this integration due to various prevailing structural conditions. Strategies to try and develop this integration need to sensitively consider these structures, and also the requirements on the ground. While trying to develop higher level research capacity through Phd students may be ideologically praiseworthy, by itself it may be at a loss to improve the field level health conditions, which is such a pressing concern in developing countries like India and Ethiopia. For such educational initiatives to be effective, they need to be fundamentally linked to addressing locally relevant problems. It is only through this mutual interaction can effective capacity be developed.

In the future, we plan to expand the research in two key directions. First, is around the issue of communication as a strategy to overcome the impediments of structure and to develop stronger mechanisms for integration. This also involves developing capacity about communication itself, where the emphasis would be on providing training to the HISP staff, especially in Ethiopia, on the importance and ways of communication. Given the infrastructure situation and cultural preferences, communication would need to be developed both though electronic medium and also through face to face interaction.

The second area of future expansion concerns the issue of institutionalization of capacity building efforts both for internal and external purposes. External capacity building is especially important, and how can mechanisms be developed for the health services to themselves take ownership of the capacity building responsibility, and institutionalize it with in the everyday working of the organization. For example, people have to be made responsible by including in their job description for capacity building on issue of both public health informatics. In this way, capacity building becomes an ongoing and integral activity of the organization rather than just a one time training exercise.

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GLOBESAFE: A PLATFORM FOR INFORMATION SHARING AMONG ROAD SAFETY ORGANIZATIONS

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Abstract: Decision-makers in some cases give low priority to traffic safety; this may be due to lack of information about accidents, hence they underestimate the problem. High quality data, and a coherent assessment of the social and economic costs of accidents, are essentials for the promotion of traffic safety at all levels of decision-making. Current road accidents data sources provide in some cases inadequate information, making it difficult to realize the full nature of the problem and thus gain the attention that is required from policy-makers and decision-makers. There are a number of areas where road traffic accident data are problematic (data collection and accident registration, information retrieval and search). There is a particular need for better transfer and sharing of information, and for more systematic and intensive use of the results already available from research and experience in accidents prevention. This paper presents a system that offers better sharing of road accident and injuries data between organizations. The current problems of data linkage, under-reporting, semantic and definitional problems are discussed. Requirements engineering and prototyping methods were used to determine users' requirements, which help to develop the conceptual model and system design of the research project. To overcome ontological problems, we used ontology engineering methods and conceptual mapping methods that are commonly used in knowledge management and AI fields and Protégé-Frames used for implementation. Users can interact with the three layers of the conceptual model, using whichever one of the applications seems most useful.

Keywords: Information sharing, Road safety, conceptual Model, Common Vocabulary

GLOBESAFE: A PLATFORM FOR INFORMATION SHARING AMONG ROAD SAFETY ORGANIZATIONS

1. INTRODUCTION

Road accidents are responsible for a considerable waste of scarce human and financial resources that are needed for development. In the case of developing countries, motorization and urbanization are growing far faster than the legal, institutional and physical infrastructures, which are needed to solve road safety problems.

Coordination and sharing of information among different actors in road safety are vital and needed to improve safety and prevent accidents. This need is usually constrained by confidentiality and other legal restrictions. Our intention is to find methods that make road accident data available without violating any legal prohibitions as suggested by Wegman (2001).

The following points can summarize the motivations behind this work:

• Death and injuries due to road accidents are a growing public health issue, have severe economic impacts and can be a threat to society

• Estimates of the annual number of road accident fatalities can vary, as a result of the limitations of injury data collection and analysis.

• Road safety is of prime concern to many individuals, groups and organizations, all of whom require data and evidence on incidents.

2. OBJECTIVES

This research has been carried out to find methods in the field of information sharing to support sharing of road safety information and some analysis tools (applications). In addition to that, during the study, these methods have been investigated in order to evaluate how they can be used with regards to the traditional methods and previous work carried out by different organizations and research institutes in this area.

This research has an interdisciplinary approach (Mark and Thorpe, 2002) and comprised studies in the area of information system design, information architecture and requirements engineering.

The overall aim of the research is to build and maintain an information sharing system that can support road safety professionals and researchers in their effort to prevent road accidents and improve safety. In particular, the following objectives have been focused on: (1) explore methods in requirements engineering to develop requirements for road safety data sets that make use of current web database technologies, (2) explore information sharing modes in road safety organization and how to respond to the specific needs of different users, (3) use knowledge sharing methods for sharing the conceptualization of information and to develop common vocabulary.

Current practices in road safety organizations

We made several studies of different information sharing practices in road safety organizations. The main purpose is to find how different kinds of information are shared among road safety organizations in a region. We conducted different meetings and interviews with the officials responsible for maintaining the International Road Traffic and Accident Database[1] (IRTAD). These studies showed that the shared information differs in various aspects. Amongst the differences was the aggregation level of the database, which could be

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[1] http://cemt.org/IRTAD/

either aggregated or disaggregated data. Disaggregated information contains detailed information for every single accident whereas aggregated information contains statistical summaries of accidents' occurrences, without providing details (Yannis et al., 1998).

In both cases the methods of information sharing affects data quality and also influence the utilization of the information.

Current methods, like using the Internet (WWW) for online data sharing, and different protocols such as FTP are used to transfer both aggregated and disaggregated data. In some cases the user has the ability to do online queries; this method enables the user to select information according to his or her needs. Producing annual publications is a commonly accepted method for information sharing, in which the responsible body will produce annual reports, containing analyses as well as the raw data of each contributing member country. In this case, data confidentiality issues are considered and some sensitive information (like driver and passengers' personal data, and vehicle brand) is removed. Personal contacts using e-mail or face-to-face communication methods are also used, to share not only non-statistical information but also different experiences in different countries with similar road safety situations.

3. INFORMATION AND SHARING METHODS

One of four activities (*exchange, pooling, notification, and dissemination*) takes place if two organizations agree to share their information (Evans, 1997). Organizations targeting the same goals are usually exchanging information (Alexander, 1995). One organization can provide information or data and receive information or data from another one, and mostly the information or the data should be of the same kind or category.

Much of the work that has been done on road accident databases has focused on statistical analysis and capabilities for making road safety indicators available for different users (Baguley, 2001).

We have however found that the level of aggregation of the databases and some concepts differ significantly between the involved countries and parties involved. This makes it difficult to capture and understand the details behind the figures or indicators. This problem has become more important with the increasing demand for road accidents data for decision-making and to develop road safety plans (Sleet and Branch, 2004). When we started identifying the information, we were guided by the following questions:

• Which information will be shared? Prevention of road accidents needs to be based on objective information, such as data on the incidents and types of crashes. For this purpose we consider data sets and schema that capture the user's requirements and could help to obtain a full understanding of the road safety situation in a specific region or country. Data sets range from spatial and location information, on a single accident to attribute data[2] that describe the type of accident.

• How is road safety information shared? Sharing road safety information across different organizations or in the road safety community may be constrained by organizational behavior and/or technical barriers. Current Internet protocols and web services are in use for sharing and exchanging different types of information (Byström and Järvelin, 1995). Current research on information sharing shows that one success factor is agreement between different parties with interests in sharing and exchanging their information (Attewell and Rule, 1984).

• How useful is information sharing for intervention and prevention of road accidents? Road safety organizations that are working on the basis of cooperative and participatory activities

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[2] Car ownership levels, traffic legislation, energy, traffic accident data, traffic accident data, transportation networks, demographic data, etc.

are looking to promote road safety and prevent accidents. For such organizations, sharing information and experiences should help in a direct way to improve road safety.

The answers to the above questions are used in order to create the following data sets. See figure (1)

• Basic data about specific countries: the basic data is usually collected by local authorities like the police or hospitals. In addition, other types of data are needed to measure the economic impact of accidents.

• Road safety indicators present important indicators when analyzing the traffic safety situation in a country.

• Traffic analysis contains methods that can be used to calculate and analyze so-called performance indicators.
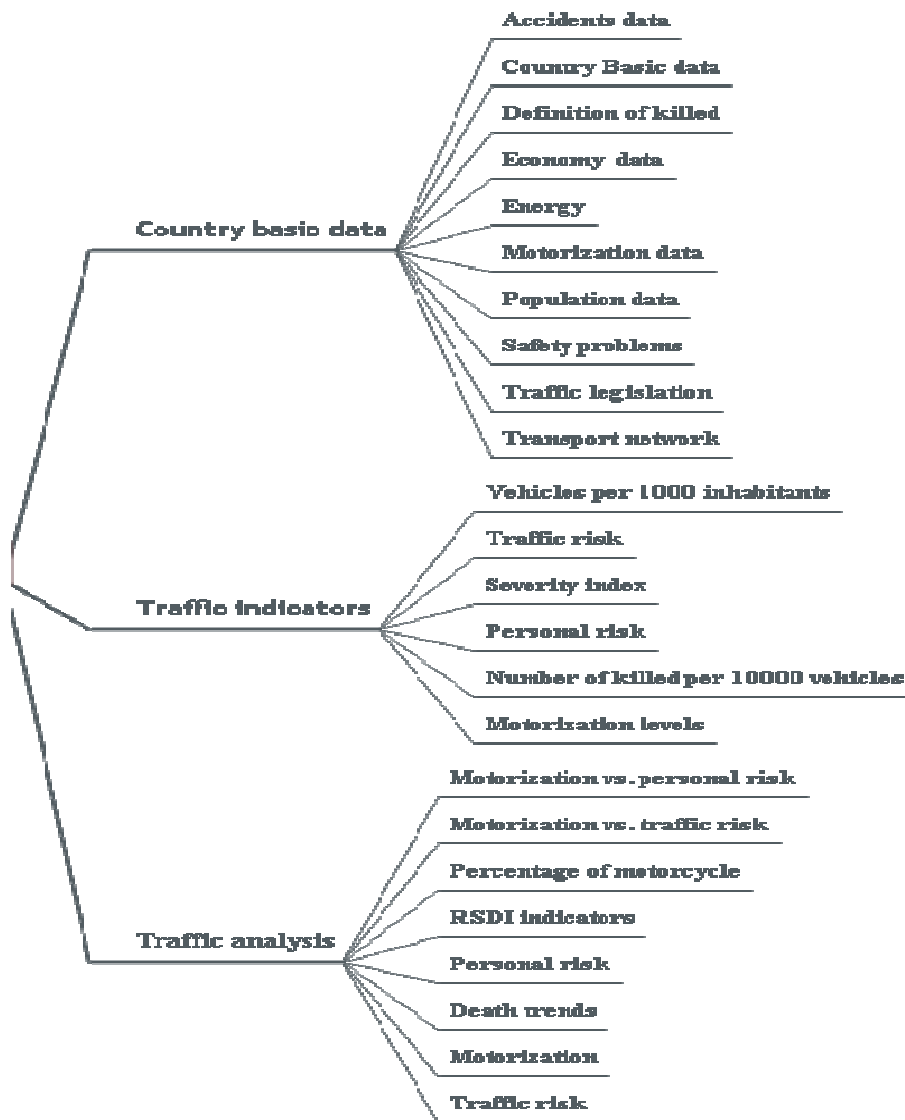
Figure 1. The data set as arranged in the GLOBESAFE system.

4. ESEARCH FINDINGS

Presented below are the findings from the preliminary study and investigation.

4.1 Multiple data sources

Since there are many groups interested in road safety data, each group will tend to have different needs and reasons for requiring the data. One important characteristic of road accident data is that the sources of such data are varied and all of these sources suffer from over-reporting and under-reporting problems (Wegman, 2001) (figure 2).

Parts of figure (2) summarize the way in which users are dealing with the current road safety data sources. To be able to obtain adequate data the user of data searches different sources (dashed line in the figure) and databases to get consistent and reliable data with the required level of aggregation. The above mentioned problems imply that there is a methodological problem regarding how the collection, analysis and dissemination of road safety information can be made more efficient. Searching through different databases and information sources can be a time consuming task. Also verification of the different data sources which may be in different formats and media can be an additional task in the process (Hills and Baguley, 1994).
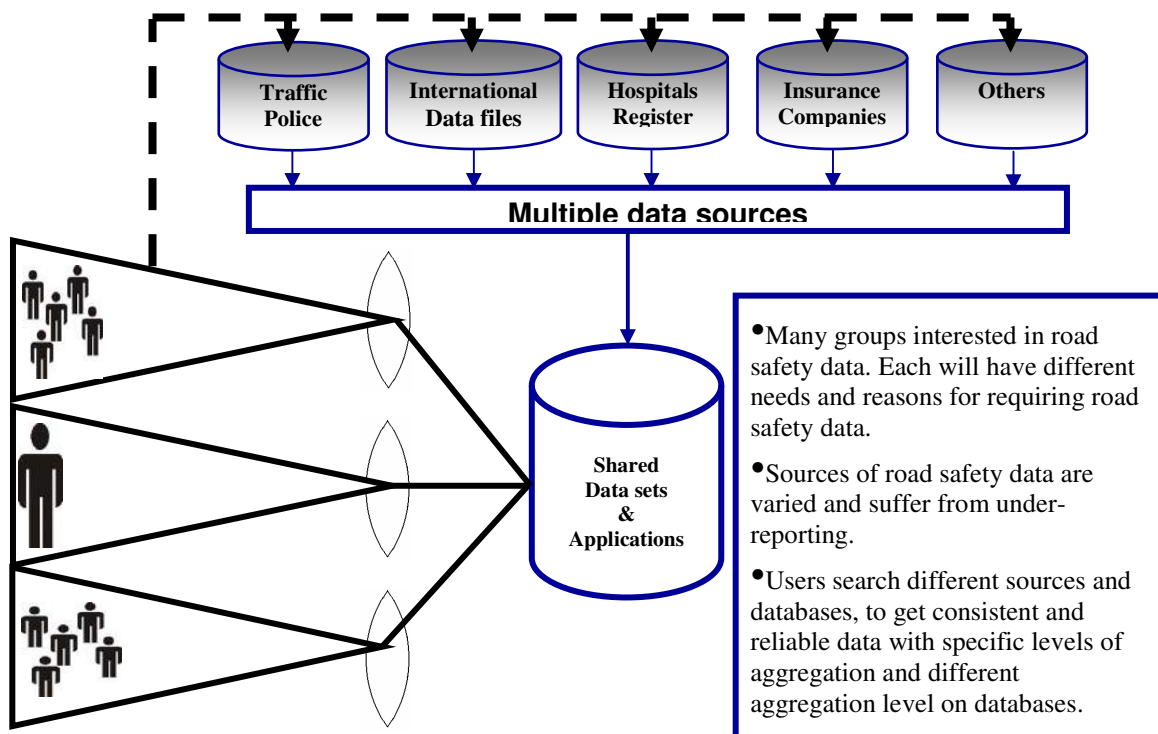
Figure 2. Multiple sources and multiple views

4.2 Data linkages

Road accidents and injury data are collected and stored by a range of agencies, such as Police, Health institutes (e.g. hospital inpatient records, emergency room records, ambulance and emergency records), insurance firms, transport companies, special interest groups in road safety, and government departments collecting data for national planning and development. This reflects the multi-sectoral nature of the phenomenon and raises important issues to do with access, harmonization and linkages between different data sources and users (Hills and Baguley, 1994; Brouwer, 1997). Ideally, where there are a number of data sources available, it is important that the data sources should be linked and indexed in a way that makes such tasks easier, to obtain maximum value from the information.

4.3 Definitions and standardization of data

There is a number of potential problems with the definitions of a road traffic death or injuries resulting from road traffic accidents:

• Variations in the interpretation of the specified time period between the injury event and death;

• The actual interpretation of the definitions in different countries and by different persons recording the information and describing the circumstances of the accidents.

The following example shows how different road accident database providers have different definitions and semantics for the same attributes in the schema, as can be seen in the definitions found in the Community Road Accident Database 'CARE'[3] and Traffic Bureau Japan[4] (JTB) for the definition of those killed in accidents. CARE counts persons that died **within 30 days** after the accident as accident fatalities where JTB only counts those who die **within 24 hours** after the reported accident. The variations in the definitions and semantics of the attributes of road accident databases and the coverage of the injury categories (person with fatal injury, person with incapacitating injury, person with non-incapacitating evident injury, person with possible injury) demonstrates the need to standardize accident registrations and definition of accident database schema (Connolly and Begg, 2005).

4.4 Under-reporting

In many road accident databases there is under-reporting of road accident deaths and injuries (Sluis, 2001). Under-reporting of injuries is known to be even worse than with the problem related to reporting of fatalities. Based on the (IRTAD)[5] report and Transport Research Laboratory reports (TRL)[6], earlier studies have estimated that only approximately 50 percent of road injuries were reported. This leads to significant variations in the number of injury accidents reported, and their reporting rate. Under-reporting highlights a number of *structural*, *methodological* and *practical issues* affecting the quality of data collected on road traffic accidents including:

• The coordination and reconciliation of data between sources;

• The harmonization and application of agreed definitions.

4.5 Data accuracy and consistency

Accurate data are essential for prioritizing public health issues, monitoring trends and assessing intervention programs (Peden et al., 2002). Many countries have inadequate information systems on road traffic injury, making it difficult to realize the full nature of the problem and thus gain the attention that is required from policy and decision-makers (Proctor et al., 2001). There are a number of areas where road traffic injury data often are problematic. An example of such a situation is the identification of the sources of data, e.g., especially when data are from a number of different data sources).

4.6 Quality of information flows

In nearly every country in the world a system exists in which the police has the task of registering road accidents (Ghee, 1997). The police do not always send accident registration forms to the national accident registration body (Hills and Elliott, 1998). This leads to problems concerning the quality of information flow between the accident registration form

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[3] http://europa.eu.int/
[4] http://www.iatss.or.jp/
[5] http://cemt.org/IRTAD/
[6] http://www.trl.co.uk/

completed by the police and the organization that processes them into a database and periodically publish the most important statistics.

4.6 Willingness of organizations to share information

The willingness of organizations to share the information and work in partnership together is the cornerstone of a successful and effective information sharing system (Tosta, 1992). In addition, the *data set* should be defined and agreed upon; this data set can be regarded as *common vocabulary*, which is an essential for comparisons of road safety situations between different countries and regions. Another feature of the common vocabulary is that it will help in the future to reuse and share applications across different systems (Guarino, 1998).

5. THE CONCEPTUAL MODEL

At the initial stage of this research, we formulated a conceptual model. The conceptual model helps to define the problem domain and serves different purposes during research (Engelbart, 1962; Gottesdiener, 2002). We propose a conceptual model, figure (3), for information sharing among road safety organizations that is implemented in the system. Basic functionalities of the model were defined in accordance with empirical studies and data collected during the research from domain experts. With respect to the required functions, the model's components and the relationships between them are defined. A triple-layered model is proposed: the bottom layer comprises the underlying infrastructure (contents, data format, access methods and agreement between users, standards and road accidents data system). Above this layer is the data needs layer (information objects, common vocabulary and data sets). At the top of the model is the application layer, in which we define different applications that could be developed with the other layers and satisfy user needs. We define interaction modes that exist between the users and the three layers model.
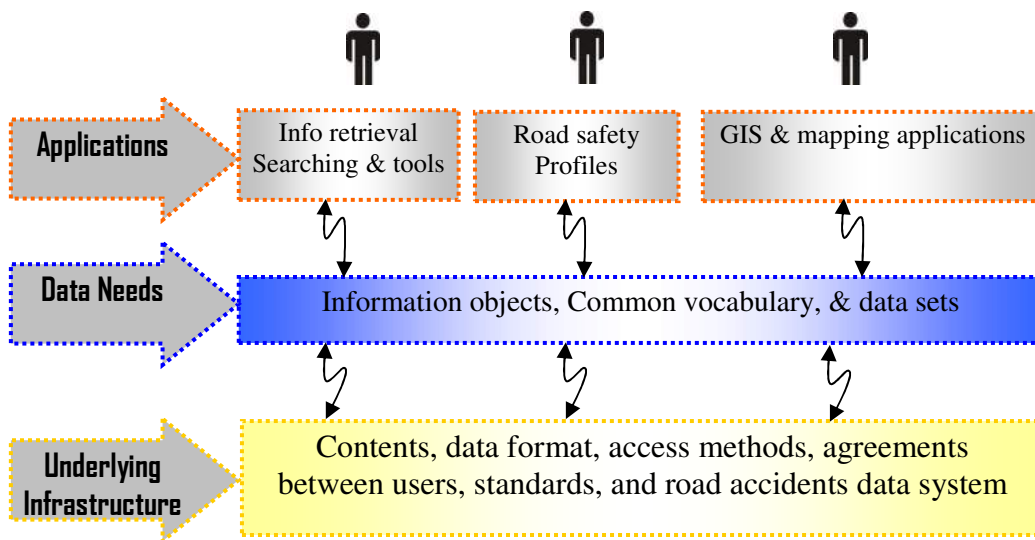
Figure 3 Suggested conceptual model

6. METHODS AND DESIGN

Suitable research methods are required to help the researcher improve his/her knowledge about the problem surrounding the research, (Gottesdiener, 2002) and provide well-defined strategy and approach that will help to build the overall research design and plan (Mark and Thorpe, 2002).

At the early stages of the research, process data was collected to maintain requirements specifications; this was done by using interviews that helps to establish the conceptual model's objectives and functionalities. Interviews are for this purpose appropriate according to Murch (2000) to help to discuss the model with different stakeholders and build up an understanding of their requirements during the research. The results of the interviews with the domain experts gave general requirements, many of which were very poorly understood, recognized, and difficult to demonstrate for the domain experts without the software available. To solve such problems in the research a prototype was used as a complementary method. A prototype can be defined as a demonstration system which shows end users and system stakeholders how the requirements can be implemented (Sommerville and Pete, 1997). The reason for using prototyping is to simulate the behavior of the system that enables end users to refine their ideas and requirements about the system. The position of the conceptual model and the prototype process in the research design is shown in figure (4).
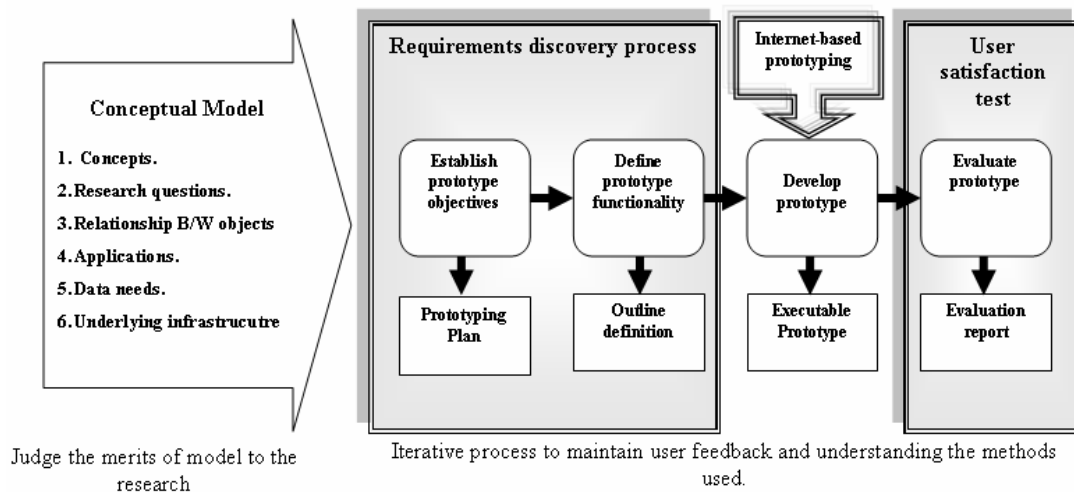
Figure 4 Overall research design

7. COMMON VOCABULARY

To overcome definitional and semantic problems, we built a common vocabulary that helps to identify the concepts used. Ontology is a formal explicit description of **concepts** in a domain of discourse 'UoD (Gruber 1993)here we used ontology that allowed us to develop this **common vocabulary** (Guarino, 1998) for reporting, classifying and analyzing road safety data using knowledge acquisition and representation tools. In the system we can define the following: (1) Domain (UoD) = road safety, (2) Class = **concepts** in the domain, (3) Slots = properties of the concept.

There is no one "correct" way for developing ontologies (Gomez-Perez et al., 2002). We used the conceptual Map (Albert and Steiner, 2005), figure (5) for representing and communicating knowledge between domain experts and also the Protégé-Frames[7] to develop a formal ontological model.

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[7] http://protege.stanford.edu/
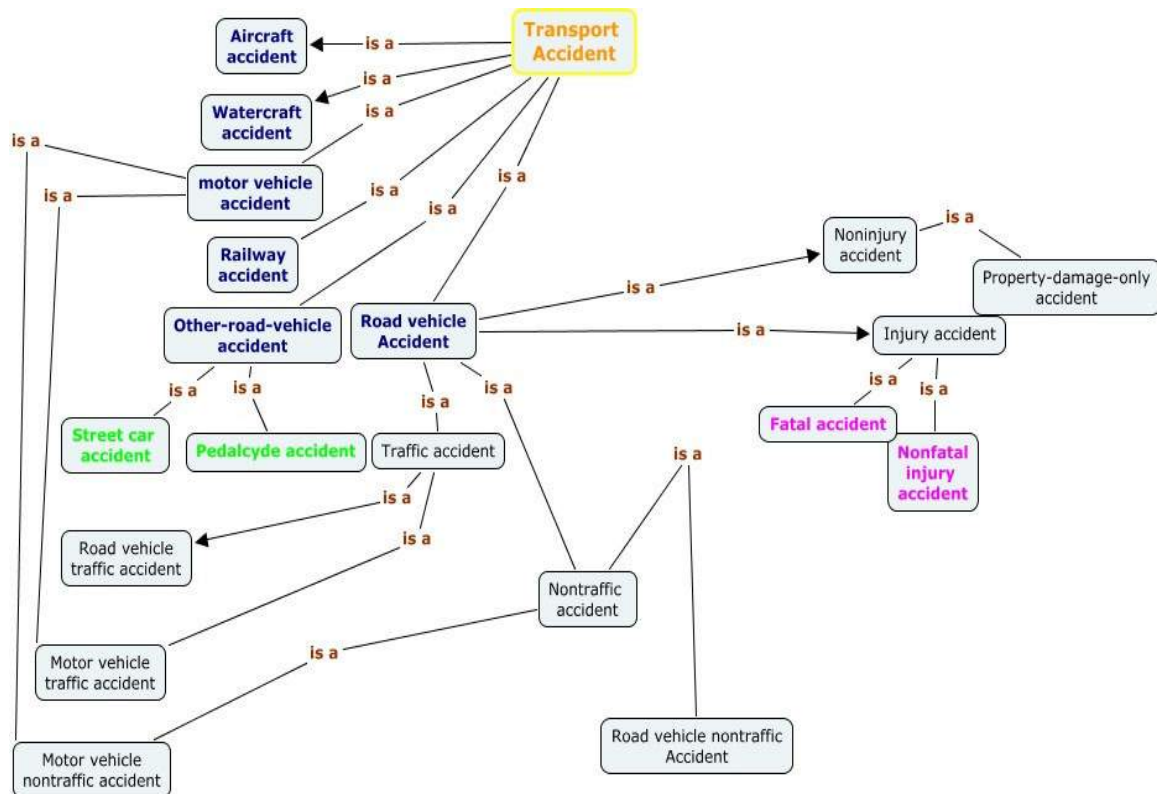
Figure 5. A simplified ontology for transport accident and its subclasses in is-a relationship

8. SYSTEM OVERVIEW

The system was consolidated as part of an existing internet based education and training system at Linkoping University[8] ASEAN Safety Network (ASNet) figure (6). The use of the internet can support sharing of knowledge and experience (Makedon et al., 2003) that normally is captured in a traditional class room environment, which requires that all partners in the education process should be physically attending the class (Docherty et al, 2005).

8.1 ASNet System[9]

Created in 2003, is an Internet-based regional network designed to strengthen the regional cooperation related to traffic safety via ICT of the 10 ASEAN countries (Thailand, Philippines, Laos, Cambodia, Malaysia, Vietnam, Indonesia, Myanmar, Singapore and Brunei). ASNet objectives are to create a sustainable support system for capacity building by providing modern tools that (1) enables communication between the practitioners, (2) enables sharing of knowledge and best practice solutions, (3) provides a system for delivering training for trainers, (4) Analysis system that helps to measure road safety situations and carry out safety programs.

In order to provide solutions we have designed GLOBESAFE to be linked to other parts of ASNet (Dong et al., 2001). The design principles that form the basis for the GLOBESAFE system are considered in our research as premises for system design and based on the ideas from (Morville and Louis, 2002). It should be structured in a way that helps

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[8] http://www.liu.se/en/
[9] http://www.virtech.se/virtech%20asnet.htm

1.To collect and analyze both country traffic safety, socio-economic and energy consumption data. This data should be up-to-date, comprehensive and accessible worldwide.

2.The system should be able to generate and present a rich set of important indicators needed to analyze the traffic safety situation in a certain country.

Two methods have been applied in GLOBESAFE.

• Methods that can calculate and analyze so called performance indicators that can be used as a diagnostic tool when comparing the traffic safety situation in different countries.

• Use of web mapping to demonstrate safety situation spatially & provides visual comparison.
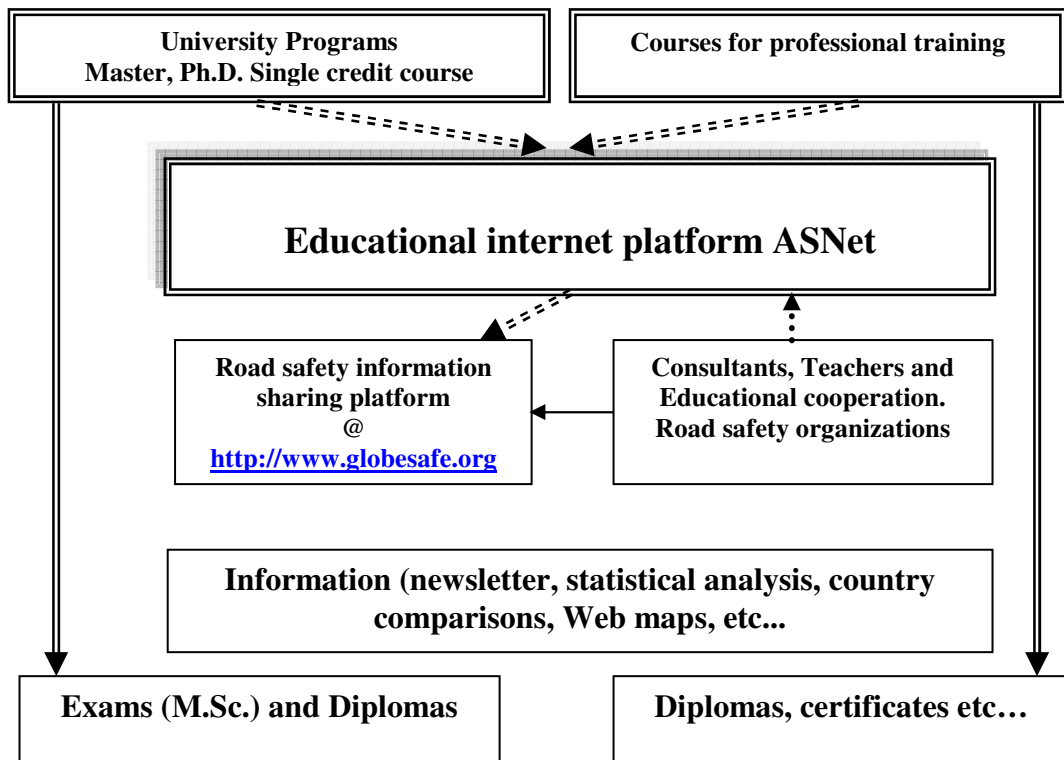
Figure 6. ASNet framework

9. RESULTS AND CONCLUSION

This paper has presented a system that addresses the needs for information sharing platform for road safety organizations. There is a great potential in the current technologies and models of sharing that has been implemented in this research. The research methods used in this work guide us to reach our goals. During requirement elicitation and development of the data sets, some of the requirements were unclear and ambiguous, prototyping helped to clarify such requirements. User feedback obtained from using the prototype was found to be valuable, especially compared with the unstructured interviews.

From the work done and the results obtained so far, we conclude that developing a conceptual model at the early stage of the research provides the researcher with a working strategy and orients the research towards specific sets of research questions. In addition, the model provides overviews of the research domain (essential objects or components of the system to be studied). However, through more studies we gain more understanding of the research problems and relationships between different actors playing roles in the domain. The system

is available online at http://www.globesafe.org and some parts of it have been evaluated using usability methods in Abugessaisa et al. (2006).

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TELEMEDICINE TRANSFER IN SUB-SAHARAN AFRICA: INVESTIGATING INFRASTRUCTURE AND CULTURE

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ABSTRACT

This research focuses on telemedicine technology transfer; to date, few comprehensive studies have examined influence of infrastructure and culture that challenges the adoption of telemedicine in developing countries. The study shapes future policies influencing telemedicine transfer outcomes in Sub-Saharan Africa, and could provide some prescriptive directions for policy makers in the SSA governments, and motivation to adopt visually-based clinical applications of telemedicine

Keywords: Telemedicine Transfer, Sub-Saharan Africa, Information and Communication Technologies

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TELEMEDICINE TRANSFER IN SUB-SAHARAN AFRICA: INVESTIGATING INFRASTRUCTURE AND CULTURE

1. INTRODUCTION

Sub-Saharan Africa (SSA) is facing continuous health threats characterized by pandemic of infectious diseases (HIV/AIDS, Malaria) and high levels of infant-maternal mortality, low-life expectancy and deteriorating healthcare facilities. Healthcare services, trained personnel and construction of health facilities have deteriorated. SSA, with 24% of the global burden of disease, has only 3% of the world's health workers and spends under 1% of world health expenditure (WHO, 2006). A combination of factors, like "brain drain," underlies the severe shortage of skilled health professionals. Concentrated urban health centers further limits access. About 70% of SSA populations live in rural areas with communities having poor or no access to health facilities, resulting in over 65% of SSA countries lacking essential care services.

Telemedicine is defined as the use of information technologies to exchange health information and provide health care services across geographical, time, social, and cultural barriers (Reid, 1996). In general, telemedicine technology includes both store-and-forward - asynchronous as well as live videoconferences – synchronous transmissions via satellite networks. In the last decade, pilot studies in SSA countries have shown the potential benefits of telemedicine for patients and healthcare providers (Kifle et al., 2006). The results demonstrated the socio-economic impacts of telemedicine, and its potential in the area of improving accessibility, containing costs, and providing quality care (Brauchli *et al.,* 2004; Craig *et al.,* 2005; Kifle *et al.,* 2006).

Despite high hopes, however, telemedicine has been slow to come into routine use. Numerous studies document problems related to telemedicine technology in general. These studies often point to scarcity of resource (Wootton, 2001), poor telecommunication infrastructures (Bashshur et al., 2002), human elements (Chau & Hu, 2002), policy-related changes (Vargneses & Scotte, 2004), and socioeconomic and cultural barriers (Straub et al., 2001).). Information and Communication Technology Transfer (ICTT) has intrigued information systems researchers (Dutta, 2001); still, few researchers have studied factors affecting telemedicine transfer within SSA.

1.1 RATIONALE & SIGNIFICANCE

We examine ICTT as it applies to telemedicine in SSA. Previous ICTT attempts from partners in developed countries to developing countries have failed because of neglecting infrastructural, socioeconomic and cultural factors that impact such transfers (Avgerou & Walsham, 2000; Bada, 2002; Loch et al., 2003; Mbarika et al., 2001; Meso et al., 2005, Straub et al., 2001). Accordingly, understanding barriers due to infrastructural and cultural factors for telemedicine transfers motivates this work.

The following rationale underscores the research significance:
(1) Recent ICTs (and telemedicine) developments in SSA are encouraging, including wireless ICT diffusion, Internet use, electronic information exchanges, and remote consultations.
(2) Healthcare is essential for SSA with the region's multiple medical problems. Many have reported growing medical problems in SSA. These problems stimulated new approaches like telemedicine for better access and reduced costs.
(3) There is dire shortage of medical personnel and facilities in SSA.

(4) The "brain drain" phenomenon is apparent throughout SSA. WHO (2006) statistics revealed that SSA-trained physicians currently practicing in OECD countries represent 23% of existing doctor workforce in countries of origin.

(5) Healthcare providers in developing countries and international organizations are promoting telemedicine transfer. Additionally, influence of ICTs due to governmental policies, economic, sociopolitical, cultural and infrastructure factors have attracted international collaborations (Avgerou, 1998).

1.2 RESEARCH QUESTIONS

Our questions center on ICT infrastructural and cultural- factors influencing telemedicine transfer social and value outcomes in SSA.

1.2.1 NATIONAL INFRASTRUCTURE

Infrastructure factors impacting telemedicine outcomes at the national level include: the national ICT infrastructure and the government's readiness, attitudes and policies towards ICT in health and healthcare development.

Studies have shown the importance of ICT diffusion at the national level (Avgerou, 1998). National Information Infrastructures (NIIs) are shared community resources, supporting a variety of activities not especially tailored to telemedicine. NIIs are relevant because telemedicine acts as a communication infrastructure to service healthcare sector holistically, not just for targeted applications among isolated institutions/individuals. SSA lacks a comprehensive telemedicine infrastructure, and one challenge to transferring telemedicine is NIIs.

> **RQ1:** What aspects of NIIs positively relate to telemedicine transfer outcomes in SSA*?*

1.2.2. CULTURAL-SOCIAL ISSUES

Another question is the influence of national culture on SSA telemedicine transfer outcomes. Past research has investigated impacts of culture on IT adoption and use (Leidner and Kayworth, 2006; Straub et al., 2001). Results indicated that the cultural context of developing countries might be so different that a cultural-social impact on ICTs (telemedicine) can be expected.

> **RQ2**: What cultural and implementation factors positively relate to telemedicine transfer outcomes in SSA?

2. THEORY

Specifically, this project studies impacts of national policies (ICT, e-health, security and standard),infrastructure, environment and cultural-social factors on visually-based clinical applications at differing level of technology maturity (radiology, dermatology, pathology, ophthalmology), application purpose (diagnostic, consultation, monitoring) and communication infrastructure (technology, bandwidth, synchronous vs. asynchronous).

2.1 TELEMEDICINE TRANSFER OUTCOMES

Generally, telemedicine is seen as offering socioeconomic benefits in cost reduction and improved access of health services. Economic savings are major factors motivating IT adoption. Social benefits embrace increased access to specialized healthcare (Kifle et al.,

2006a; Stanberry, 2000), improved interactions and opportunities for follow-up (Fraser & McGrath, 2000), and reduced isolation of healthcare service providers (Wootton, 2001).

The ISO recommends basing health outcomes on some standards. Field (1996) measures IOM model outcome indicators in relations to access, cost, and healthcare quality. Access refers to individual (group) ability to obtain needed services while cost refers to the economic evaluation of telemedicine vis-a-vis traditional alternatives. Cost may be affected by transportation, volume, time sensitivity of care, and expenditure on alternative (Kifle et al., 2006b; McIntosh & Cairns, 1997). Quality refers to satisfaction of clients (providers) on the care process (Donabedian, 1980).

The social and value outcomes of telemedicine dimensions deal with the issue of inadequate access to healthcare, and rising health costs as a consequence of the high level of disease burden. The potential of telemedicine system can be expected to improve access to healthcare, and the efficiency with which it is delivered. Thus we hypothesize:

H₁: Telemedicine capabilities are positively related to value outcomes of telemedicine.
H₂: Telemedicine capabilities are positively related to **social** outcomes of telemedicine.
H₃: Social outcomes of telemedicine are positively related to value outcomes of telemedicine

2.2 NIIS FOR SSA TELEMEDICINE

2.2.1 IT POLICIES

IT policies impact SSA telemedicine implementation. Government policies have been highly instrumental in IT diffusion. Within SSA, governments control most of IT infrastructures and uphold different policies that influence acquisition and private use of these infrastructures. With policies encouraging IT ownership and investment, it is expected that IT will be more readily transferred to all population segments.

Privatization is another major IT policy issue in SSA. Government owns and manages key infrastructures needed for the transfer of telemedicine technologies like the telecommunications operator who provides phone-lines for Internet, fax, and email. As some governmental policies restrict privately-owned IT services, these can become unusually expensive and often lack quality due to absence of competition (Checchi et al., 2002, Dutta, 2001)

Research on effects of ICT policy on ICT development generally indicates that policies favoring ICT development will help growth of national ICT infrastructures. Thus, we hypothesize:

H₄ₐ,ᵦ: Policies favoring development of ICTs in general are positively related to (a) telemedicine capabilities; and (b) level of ICT infrastructure.

2.2.2 EHEALTH POLICIES

Researchers have discussed the actual need for a "telemedicine policy," which can support decision-making and instill greater public awareness (Vargneses & Scotte, 2004). Conversely, absence of such public policies poses problems for telemedicine. Thus, we hypothesize:

H₅ₐ,ᵦ: Policies specifically tailored to promote ICT applications in healthcare are positively related to (a) telemedicine capabilities; and (b) level of ICT infrastructure.

2.2.3 DATA SECURITY POLICIES

Stanberry (2000) noted the need for security polices and standards to address the unique combination of patient data, video imaging, and electronic clinical information that is generated between two distant sites during telemedicine sessions. Privacy concerns normally pertaining to patient data may be magnified within telemedicine. Issues of data security relate to confidentiality, integrity, availability, and accountability. Thus, we hypothesize:

> **$H_{6a,b}$:** Policies specifically tailored to ensure data security and standards are positively related to (a) telemedicine capabilities; and (b) level of ICT infrastructure.

2.2.4 IT INFRASTRUCTURE

Briefly, telemedicine is physicians using IT to examine patients remotely. To enable telemedicine, a country needs a solid IT infrastructure. Previously, telecommunications infrastructure was measured in "teledensity," the number of land lines/capita (Mbarika et al., 2002). However, with the proliferation of wireless telecommunications, a broader perspective in identifying IT infrastructures emerges.

Owing to various socioeconomic and political problems faced by SSA countries, the region has the lowest levels of IT-related infrastructures in the world. SSA countries share a set of IT problems: among them are a huge supply-demand gap; a strong distribution imbalance favoring urban over rural areas; poor service quality; long waiting times for new services; and peak traffic demands exceeding network capacity. The result is extremely low levels of basic telephone penetration.

There are several factors that can influence the use of national ICT infrastructure in developing countries. These include data transmission speed, bandwidth, availability, or reliability of maintenance services. Additionally, two commonly cited elements of ICT infrastructure on telemedicine outcomes issues are bandwidth and impact of the Internet. Broader bandwidth allows for more data to be transmitted more quickly and enables greater resolution that will expand the technical capacity of telemedicine. Also, the Internet has become a medium for transmission of data for teleconsultation and communications used by health providers. Thus, we hypothesize:

> **H_7:** More reliable and readily accessible ICT infrastructure is positively related to telemedicine capabilities.

2.2.5 HEALTH ENVIRONMENT

Adoption of telemedicine has been driven justifiably by factors like healthcare organizational services access, improvement in organizational performance, effectiveness, efficiencies, and competitiveness. Indeed, organizational readiness and availability of appropriate conditions/needs are also motivators for telemedicine adoption.

Tornatzky & Fieischer (1990) suggest the combination of organizational, technological and environmental contexts to determine organizational innovation adoptions. An organization can influence its internal conditions (readiness to particular technology adoption) and a complex technology is unlikely to be adopted (Hu et al., 2000). Organization readiness is important as it reflects potential services volume, thereby determining the extent to which innovations can be translated into reality. Physician readiness and acceptance, however, are primary challenges for telemedicine projects.

Telemedicine allows organizations to access, conveniently, skills and knowledge beyond that which is currently available. Here, we extracted from studies specifically focused on healthcare infrastructure and telemedicine readiness in the context of developing countries. Here, we hypothesize:

H$_8$: Greater readiness for telemedicine is positively related to telemedicine capabilities.

H$_{9a,b}$: The quality of healthcare infrastructure is positively related to (a) telemedicine capabilities; and (b) social outcomes of telemedicine.

2.3 CULTURAL-SOCIAL ISSUES INFLUENCING SSA TELEMEDICINE

2.3.1 IMPLEMENTATION

Implementation factors include top management support; financial/technical support; user satisfaction; and system usage. Moore & Benbasat (1991) note that 30% of IT innovation failures were non-technical organizational factors. Other factors include user training, organization readiness, managerial commitments and organization logistical support. Here, we have focused on previously identified considerations pertinent to developing countries, including efficiency, cost, technology, and social factors. We hypothesize:

H$_{13}$: Implementation effectiveness is positively related to telemedicine capabilities.

H$_{14}$: Rational decision-making factors are positively related to telemedicine capabilities.

2.3.2 BELIEFS-VALUES & TECHNOLOGY CULTURATION

Culture is complex, assessed typically in multiple dimensions. While few study the impact of cultural factors specific to telemedicine, considerable research has examined cultural dimensions of IT transfer. The beliefs and values that people have ingrained in themselves by their cultural context significantly affects their thinking and perspective, and hence their approach to using technology (Bada, 2002).

Straub et al. (2001) divided "Culture" into two sub-constructs:
(1) Culture-specific Beliefs-Values, representing specific beliefs or values a person might hold because of the influence of their heritage; It focus: *Power Distance*: 'the extent to which the less powerful members of organizations expect and accept that power is distributed unequally'; *Uncertainty Avoidance*: 'intolerance for uncertainty and ambiguity' (Hofstede and Peterson, 2000).

(2) Technology-Culturation, representing a person's exposure to a relatively technology-intense culture. For IT diffusion in developing countries, this could indicate the degree to which citizens of a developing country have been exposed to more technologically advanced cultures.

Despite the importance of culture, effects of cultural factors on telemedicine research have received isolated attention. Technology culturation has been generally neglected. We focus primarily on culture-specific beliefs in two cultural sub-constructs: Power-Distance and Uncertainty-Avoidance (Hofstede, 1998) and technology culturation.

Straub et al. (2001) noted that higher power distance country shows low technological adoption whereas those with low power distance culture orientation are likely to take new responsibilities. They argued that uncertainties could be reduced through effective use of technologies. We hypothesize:

H$_{10a}$: Power-Distance between senior healthcare practitioners and subordinates is negatively related to telemedicine capabilities.

H$_{10b,c}$: Power-Distance between senior healthcare practitioners and subordinates dampens the positive relation (b) of implementation effectiveness, reducing telemedicine capabilities; and (c) of rational decision-making, reducing telemedicine capabilities.

H$_{11a}$: Uncertainty-Avoidance in telemedicine decisions is negatively related to telemedicine capabilities.

H$_{11b,c}$: Uncertainty-Avoidance in telemedicine decisions dampens the positive relation of
(b) implementation effectiveness, reducing telemedicine capabilities; and (c) rational decision-making, reducing telemedicine capabilities.

H$_{12a}$: Exposure to technologically advanced cultures is positively related to telemedicine capabilities.

H$_{12b,c}$: Exposure to technologically advanced cultures enhances the positive relation of
(b) implementation effectiveness, further increasing telemedicine capabilities; and (c) rational decision-making, further increasing telemedicine capabilities.

3. RESEARCH MODEL

3.1 NATIONAL INFRASTRUCTURE

We postulated 6 predictor constructs to influence telemedicine transfer outcomes on the national level. National ICT polices have three dimensions:

(1) General ICT policies -- government's objective to prioritize ICTs for national development;
(2) E-health policies -- government's attitude and commitment to improve healthcare development by using ICT; and
(3) Data security policies -- government's awareness and support of data standards and procedures for improving telemedicine communications.

ICT infrastructure impacts telemedicine capabilities uni-dimensionally; also, national policies have a direct effect on ICT infrastructure. Thus, ICT Infrastructure is a dependent construct that is both independent and itself dependent.

Health environment is bi-dimensional -- one that impacts the practice of health in general and the other that influences primarily telemedicine. Factors include the effectiveness and readiness of government in the healthcare institutions dimension.

3.2 CULTURE

Straub et al. (2001) showed that culture influenced IT technology transfer; indeed, the significance of cultural factors deepens in developing countries (Meso et al., 2005).

Telemedicine transfer implementation influences the effectiveness of the process of adopting telemedicine tools and practices. There are two specific factors here: culture-specific beliefs and values, and specific patterns of thinking that include the impacts of "power distance" and "uncertainty avoidance" on telemedicine outcomes.

"Technology culturation" is the influence of technologically advanced cultures on an individual's attitude to technology and the degree to which people are exposed to more technological advanced contexts. Besides their direct impacts on telemedicine outcomes,

cultural factors may interact with telemedicine transfer implementation to give a composite influence.

3.3 DEMOGRAPHICS

Besides theoretically-based items for model testing, a number of demographic data to characterize respondents were collected. These include the nature of respondents' organization, their technology expertise and specialty and how long have respondents have worked on ICT/health in SSA. Other data include gender, age, country, and educational qualifications.
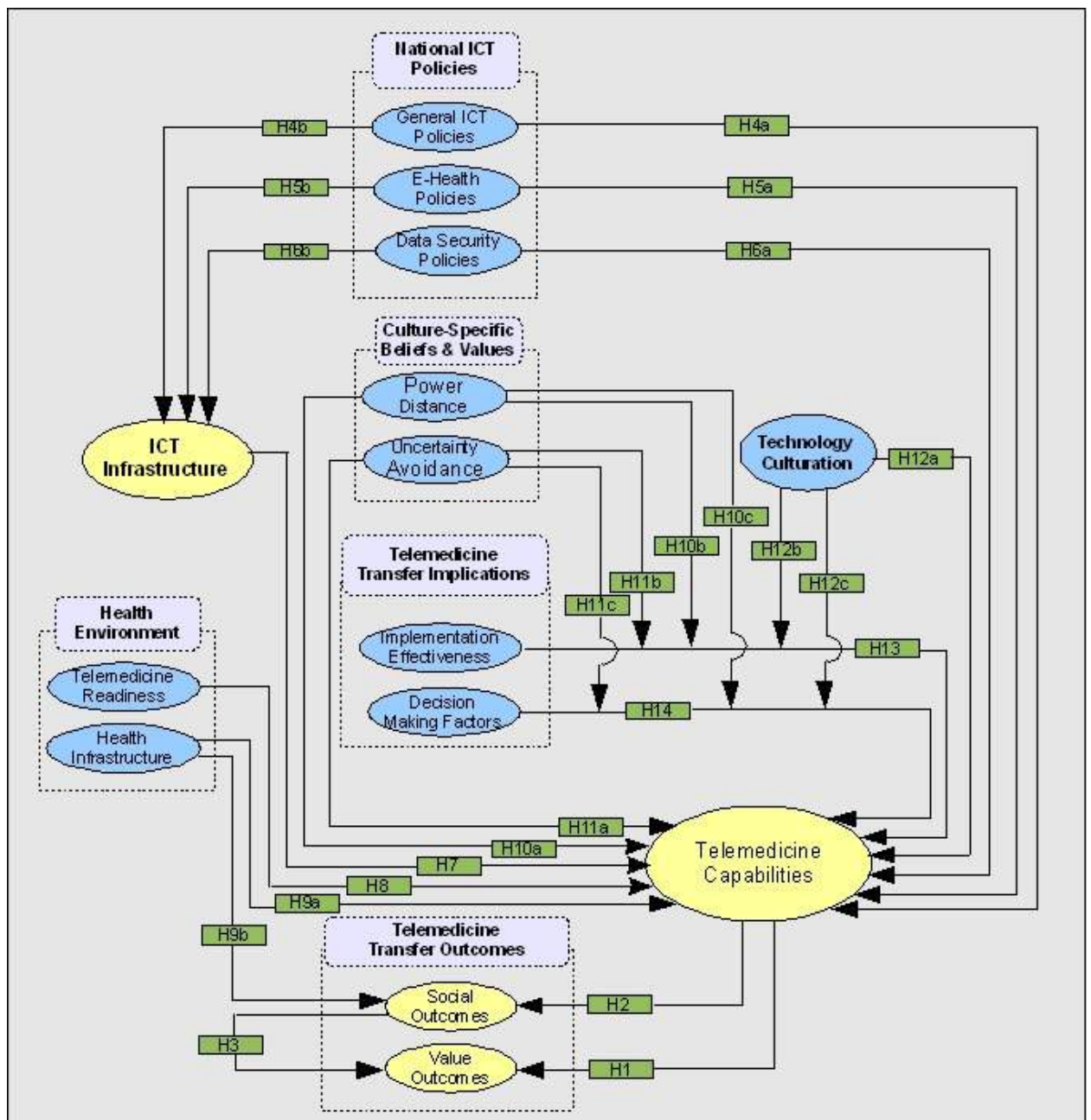

Figure 1 shows the overall model.

4. METHODOLOGY

We adopted a quantitative positivist research (QPR) approach as the guiding philosophy and methodology for our research. As Straub et al. (2004) noted, QPR consists of two foundations:

(1) Quantitative data gathering (or exploration); and
(2) Positivist philosophy dealing with problem-solving and theory-testing.

The principles determining how QPR rigor is conducted are essential for evaluating the quality of IS research. Here, we rigorously followed Straub's validation guidelines to strengthen "generalizablity" and "scientific soundness" of our research**.**

4.1 SURVEY PROCEDURES

Development of the survey instrument followed IS survey research methodology rigorously (Straub et al., 2004).

Relevant prior research to identify appropriate measurements were reviewed and discussed with a focus group comprising three experts from different specialty areas. The questionnaires were revised to fit SSA context and feedback was obtained from SSA physicians to ensure that each respondent understood the questions. The same focus group also studied the preliminary questions and evaluated *content validity*. An initial survey draft was developed based on group feedback, several minor modifications/iterations, including word choice.

Subsequently, we sent the instrument out to external researchers with domain expertise for *content and face validation*. One is an expert on cultural issues that impact ICTs; the others have specific expertise in ICTs for healthcare. 24 key informants (12 ICTs/healthcare practitioners and 12 physician/telemedicine experts) tested the high-level questionnaire to offer feedback for *content validation* (Cronbach & Meehl, 1995).

Eventually, a 90-item survey instrument covering all key constructs was developed. With nine demographic questions, there were a total of 99 questions in the pilot instrument. We have also included solicitations for qualitative comments at the end of each survey section. A 7-point Likert scale was used for all question items with "AAA" being equivalent to "strongly agree" and "DDD" equivalent to "strongly disagree". Telemedicine diffusion in SSA is, for the most part, in early stages of development and actual technology use is growing rapidly. Thus, the use of continuum methods is suitable for studying current factors that influence telemedicine transfer. Simultaneously, the approach enables the identification of potential factors impacting transfer of telemedicine barriers (see Appendix I for sample survey).

4.2 PILOT

The pilot study was aimed at assessing *reliability* of the instrument. A mailed survey, with initial questions being sent out to respondents in Ethiopia, was used in the pilot. To facilitate data collection, a letter signed by the university and the Ethiopian National Telemedicine Committee (NTC) was distributed to all participating institutions, asking for the identification of focal persons to participate in the study. The research was conducted across 17 institutions: four hospitals, five governmental, two private, three non-government, and three international organizations.

4.3 SAMPLE

The target population was chosen in consultation with the Ethiopian NTC, Addis Ababa Medical Faculty and participating international organizations.

We attempted to create a sample that would represent hospitals at different levels (tertiary, secondary, primary, and clinic) and different types (government, private, police, and army). Experts from government, non-governmental, and international organizations were included. Our final sample comprised health practitioners, telemedicine stakeholders, IT/health professionals, government policy makers, non-governmental organization officials, and academics involved with telemedicine in SSA. Within these organizations, we identified 82 professionals as potential participants. We arranged onsite face-to-face meetings for pre-contact with the pilot subjects; during those meetings we were able to validate each individual's willingness to participate in the survey. Those who voluntarily responded appear to have stronger opinions than those who did not.

4.4 DATA

Questionnaires were sent to the senior administrator and/or medical director of each organization. Data were gathered using a self-administrated questionnaire. Before distributing the instrument, each organization's management was informed of our intent by means of an introductory letter that briefly stated the study's purpose and its significance. Up to three calls were made to management in each of these target organizations, encouraging survey completion. Also, institute faculties entrusted their personnel management and physician contacts to request completion of questionnaires. Most questionnaires were delivered personally. Participants completed some immediately; enumerators collected some later; no responses were returned via fax or email.

Pilot data collection was done primarily onsite face-to-face from December 17th, 2003 through February 27th, 2004.

5. RESULTS

17 institutions were surveyed in our pilot study. The actual number of survey responses was 51 with 73.9% response rate. 36 responses were from health sector specialists (physicians) and 15 from IS (health) specialists. Pilot data have to be interpreted cautiously as the sample size was only marginally sufficient. Even so, we purport that such statistical analyses could be invaluable for suggesting changes and modifications to the main study. Moreover, detailed qualitative comments from respondents provided insight to finalizing the instrument.

Gender				Highest Education Level		
	No.	%			No.	%
Female	7	14		Bachelor's	2	4
Male	44	86		Master's	13	26
Total	51			Doctorate/MD	36	70
				Total	51	
Age						
	No.	%		Primary Specialty		
25-34	11	22			No.	%
35-44	16	31		IS	15	29
45-54	14	27		Medicine	36	71
55-64	9	18		Total	51	
65>	1	2				
Total	51					
Specialty				**Organization**		
	No.	%			No.	%

Dermatologists	4	11		Hospital Teaching	12	33
Ophthalmologists	6	17		Hospital Non-Teaching	16	45
Orthopedics	4	11		Private Clinic	3	8
Pathologists	6	17		Others	5	14
Radiologists	6	17		Total	36	
Doctors (NTC)	2	5				
Doctors (MOH)	2	5		**Telemedicine Knowledge**		
Surgeon	1	3			No.	%
Cardiologist	1	3		Not-at-All knowledgeable	3	6
Neurology	1	3		Somewhat Knowledgeable	11	21
Pediatrics	1	3		Knowledgeable	28	55
General Practitioner	2	5		Very Knowledgeable	9	18
Total	36			Total	51	

Table 1 displays descriptive analyses of pilot data.

5.1 MEASUREMENT MODEL ASSESSMENT

Using SPSS 10, *reliability* analysis to produce Cronbach's Alpha for each construct dimension was performed to determine which items to eliminate (or revise). We tested *discriminant validity* using Partial Least Squares (PLS 3.0), a second-generation multivariate technique that allows for testing of psychometric properties of scales used to measure a variable, as well as the strength and direction of the relationships among variables. Specifically, we conducted *convergent and discriminant validity*, including *Average Variance Extracted (AVE) analysis* (Marcoulides and Saunders, 2006; Straub et al., 2004).

5.2 RELIABILITY

Table 2 reveals that all Cronbach's alpha values (except for ICT penetration in health) were above 0.70, the acceptable cut-off point (Nunnally, 1978). In fact, most were above 0.90 ranges.

Constructs	No. of Case	Reliability Coefficients	Alpha
Telemedicine Outcomes	51	4	0.90
Technology-Culturation	51	4	0.93
Cultural-Specific Beliefs-Values	51	10	0.94
ICT Policies			
General ICT Policies	51	6	0.82
e-Health Policies	51	5	0.93
Data Security Policies	51	6	0.80
ICT Infrastructure	51	10	0.87
Telemedicine Implementation Factor			
ICT Penetration in Health	51	5	**0.69**
Telemedicine Support & Involvement	51	5	0.93
Implementation Effectiveness	51	4	0.91
Telemedicine Policy	51	10	0.86
Decision-Making factors	51	6	0.91
Telemedicine Readiness	51	15	0.79

Table 2: Cronbach's Alpha

5.3 CONVERGENT VALIDITY

Convergent validity assesses the degree to which items that should be related to a construct are, in reality, related. For this, the composite reliability coefficient was used, the value of which is determined by the respective loading of the items. The criterion established by

Nunnally (1978) pertaining to the reliability of constructs is that any construct having a composite reliability value equal or greater than 0.70 should be kept. Except for telemedicine readiness, **Table 3** shows all values to be above 0.87.

Constructs	Item	Convergent Reliability
Telemedicine Outcomes	SC	0.92
Technology-Culturation	CU	0.95
Cultural-Specific Beliefs-Values	CS	0.95
ICT Policies		
General ICT Policies	IP	0.88
eHealth Policies	HP	0.95
Data Security Policies	SP	0.89
ICT Infrastructure	II	0.91
Telemedicine Implementation Factor		
ICT Penetration in Health	PI	0.93
Telemedicine Support & Involvement	TI	0.87
Implementation Effectiveness	IE	0.93
Telemedicine Policy	TP	0.89
Decision-Making factors	DM	0.96
Telemedicine Readiness	RE	0.75

Table 3: Convergent Reliability

5.4 DISCRIMINANT VALIDITY

Discriminant validity reflects the degree to which each construct is unique: items associated with a construct correlate more highly with each other than with other constructs in the model. The square root of AVE calculated for each construct was compared to the correlation between each construct and other constructs. All values of AVE (the diagonals) are higher than the correlations between constructs (off-diagonals).

	IP	SP	HP	II	CS	CU	IE	TP	PI	TI	DM	RE	SC
IP	**0.700**												
SP	0.033	**0.720**											
HP	0.014	0.281	**0.780**										
II	0.028	0.058	0.017	**0.720**									
CS	0.055	0.026	0.035	0.005	**0.760**								
CU	0.032	0.063	0.045	0.035	0.653	**0.820**							
IE	0.010	0.298	0.812	0.006	0.047	0.064	**0.770**						
TP	0.531	0.017	0.083	0.011	0.081	0.033	0.094	**0.660**					
PI	0.025	0.004	0.085	0.003	0.353	0.291	0.124	0.030	**0.760**				
TI	0.106	0.056	0.025	0.018	0.637	0.415	0.026	0.034	0.204	**0.810**			
DM	0.003	0.029	0.013	0.016	0.669	0.682	0.033	0.000	0.283	0.309	**0.780**		
RE	0.004	0.006	0.054	0.005	0.057	0.027	0.070	0.021	0.148	0.008	0.026	**0.590**	
SC	0.399	0.030	0.018	0.014	0.180	0.240	0.037	0.361	0.049	0.189	0.085	0.056	**0.780**

Diagonal elements are square root of average variance extracted, and the other matrix entries represented the correlations between constructs

Table 4 indicates all constructs in the model demonstrated *discriminant validity*.

5.5 INSTRUMENT MODIFICATIONS

Instrument *validity*, which includes content, constructs, discriminant, convergent and reliability analysis, guided its modifications for main study. When convergent reliability and Cronbach's alpha met the threshold 0.707, items were kept.

After conducting various analyses, these steps were taken to finalize the instrument for the main survey:

(1) Items loaded poorly on respective factors based on reliability analysis were dropped/modified;
(2) Detailed qualitative comments from respondents were carefully examined to guide instrument revisions; and

The three domain experts who had initially assisted in the pilot instrument development were repeatedly consulted on which items to revise, drop, or add to the final instrument.

6. WORK IN PROGRESS

Currently the main study data are being analyzed for measurement and structural equation modeling. The interpretations and discussions of partial results will be presented at IFIP 2007.

Prior to any telemedicine implementation in SSA, it is worthwhile to understand potential factors influencing such a telemedicine transfer -- the impacts telemedicine will have upon policies, infrastructures, health environment, implementation factors, culture-specific beliefs-values, and technology-culturation. This study aims to help us understand how the national infrastructure and culture influence telemedicine transfer in SSA and to minimize some of the unanticipated elements that may accompany telemedicine transfer.

7. IMPLICATIONS

This study has important implications for practice, and could provide some prescriptive directions for policy makers in the SSA governments, and motivation to adopt visually-based clinical applications of telemedicine. Besides the general implications for the governments and the research community, multinational companies involved in telemedicine and other ICT projects could better understand the factors influencing the transfer of telemedicine in SSA. Government policy makers will have new insight into the effectiveness of various national infrastructures on telemedicine transfer in their respective countries. This could help them focus efforts on visually-based clinical applications and low-cost (store-and-forward) telemedicine technology.

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Appendix I. An Example of Postal Version of the survey
Telemedicine Survey

IMPORTANT DEFINITIONS FOR THE SURVEY

SUB-SAHARAN AFRICA (SSA): FOR THIS SURVEY, SSA REFERS TO ALL AFRICAN COUNTRIES EXCLUDING NORTH AFRICA (MOROCCO, ALGERIA, TUNISIA, LIBYA, AND EGYPT), AND THE REPUBLIC OF SOUTH AFRICA.

Telemedicine: **the use of medical information exchanged from one site to another via electronic communication for the health and education of the patient or health care provider and for the purpose of improving patients care.**

Image based telemedicine applications: less contact with patients and mostly applied for consultation or second opinion, (such as, teleradiology, telepathology, teledermatology, teleophthalmology, telecardiology) most common use of store-and-forward images.

Internet: E-mail, the world Wide Web (WWW), FTP, chat, instant messaging, Voice over IP, and other services.

ICT or IT: Information and Communication Technologies (ICTs) or Information Technologies (IT) includes all telephone, computer and network-based technologies: wireless, fixed, satellites, the Internet and so on

Select one country in Sub-Saharan Africa for this survey:
_____
(In the space above, please write the country in SSA that you are most familiar with.
What is your specialty (self declared):
_____
How would you describe your knowledge of ICT in health care: O not at all   O somewhat O knowledgeable O Very Knowledgeable?

Please answer all questions in this survey to the best of your ability.
Telemedicine outcomes in Sub-Saharan Africa

Adaptation of telemedicine technology in many organizations has been driven by legitimate motivations, including service improvement (the degree to which health care service for individuals and population), access (timely receipt of appropriate care), cost effectiveness (economic value of the resource use associated with the pursuit of defined objectives or outcome), acceptability (with the degree to which "patients, clinicians, or others" are satisfied with a services or willing to use it), efficiency and competitiveness enhancement.

Please indicate how much you agree or disagree that image based telemedicine applications in your country will have the following **potential**.

DDD=Strongly Disagree; DD=Disagree; D=Somewhat Disagree; N=Neutral; A=Somewhat Agree; AA=Agree; AAA=Strongly Agree	DDD	DD	D	N	A	AA	AAA
1. **Practice improvement:** Telemedicine service reduce medical error by means of evidence-based care through best practices made possible by integrated decision –support tools as well as more knowledgeable workers through convenient and accessible online continuing education.	O	O	O	O	O	O	O
2. **Cost:** From informed decision-making leading to more efficient use of medical and clinical resources.	O	O	O	O	O	O	O
3. **Knowledge**: Education, training and continuing professional development.	O	O	O	O	O	O	O
4. **Service:** Using telemedicine infrastructure to close loop on data and information, horizontal and vertical.	O	O	O	O	O	O	O

OPEN SOURCE: TOWARDS SUCCESSFUL SYSTEMS DEVELOPMENT PROJECTS IN DEVELOPING COUNTRIES

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Abstract:　Open source software (OSS) has recently become the subject of scrutiny and debate, not least for the promise it holds to solve systems development challenges. This paper investigates the benefits as well as the challenges of open source development.　While significant process benefits exist, open source is not without several limitations to more widespread use and implementation. The report notes the specific application to developing countries.

Despite these flaws, open source remains highly suited, both as a software product and as a development methodology. However, no standard development lifecycle exists.　A model of the open source development process life cycle is derived from current OSS models. The model is intended to be used as an alternative development framework that potentially solves many problems associated with systems development. This holds the promise of increasing OSS development, which in turn can benefit organisations in developing countries.

Keywords: open source software; OSS; systems development; developing countries

OPEN SOURCE: TOWARDS SUCCESSFUL SYSTEMS DEVELOPMENT PROJECTS IN DEVELOPING COUNTRIES

1. INTRODUCTION

Open source has recently attracted significant interest from the IT community. It has been hailed as the panacea for the ills of traditional software development, criticised as a threat to innovation, intellectual property and the application industry as a whole, and seen as a solution to the ICT woes of the developing world. Whatever the perspective, there is little doubt as to the impact the open source paradigm has on the processes of the development of information systems.

In developing countries, especially for Governments, the costs associated with licensing fees and the problem of software not meeting the perhaps idiosyncratic needs specific to developing countries is a cause for concern. There has thus been a great deal of interest in using Open Source Software with reasons given as cost-cutting and skill development, amongst others. However, no standard development lifecycle exists. This paper therefore attempts to answer the question "What Systems Development Lifecycle would be suitable for OSSD in developing countries?".

The paper starts by examining how the free and open source software phenomenon can alleviate system development challenges, and then focuses on the relevance of these features for developing countries. The paper next examines the distinguishing features of open source software development (OSSD) that represent potential benefits to the system development process (as well as the challenges) compared to traditional software challenges. The specific appeal of OSS development for developing countries is noted.

The paper continues with an analysis of existing OSS development life cycle models. It uses a theory based evaluation approach (as the first phase of a research project) in order to devise a proposed life cycle model incorporating aspects of the discussed OSS development models for use in developing countries.

Such a software life cycle would assist in the development of software in developing countries by providing a standard useful for novice designers, and so doing increase usage of OSSD to achieve the benefits outlined in the paper.

The paper concludes by briefly describing the research method to be employed to verify this model.

2. WHAT IS FOSS/OSS

Free/Libre and Open Source Software (FLOSS) refers to software whose licenses give users four essential 'freedoms':

- to run the program for any purpose,

- to study the workings of the program, and modify the program to suit specific needs,

- to redistribute copies of the program at no charge or for a fee, and

- to improve the program, and release the improved, modified version (Perens, 1999; Perens, 2004).

OSS users do not pay royalties as no copyright exists, in contrast to proprietary software applications which are strictly protected through patents and intellectual property rights (Asiri, 2003; Wheeler, 2003).

The term "free software" has an unintended meaning, "Software you can get for zero price," which fits the term just as well as the intended meaning, "software which gives the user certain freedoms." OSS is software for which the source code is publicly available, though the specific licensing agreements vary as to what one is allowed to do with that code. (Stallman, 2007)

3. PROBLEMS WITH TRADITIONAL DEVELOPMENT PROJECTS

Proponents of open source argue that 'traditional' software development projects suffer from various ills. Such projects have been shown be prone to time and cost overruns, are largely unmaintainable, with questionable quality and reliability. The 1999 Standish Group report revealed that 75% of software projects fail in one or more of these measures, with a third of projects cancelled due to failure. In addition, systems often fail to satisfy the needs of the customer for whom they are developed (Sommerville, 1995).

These failures are ascribed to:

- Inadequate understanding of the size and complexity of IS development projects coupled with inflexible, unrealistic timeframes and poor cost estimates (Hughes and Cotterell, 1999; McConnell, 1996).

- Lack of user involvement is touted as contributing to project failure (Addison and Vallabh, 2002; Keider in Frenzel, 1996; Hughes and Cotterell, 1999; McConnell, 1996).

- Shortfalls in skilled personnel: Team members with insufficient technical expertise, managerial skill or knowledge about the problem domain can affect project success (Addison and Vallabh, 2002; Boehm, 1991; Frenzel, 1996; Hughes and Cotterell, 1999; Satzinger, Jackson and Burd, 2004; Turban, Mclean and Wetherbe, 2002).

- Project costs are further exacerbated by the price of license fees for software and tools required for application development as well as add-on costs for exchange controls.

The last two points are of specific concern to developing countries. The issue of skill is particularly pertinent to developing countries. Developed countries have a relative glut in IT skills. In developing countries sourcing skilled individuals for projects is a struggle due to a lack of training or the brain drain (Kunda and Brooks, 2003). The cost of software licenses is problematic for the software industry in developing countries, which tend to rely on donations or concessions from software companies such as Microsoft (Frenzel, 1996; Kunda and Brooks, 2003; Ould, 1999).

4. BENEFITS OF OSS

Does OSS have answers to these problems? It is claimed that OSSD produces reliable, high quality software in less time and with less cost than traditional methods. Adelstein (2003: 1) is even more evangelical, claiming that OSSD is the "most efficient" way to build applications. Schweik and Semenov (2003: 1) add that OSSD can potentially "change, perhaps dramatically, the way humans work together to solve complex problems in computer programming". While there is a level of exaggeration, OSS should be afforded serious consideration as an alternative to traditional software development.

Raymond (1998a: 1) likens OSSD to a "bazaar" – a loosely centralised, cooperative community where collaboration and sharing enjoy religion status. Conversely, traditional software engineering is referred to as a "cathedral" where hierarchical structures exist and little collaboration takes place.

The OSSD model has the following features:

- Collaborative, parallel development involving source code sharing and reuse

- Collaborative approach to problem solving through constant feedback and peer review

- Large pool of globally dispersed, highly talented, motivated professionals

- Extremely rapid release times

- Increased user involvement as users are viewed as co-developers (Feller and Fitzgerald, 2000; FLOSS Project Report, 2002; Scacchi, 2003; Weerawarana and Weeratunge, 2004).

4.1. Quality Software

Furthermore, it is maintained that OSS features result in quality software as collaborative development allows for multiple solutions. At the same time there is little tolerance for failure to adhere to the tacitly accepted norms (FLOSS Project Report, 2002; Valloppillil, 1998). Reliability of products has withstood the test of time (Netcraft, 2004; Weerawarana and Weeratunge, 2004).

4.2. Development Speed

Reuse of code implies speedier development: the more people there are creating code and adding value to a project, the quicker the product is released and becomes valuable to a user group (Scacchi, 2003).

4.3. User Involvement

Users are treated as a valued asset in the development process. Viewing users as co-developers leads to code improvement and effective debugging. If encouraged, users can assist developers in finding system faults and improvements, thereby reducing the need (and cost) for extra developers to perform the same function (Raymond, 1998a; FLOSS Project Report, 2002).

4.4. Access to existing code

Developers have access to the "open source toolset" (Adelstein, 2003: 4), a huge amount of open source project code which can speed up development.

4.5. Collaboration

A further important feature of the OSSD model is the nature of the development community. Large numbers of geographically dispersed programmers are joined by the Internet to produce complex software. They do so largely without pay. Reasons for participation in open source projects range from challenge and improving skills, to altruism and fun, as well as for financial reward (FLOSS Project Report, 2002; Hars and Ou, 2001; Rajani, 2003).

4.6. Cost

Total cost of ownership (TCO) of OSS is widely debated, particularly within developing countries. A basic tenet of open source is that all source code is free and available to any user to modify and improve. By contrast proprietary software requires paid-for licensing that is generally considered a barrier to access for developing countries. The cost of Windows XP and Office XP is about US$560 (Ghosh, 2003) which equates to approximately 2.5 months of GDP per capita in South Africa, and 16 months in Vietnam.

In some phases of ownership, there is evidence that OSS may have advantages in the area of TCO. OSS can be tested without cost. Once acquired, OSS has no license fees, removing the necessity to purchase additional licenses as the organisation grows. Throughout usage and maintenance, where the bulk of TCO is typically spent, software can be fixed or configured by in-house developers due to the availability of source code (Weber, 2003; Wheatley, 2004).

5. PERCEIVED DISADVANTAGES OF OSS

5.1. Speed of development

Critics question whether open source provides a rapid development environment and suggest that the result could be slower given the absence of formal management structures. The open source community is likened to a "large, semi-organised mob with a fuzzy vision" (Bezroukov, 1999; Levesque, 2004; Valloppillil, 1998; Zawinski in Bezroukov, 1999).

5.2. User involvement

Strong user involvement and participation throughout a project is a central tenet of OSSD. However, involving users closely can become problematic as users tend to create bureaucracies which hamper development (Bezroukov, 1999).

5.3. Scope creep

Because the open source community is meritocratic and ego-driven, open source projects run the risk of falling prey to feature creep – a primary software risk. Levesque (2004) suggests that programmer credibility within the community is often viewed as more important than the philosophy of 'keeping things simple' while providing the required functionality.

5.4. Releases

OSS is premised on rapid releases and typically has many more iterations than commercial software. This creates a management problem as a new release needs to be implemented in order for an organisation to receive the full benefit. The informal requirements analysis process is problematic amongst CIOs as it is impossible to predict what newer versions of a particular piece of software might include, and whether these newer versions will continue to support business needs (Farber, 2004; Valloppillil, 1998).

5.5. Usability issues

OSS is traditionally perceived to be 'code-centric', targeted mainly at high-end power users. Less attention is focussed on who the potential audience might be and what their user interface needs are. Generally, the user interfaces of open source products are not intuitive (Levesque, 2004; Valloppillil, 1998; Wheatley, 2004).

5.6. Support issues

Wheatley (2004: 2) mentions the lack of accountability from a single vendor. While open source projects have a wide variety of resources (developers themselves, Internet mailing lists, archives and support databases) that can be tapped for support, the problem is that there is no single source of information, no help desk that provides 'definitive' answers to problems. Open source developers are not contracted and therefore cannot be forced into creating documentation (Bezroukov, 1999; Levesque, 2004).

5.7. Cost and development

System deployment and training is often more expensive with OSS as it is less intuitive and does not have the usability advantages of proprietary software.

5.8. Credibility issues

Flagrantly anti-Microsoft sentiments often expressed in the name of open source serves to discredit the value of the open source product (Levesque, 2004).

5.9. Tools

The confusion surrounding the wide variety of open source licensing models (Farber, 2004) is a risk. Many CIOs are concerned about the implications of implementing code that they cannot verify the right to use. Fear of legal action is a principal deterrent to using OSS as part of an enterprise solution.

6. ISSUES FOR DEVELOPING COUNTRIES

6.1. Independence from monopolistic suppliers

A noticeable trend is emerging in which many governments table policy regarding state use of OSS, largely motivated by savings in cost. Governments everywhere encourage the use of OSS as a means to curb software maintenance and acquisition costs (Weber, 2003). The South African government views foreign currency savings as an explicit motivator for open source use (Government Information Technology Officers Council, 2002). Countries want to minimise their over-reliance on an elite group of suppliers. Thus, particularly for developing countries, lower total cost of ownership, and the independence from commercial monopolistic models make open source an alternative to proprietary systems. Its use allows organisations to avoid software lock-in, and maintain autonomy and control of corporate information systems (Ghosh, 2003; Weber, 2003; Weerawarana and Weeratunge, 2004).

6.2. Technological development

When a country converts to OSS, Steffen (2003) argues that there is the potential for development of a local software industry. The skills needed to install and manage OSSD will, in theory, be a by-product of this industry. While Steffen verges on being overly optimistic, the potential for local IT industries to be empowered exists, which in turn can create development and further employment opportunities (Weerawarana and Weeratunge, 2004).

In addition, internationalisation of software is a by-product of the open source movement. Given the global nature of the developers and users, functional requirements are not only directed from, for example, the USA. This allows for development of applications that specifically fit the indigenous needs of emerging markets in developing countries (FLOSS Project Report, 2002; Valloppillil, 1998 Weber, 2003). OpenOffice has been released in several languages other than English, namely Zulu, Northern Sotho and Afrikaans (Translate.org.za, 2004).

6.3. Intellectual property rights

Internationally, there is an increased emphasis on enforcing intellectual property rights. Threatened with sanctions and other punitive action, governments and organisations are being forced to distance themselves from piracy (Weber, 2003). Organisations are looking increasingly to open source because of cost and compliance with intellectual property rights. The South African Government Information Technology Officers Council on OSS (2002) has recognised the threat of usage of unauthorised proprietary software.

6.4. New business opportunities

The advent of the OSS phenomenon has resulted in new business ventures, including the distribution and retail of open source products, and the provision of several open source related services. Also, OSS is generally complex to use and user interface issues are not considered a priority. This gap in usability opens a business opportunity. This is particularly relevant in the developing world where service and support is perceived to be lacking for open source products (FLOSS Project Report, 2002).

6.5. Skills development

The IT skills shortage in developing countries necessitates the development of such skills. The OSS model, with the existence of code examples which novices can use, as well as the collaborative aspect of development can provide for unique experiential learning.   The tenet that users can co-develop is perhaps unrealistic in developing countries, although their involvement is part of mutual learning.

6.6. Threats and limitations of OSS

In the context of developing countries, several specific critical factors are required for the success of open source conversion. Internet access is vital for participation in the open source community as most communication takes place via e-mail or through development portals. Heeks (1999) points to limited Internet access due to a lack of telecommunications links, reliable electricity supply and sufficient computers. A good educational infrastructure is necessary to foster a culture of learning (FLOSS Project Report, 2002).   Freedom of information is necessary for a thriving open source community.   (The exception here is China, with a large open source community despite restrictions on freedom).   Finally, English-skilled developers are necessary in an environment where English remains the lingua franca.

7. MODEL FOR DEVELOPMENT

Mockus, Fielding and Herbsleb (2000) suggest there are several basic differences between OSSD and traditional methods. Firstly, OSS systems are built by large numbers of people, largely volunteers, although increasing numbers of OSS projects are supported by companies. Secondly, work is not assigned; rather individuals choose to participate in specific project activities. Thirdly, there is no clear design process, at either a system or detailed level (Vixie, 1999). In addition, there is no explicit project plan, list of deliverables or schedule.

All these differences suggest a weakening of traditional process models. However, successful projects such as Linux and Apache and others are testimony to the viability of the OSSD model as a successful alternative to traditional software models. While there is proof that the OSSD paradigm can produce high-quality software with less cost and often in less time, there are few models to understand how this is achieved. This report examines the importance of adopting a life cycle approach to direct the development process.

7.1. Traditional models

The systems development life cycle (SDLC) approach can be viewed as a management framework that leads to "well-engineered software" (Sommerville, 1995: 6).   An SDLC comprises many different phases or sets of related activities, depending on the process model that is adopted. There are, however, generic phases into which all project activities can be organised: planning, analysis, design, implementation and support (Satzinger et al, 2004). These activities can be organised different ways, often referred to as process models (Hughes and Cotterell, 1999: 64).

Different process models or software development approaches exist. Each has specific sets of related activities and deliverables, representing adaptations of the generic SDLC. In an attempt to define the OSSD process, researchers have compared OSSD with several of the more traditional models found in commercial environments. These are briefly, the waterfall model with sequential phases, which has been the standard model for large projects (Hughes and Cotterell, 1999; Satzinger et al, 2004; Sommerville, 1995). The waterfall model has limitations, and other models have been put forward to overcome the rigid and lengthy

process that is resistant to changing specifications. Iterative and incremental development methods, as well as Boehm's spiral model and prototyping, are models that break tasks up into smaller modules in different ways. More recently the RUP model, XP (eXtreme programming) and agile modelling have also been introduced. Despite the differences, the phases identified in the waterfall model are still generally adhered to.

There is no universal project process model that simultaneously shortens a project lifespan, decreases cost and increases quality on all projects (Glass, 2004). There is also no single process model that adequately describes OSSD.

7.2. Existing OSS development models

One critique of the open source methodology is that it is too loosely defined (McConnell, 1999), resulting in perceptions that OSSD is largely chaotic.
Several researchers have proposed life cycle models derived from analyses of successful open source projects. Opinions differ as to the stages that comprise a typical open source development project. However, regardless of the open source life cycle model that may be subscribed to, the OSSD paradigm demonstrates several common attributes:

- parallel development and peer review,

- prompt feedback to user and developer contributions,

- highly talented developers,

- parallel debugging,

- user involvement, and

- rapid release times.

7.2.1. Comparative model

Vixie (1999) holds that an open source project can include all the elements of a traditional SDLC. Classic OSS projects such as BSD, BIND and SendMail are evidence that open source projects utilise standard software engineering processes of analysis, design, implementation and support, albeit informally.

Vixie (1999) suggests that during the analysis phase requirements for a new project are often based on what open source developers themselves want or need. What is ultimately included in a piece of software is battled out over the Internet. Developers reach consensus on requirements.

System-level and detailed design is often the casualty in the process. Design issues are often inherent in the system that is being built, and therefore, assumed to be widely understood, or they evolve or are reverse-engineered over time. Either way, the fact that design issues are not made visible, or written down anywhere limits the quality and credibility of the project.

Implementation and coding is really why developers involve themselves in open source projects. Here people experiment, post code and wait for peer acknowledgement. There are no formal review procedures, but given the nature of the community, feedback is almost immediate.

Testing in open source projects involves large numbers of developers, often users of the software, reading and scrutinising the code for errors. The danger of an unstructured, informal testing phase is lessened by the advantages of having "uncounted strangers" with real world experiences looking for bugs (Vixie, 1999: 6).

In his comparison between OSSD and the traditional SDLC, Vixie (1999) recognises the fundamental differences that the OSS life cycle present, but fails to suggest an appropriate model that analyses this new process.

7.2.2. Organisational models

Schweik and Semenov (2003) propose an OSSD project life cycle comprising three phases: project initiation, going 'open', and project growth, stability or decline. Each phase is characterised by a distinct set of activities.

Project initiation occurs for similar reasons as outlined in the initial stages of Vixie's model. Developers decide to take on projects for a variety of reasons. During project initiation, the project core is developed upon which others build. Project initiation is premised on modularity, such that future development is organised around small manageable pieces. The advantages are: multiple programmers can work on the same module; competition for the best solution code increases quality; and there is greater control over project progress (Schweik and Semenov, 2003; Torvalds, 1999).

Going 'open' involves a choice on the part of the project founders to follow OSS licensing principles. It also ensures that the project enjoys the support of a core group of dedicated developers, shows technical promise and is of interest to future developers, and that a sufficient amount of the original requirements have been solved to create a framework in which future development can take place (Schweik and Semenov, 2003).

In this phase appropriate technologies and web sites need to be chosen to act as a vehicle for sharing code and recruiting developers. Some web sites offer project hosting services, including version management, problem tracking, and other project management tools. Possibly the most important aspect of this phase is developing operational designs to provide some level of project leadership in the absence of clearly defined hierarchies (Schweik and Semenov, 2003: 8).

The final phase, growth, stability or decline, poses an element of risk for open source projects: will the project generate enough interest to attract developers and users globally to use the product and participate in further programming, testing or documentation (Schweik and Semenov, 2003)?

Wynn (2004) proposes a similar open source life cycle but introduces a maturity phase in which a project reaches critical mass in terms of the numbers of users and developers it can support due to administrative constraints and the size of the project itself.

The OSSD life cycle models proposed by Wynn (2004) and Schweik and Semenov (2003) provide interesting insight into the managerial aspects and organisational structure behind a typical open source project. However, these models do not provide a task-related analysis of the OSSD process.

7.2.3. Task-related models

Several researchers have derived life cycle models from investigating successful open source projects such as Apache and the FreeBSD Project (Mockus et al, 2000; Jorgensen, 2001). Mockus et al (2000) describe a life cycle that combines a decision-making framework with task-related project phases. The model comprises six phases:

- Roles and responsibilities,

- Identifying work to be done,

- Assigning and performing development work,

- Pre-release testing,

- Inspections, and

- Managing releases.

The model has a strong managerial focus emphasising developer management and the work to be done, rather than on product-related activities. While there is more detail regarding task-related issues than the organisational models (Schweik and Semenov, 2003; Wynn, 2004), it fails to do so in sufficient detail to be considered a true development process model. Process models incorporate at some level all the phases of the traditional SDLC.

The model proposed by Mockus et al adequately caters for the planning phase of the SDLC but is less explicit regarding other phases. Furthermore, Mockus et al assume that some sort of prototype already exists, failing to explain where design and analysis phases occur within their model.

Jorgensen (2001) provides a more detailed description of specific product related activities that underpin the OSSD process. The model (fig. 1) explains the life cycle for changes that occurred within the FreeBSD project.
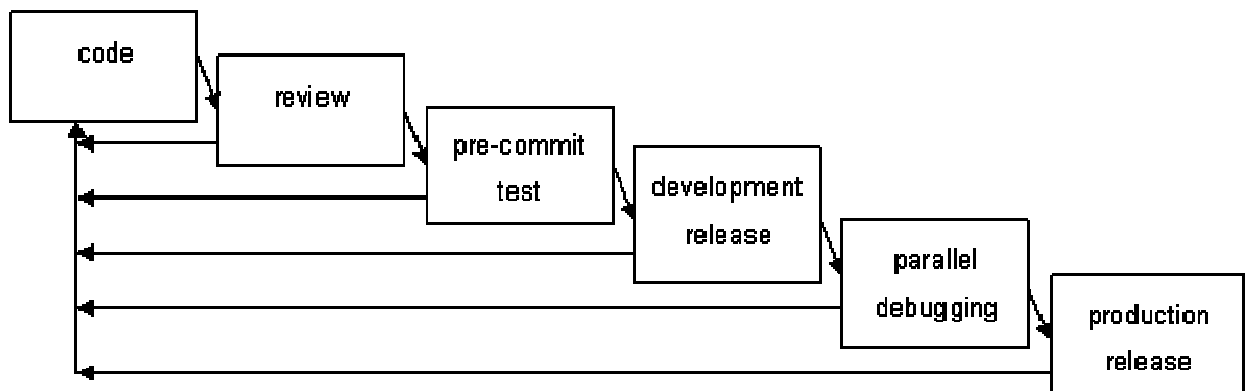
Figure 1. Jorgensen life-cycle, 2001

Several stages or sets of activities are proposed:

- **Code:** Code is submitted by talented developers for review and improvement by respected peers.

- **Review:** Most (if not all) code contributions are reviewed. This independent peer review is a central strength of the OSSD process.

- **Pre-commit test:** Review is followed by an unplanned, yet thorough, testing of all contributions for a particular code change. While informal, this phase is taken very seriously as negative implications of permitting a faulty contribution can be considerable.

- **Development release:** If the code segment is deemed release-ready it may be added into the development release.

- **Parallel debugging:** Development releases of software undergo a rigorous debugging phase where any number of developers is able to scrutinise the code in search of flaws.

- **Production release:** Where development versions are deemed stable, they are released as production versions.

The process is repeated incrementally for new modules – reinforcing the cyclical nature of all open source projects where there is no real end point - unlike many commercial projects.

Jorgensen's model is widely accepted (Feller et al, 2001; FLOSS Project Report, 2002) as a framework for the OSSD process, on both macro (project) and micro (component or code segment) levels. However, flaws remain. When applied to an OSS project, the model does not adequately explain where or how the processes of planning, analysis and design take place.

7.2.4. Summary of existing OSS project models

Existing OSSD models explain some aspect of the OSSD approach. However, an explanation of where the analysis and design phases occur within the project life cycle remains distinctly absent. Existing models seem to start at the implementation phase, either assuming details regarding initial SDLC or ignoring them completely.

7.3. Proposed Model

The proposed model (fig. 2) expands on Jorgensen's life cycle model (fig. 1) and incorporates aspects of previous models, particularly that of Schweik and Semenov (2003). In addition, the proposed model attempts to encapsulate the phases of the traditional SDLC.
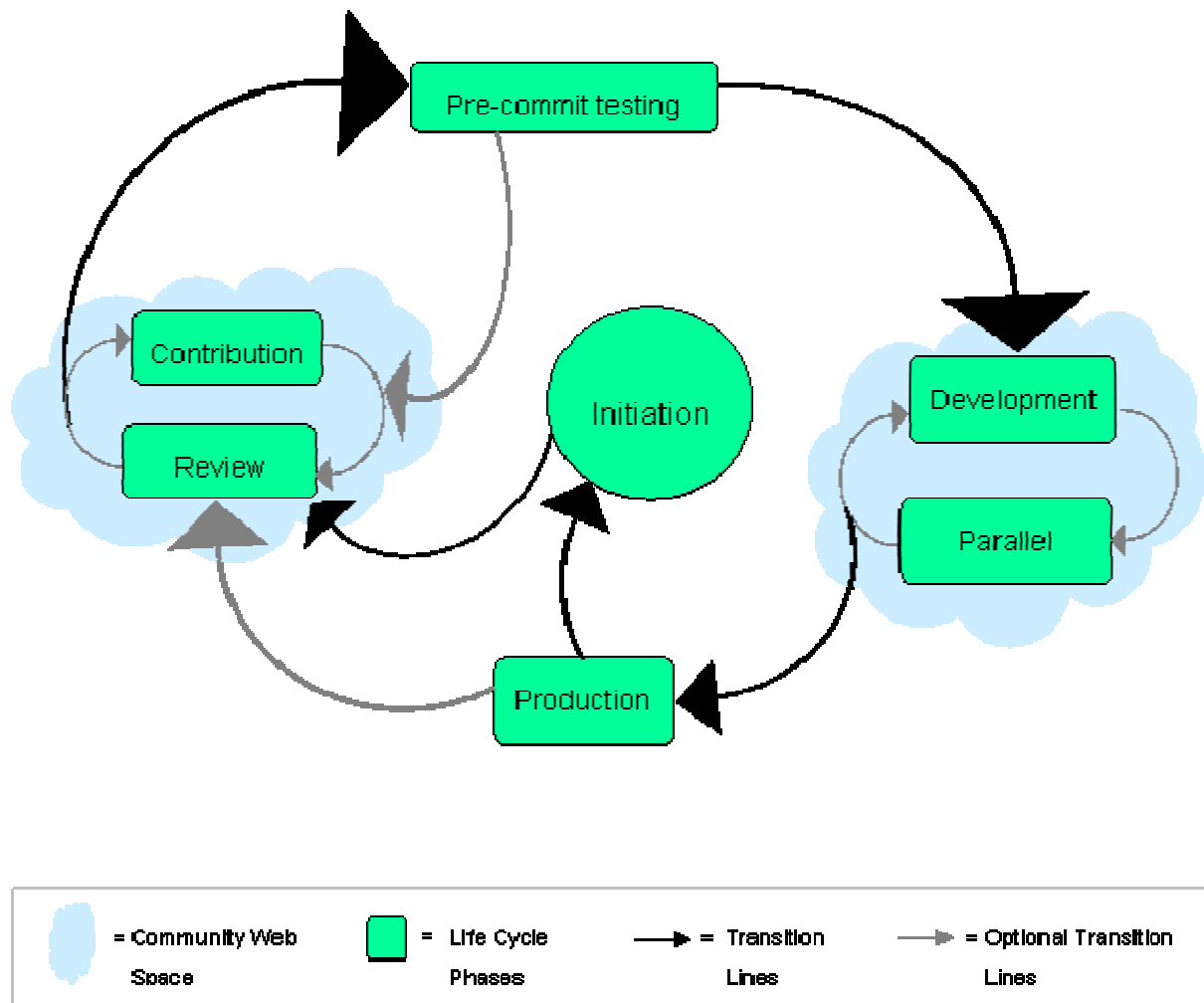
Figure 2. Proposed life cycle model of OSSD projects

The introduction of a generic initiation phase replaces Jorgensen's code phase. The initiation phase can be applied at both the micro and macro level of a project. This first phase refers to developed code that is used as a prototype for further progress on a particular project, be that code a small code segment or the initial version of an entire project. The phase is undertaken either by a developer who develops a piece of code for an existing project, or the project founder in a new project.

The initiation phase moves into a cycle of code review and further contribution. The number of iterations occurring at this phase is dependent on the interest that the code segment, component or entire project generates within the developer community. Independent peer review and prompt feedback characterise this phase. The cycle of code contribution and review take place within the wider Internet developer community, employing tools such as e-mail, bulletin boards and discussion groups.

Once a piece of code is considered adequate for inclusion in a development release, pre-commit testing is performed to ensure that this new piece of code, once added, does not break the existing release. Testing is usually performed by core developers. No rigorous testing schedule exists and, indeed, the process is not even required. However, the consequences of allowing faulty code into a development release can be severe for the programmers involved and in turn the reputation of the project as a whole.

A process of debugging and reincorporation of code into the development release then takes place. This is again an iterative process occurring within the community web space. No formal planned debugging occurs; individuals volunteer. This is another area exemplifying the strength of open source projects. The more people that seek, find and remove bugs, the better the quality of the software.

Eventually, code forms part of a production release which is generally managed by a core developer. Production releases take the form of a prototype that can be used in the initiation phase of the next iteration of that project, component or code segment.

It is useful to compare the proposed model to the traditional SDLC (fig. 3), as most process models encompass these phases in some way. Planning, analysis and design phases are undertaken largely by the project founder. Rather than glossing over design issues, as is the perception of open source projects, it is suggested that it may be even more important to get design right prior to actual programming so that all developers are working towards a clearly defined common purpose. As such, the OSS development life cycle is largely positioned in the traditional implementation phase of the SDLC (Feller et al, 2001; The FLOSS Project Report, 2002).
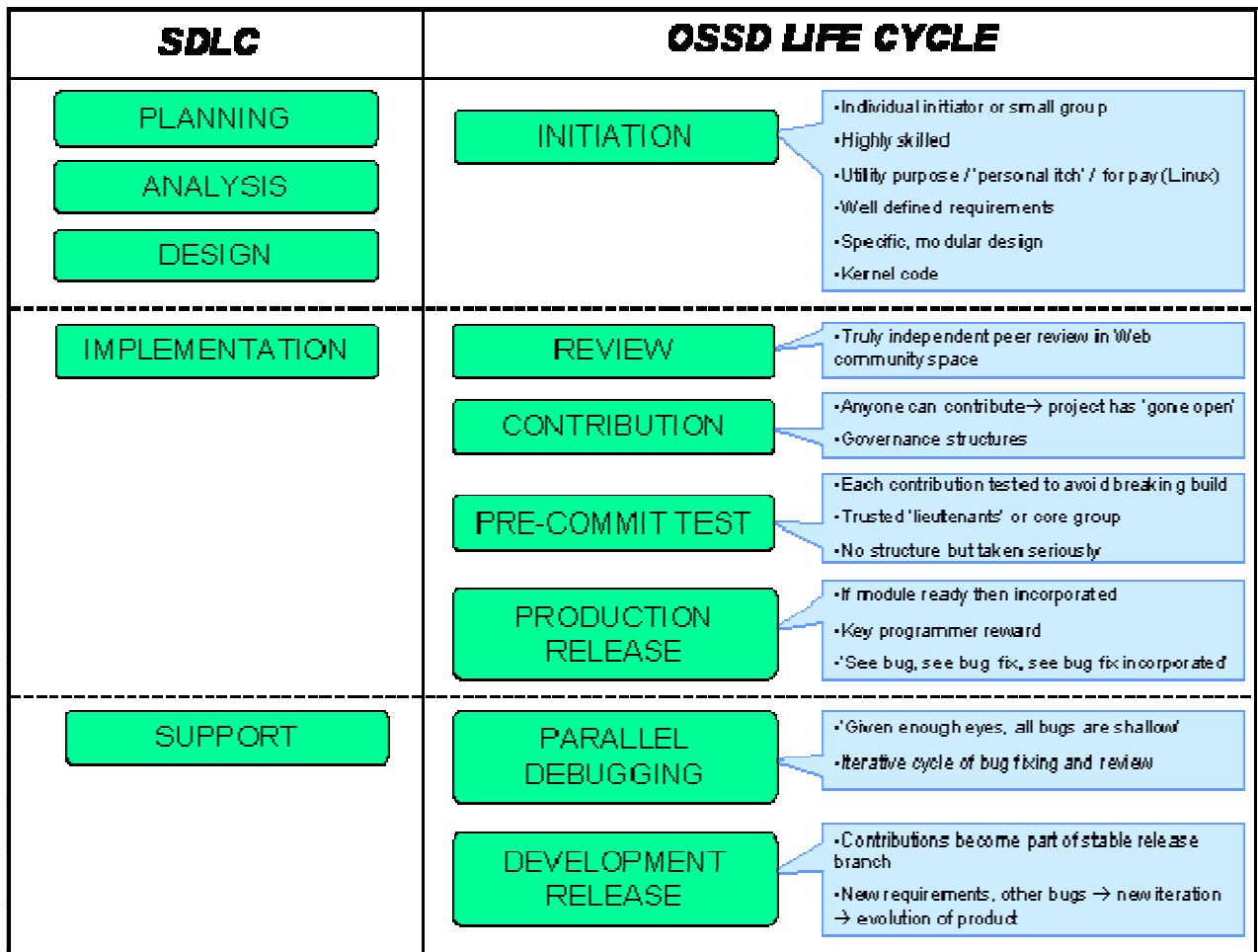
Figure 3. Comparison of SDLC and a proposed model of OSS

7.4. Model Validation

The next phase of the project is to test the model empirically. OSS development is taking place at the Office of the Premier of the Provincial Government in the Eastern Cape. A case

study methodology will be used to assess existing practice in the Government and compare it to that proposed in the model. Interviews will be conducted with the developers (programmers and analysts), as well as project initiators and users in order to assess the perception of the value of the projects, the OSS environment and then more importantly, the nature of the development cycle. The model will be critiques in the light of the findings.

8. CONCLUSION

The purpose of this research paper was firstly to identify how the open source phenomenon can alleviate system development challenges faced by organisations, particularly within the developing world where the quoted failures of traditional development are a luxury that developing countries cannot afford. OSSD combines features found in traditional software processes with other features in a unique way that can potentially produce high-quality software, faster and cheaper within the rapidly changing Internet environment.

Although OSSD is not a faultless solution, it provides potential benefits and opportunities to the system development process. The most obvious benefit is the reduced cost that open source provides. In addition, open source offers new business models that can be exploited, particularly within developing economies, and has an added benefit of skills development.

There is, however, no standard development lifecycle to produce OSS. The main purpose of the paper was therefore to arrive at a model for an OSSD development lifecycle. Such a model is proposed which, by facilitating OSS development, would provide benefits for developers in developing countries, specifically in terms of promoting improved programming skills, through the availability of expertise and model code, as well as software cost reduction.

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EXPERIENCES OF OPEN SOURCE SOFTWARE IN INSTITUTIONS: CASES FROM TANZANIA AND NORWAY

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Abstract: Despite the wide spread adoption of Open Source Software (OSS), there are continuing debates over the competition between OSS and proprietary software. Proponents of open source software contend that developing countries find ICT to be too expensive to afford but with Open Source Software they will manage to leap frog and address the digital divide. We found it useful to establish more evidence of the usefulness of open source software. In this study, the consequences of adoption and use of OSS was investigated in a cross sectional interpretive case study in selected Institutions in Tanzania and Norway. The empirical material suggests that OSS products are enterprise dependent software. They lower ICT expenditure, support open standards implementation, and promote creative knowledge on the use of local languages.

Keywords: open source software, ICT in public sector, zalongwa, kilinux, Tanzania, Zanzibar

EXPERIENCES OF OPEN SOURCE SOFTWARE IN INSTITUTIONS: CASES FROM TANZANIA AND NORWAY

1. INTRODUCTION

The public become familiar with Open Source Software (OSS) concepts with the success of Linux Operating System. As a result, OSS has generated much interest among researchers and practitioners. OSS development approach claims to improve the timeliness and effectiveness of software development and support for demanding applications run by large organisations (Isene, 2005; Simon, 2005; Weber, 2004). Proponents of open source software contend that developing countries find ICT to be too expensive but with open source software they will manage to leap frog and address the digital divide (Lungo, 2005a; Schmidt, 2005; Weerawarana & Weeratunga, 2004). However, there is much hype about open source software and existing studies on the use of OSS in public organisations (Schmitz, 2001; Wichmann, 2002) are a bit old when compared to the pace of ICT advancements. We found it important to establish more evidence of the usefulness of OSS. Our study aimed to give both: evidence of use and reasons for use of OSS in public sector establishments. This study is an interpretive case study organised around four research questions:

- *How are the performances of Open Source products perceived after installation and use?*
- *Is there any consequence on ICT expenditure after adopting Open Source Products?*
- *Is the organisation depending on external supplier or internal staff to support ICT functions?*
- *What are the most common Open Source Products used in the organisation?*

The public sector is the main source of funds particularly in developing countries. In addition, the public sector hosts large information systems which demands serious IT solutions. Our main assumption is that if the public sector found OSS as useful as proprietary software products, it is an indication that OSS is mature enough to be trusted.

The remainder of the paper is organised as follows: In section 2 we present theoretical perspectives. In this section we describe the cathedral and the bazaar theory, total cost of ownership and open standards concepts. Section 3 presents research settings and methodology. Section 4 is the findings and discussion. In the last part, section 5, we formulate the concluding remarks.

2. FREE AND OPEN SOURCE SOFTWARE

2.1 Definitions and Concept of Free and Open Source Software

The restriction of rights to software and charging fees for each copy of software are the main characteristics of 'proprietary software'. Proprietary software means software that is owned by someone or an organization, who exercises control over the software by putting restrictions on use and copying of the software. The prevention of use, copying, or modification can be achieved by legal or technical means. Technical means include releasing machine-readable binaries only, and withholding the human-readable source code. Legal means can involve software licensing, copyright and patent law. Proprietary software put the owner as of prime importance, in contrast to 'free software' in which the freedom of computer users is of prime importance.

Free Software as a political idea has been popularized by Richard Stallman since 1984, when he formed the Free Software Foundation (FSF, 2006a) and its GNU Project (FSF, 2006c). The

freedom envisioned by FSF which was formalised in the General Public License (GPL) concerns four freedom to (FSF, 2006b):

(0) run the program, for any purpose;
(1) study how the program works, and adapt it to your needs;
(2) redistribute copies so you can help your neighbour; and
(3) improve the program, and release your improvements to the public, so that the whole community benefits.

Klang describes the term "free software" as including a philosophy, an understanding that software is an important building block in the information society and that the control of this infrastructure needs to remain accessible to all (Klang, 2005). However, opponents of FOSS sees the FSF's GPL license being constraining the user since it requires any derivative to be licensed under the same terms (Rosen, 2004).

In 1998, the Open Source Initiatives (OSI) movement was launched with the term 'Open Source Software'. The Open Source definition includes many of Stallman's ideas. Explaining open source and the way open source works, Weber argues that, the philosophy of open source is not the software. It is the 'process' by which software is created (Weber, 2004). For example, today there is ongoing Open Source Car (OSCar) project (Tucci, 2000). Klang (2005) describes the essence of open source as a software development model acceptable to corporate developers, who had been reluctant to adopt a methodology connected to the 'free software'. The Open Source definition coined by Perens (2005) defines nine terms of rights that a software license should conform in order to be certified as Open Source Software (OSS). The terms of OSS definition are summarized in Table 1.

Terms of Open Source Software	Description
Free Redistribution	Any one can make any number of copies of the software, and sell or give them away, without paying anyone for that privilege
Source Code	The intent here is for source code to be distributed with the initial work, and all derived works.
Derived Works	The intent here is for modification of any sort to be allowed. It must be allowed for a modified work to be distributed under the same license terms as the original work.
Integrity of The Author's Source Code	This gives a way to enforce a separation between modifications and original author's work without prohibiting modifications.
No Discrimination Against Persons or Groups	Open Source Software license must not discriminate against any person or group of persons.
No Discrimination Against Fields of Endeavour.	The license must not restrict anyone from making use of the program in a specific field of endeavour.
Distribution of License	The license must be automatic, no signature required
License Must Not Be Specific to a Product	The rights attached to the program must not depend on the program's being part of a particular software distribution
License Must Not Contaminate Other Software	The license must not place restrictions on other software that is distributed along with the licensed software
Example Licenses	The GNU GPL, BSD, X Consortium, and Artistic licenses are examples of licenses that are considered conformant to the Open Source Definition.

Table 1: Terms of Open Source Software Definition (Perens, 2005)

OSS rights address the rights of users as well as the rights of programmers. This provides users with the option of providing their own support, or the economy of a number of competing support providers. The fact that any programmer can tailor an Open Source program to specific markets in order to reach new customers adds strength to the open source movement. This is because people who do these things are not compelled to pay royalties or license fees to the original author of the software.

Although there are some ideological differences between Free Software Foundation (FSF) and Open Source Initiative (OSI), in this paper we treat the two schools of thought as the same. We only focus on the differences between proprietary software and free open source software.

2.2 The Cathedral and the Bazaar Theory

The cathedral and the bazaar theory (Raymond, 2001) state that proprietary software production is a carefully planned building of a cathedral while OSS production is a chaotic interactions of participants of an oriental bazaar. This gives hints to a major difference between the two types of software development: strong powerful management on one side (i.e. proprietary) and loosely related developers and users organised in several thousand seemingly interdependent projects on the other side (i.e. open source). The Cathedral and the Bazaar theory is a means of communicating the core aspects that philosophers would call the research programme hardcore theory (Lakatos, 1970) of the OSS. Three concepts of cathedral and bazaar are important in distinguishing OSS characteristics and performance. Raymond (2001) describes those concepts as follows:

(1) The simplification of resolving software bugs, 'given enough eyeballs, all bugs are shallow'
(2) Referencing to Linux as one of the bazaar development model and mentioned that "Linus Torvalds' style of development [is:] release early and often, delegate everything you can, be open to the point of promiscuity"
(3) The claim that open source software development creates high quality software products where "quality was maintained not by rigid standards or autocracy but by the naively simple strategy of releasing every week and getting feedback from hundreds of users within days"

Our stands on the cathedral and bazaar assertions are that, they were aimed at distinguishing OSS development from that of proprietary software development approaches. However, this does not imply that all OSS development take the same path. Thus, we refer to the cathedral and bazaar as a theoretical presentation of OSS development. For example, the cathedral and the bazaar simplification of software debugging process by claiming 'given enough eyeballs, all bugs are shallow' (Raymond, 2001) is a critical assertion in free and OSS. In the cathedral and the bazaar, the assumption is that several talented developers can successfully work on the same piece of code in parallel without much coordination and will eventually fix a bug quickly, but this is not always the case.

The Cathedral and Bazaar theory was one of the main promoters of FOSS ideas and influenced individuals as well as companies to rethink open source software, including government owned institutions. Perhaps this theory aimed at appealing and enticing its readers and hence it required attractive writing style.

2.3 Total Cost of Ownership in Open Source Software

The decision to introduce new software in an organisation begins with cost calculation. Total cost of ownership of a software may cover not only the selling price of the software, but also any cost that is caused by the decision to install the software in the organisation (Evers, 2000; Samuelson, 2006). Thus, the economic of free OSS should consider among other things the costs incurred for activities presented in Table 2.

Activity	Description
Purchase	this is the selling price of the software (in case the software is delivered for free – without pay)
System Setup	additional hardware and software required to facilitate smooth running of the software
User Training	extra money should be spent for training users and therefore provide them with additional skills in order for them to use the system smoothly
User Support	in the case where the training was not able to deliver all required skills to users, additional support costs is required
Updates	after a system is put into use, software update might be required to fix bugs and introduce new features. These updates have cost implications

Table 2: Items to be considered in calculating Software Total Cost of Ownership (TCO)

On the other side, individuals and companies who develop open source software could easily give away their software products and concentrate on making profit with related services and support. That is, their business is based on the knowledge gained in developing the software and their popularity as the original authors. With this model of not focusing on the selling price of the software but on its related products, many make money with activities described in Table 3.

Activity	Description
Software Distribution	distributors make life easy for users who are willing to pay a small amount for comfortable access to the software.
User Support	support range from disaster recovery, backups, training to bug fix
Hardware drivers	developing hardware drivers
Information	publishing books, magazines, news tutorials and software manuals

Table 3: Sources of Profit in Open Source Software

2.4 Open Source Software Supports Open Standards

A standard, as defined in the concise Oxford English Dictionary, is 'a level of quality or attainment' (Soanes & Stevenson, 2004). From the financial point of view, a standard may be defined as an agreement between a number of players within a certain area of technology (NITA, 2004). In the IT industry the players are software developers and hardware vendors. Standards are of two kinds: market created standards (de facto) and standards introduced by a recognised standardization body (de jure). NITA[1] (2004) define a *de facto* standard as the one which is introduced by a market player and establishes itself as the – or one of the – dominant standards without the backing of official standardisation bodies. A *de jure* standard is drawn up by a recognised official standardisation body. Standards have two characteristics: proprietary and open standard. Open source supports the implementation of open standards in IT technologies through addressing inter operability among the technologies. Open standards is the choice of many government owned establishments. For example, the UK government insist on interoperability through mandatory compliance with electronic-Government Interoperability Framework (e-GIF) (OGC, 2004).

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[1] The Danish National IT and Telecom Agency

In summary, four main concepts from the literature form the base of our paper: (1) the definition of free and open source software, (2) OSS use Bazaar development approach; (3) OSS has a low initial total cost of ownership and (4) OSS supports open standards. These are the driving forces underlying OSS development and philosophical features.

3.0 RESEARCH METHODOLOGY

The research presented in this article is based on an interpretive approach to case study. We have chosen this case study approach because we wanted to investigate Open Source Software phenomenon within its real life context in organisations. Throughout the study, we were flexible in questioning similar themes to overcome subjective observations (Lincoln & Guba, 1981). The large amounts of verbal information became easy to analyse using empirical material summaries and concepts from grounded theory (Glaser & Strauss, 1967; Orlikowski, 1993; Pettigrew, 1989) where data codes and categories were largely developed from the data. In addition, direct quotes (interviewee excerpts) were used to bring out actual voices from the informants.

Research Settings

Six months in Norway (September 2005 – February 2006) and five months in Tanzania (March 2006 – July 2006) were used to collect empirical material from a total of eight organizations, four in Tanzania and four in Norway. The organizations and the number of informants involved from each country are presented in Table 4.

Country	Setting	Informants
Tanzania	Tanzania Commission for Universities (TCU)[2]	4
	University of Dar es Salaam (UDSM)[3]	6
	National Council of Technical Education (NACTE)[4]	4
	National Examination Council of Tanzania (NECTA)[5]	6
	Sub-total	20
Norway	Hurum Municipal (HUKO)[6]	5
	Sarpsborg Municipal (SAKO)[7]	2
	University of Oslo (UiO)[8]	6
	Agder University College(AUCO)[9]	5
	Sub-total	18
Grand-total		38

Table 4: The Research Settings

[2] Website: http://www.heac.go.tz/ [Accessed 11th September 2006]
[3] Website: http://www.udsm.ac.tz [Accessed 11th September 2006]
[4] Website: http://www.nacte.go.tz/ [Accessed 11th September 2006]
[5] Website: http://www.necta.go.tz/ [Accessed 11th September 2006]
[6] Website: http://www.hurum.kommune.no/ [Accessed 11th September 2006]
[7] Website: http://www.sarpsborg.com/ [Accessed 11th September 2006]
[8] Website: http://www.uio.no [Accessed 11th September 2006]
[9] Website: http://www.hia.no/ [Accessed 11th September 2006]

In line with the technique of theoretical sampling presented by Glaser and Strauss (1967), the eight institutions were selected for their similarities as well as their differences. All settings have common characteristics: they store large amount of data and are using or intend to use OSS products in their critical systems. Theoretical sampling requires paying attention to theoretical relevance and purpose. With respect to relevance, the selection process of settings ensured that the substantive area addressed and the adoption and use of FOSS are kept similar. In addition, the FOSS themselves, while not identical, were compatible across all organizations in that they are of two categories: infrastructure software and application software. Infrastructure software includes software platforms like database management systems; operating systems; web server; and email server systems. Application product includes applications like email client systems; web browsers; office application suites; and bespoke application software that support user interactions with computers.

Data Collection Methods

Selection of organisations to be included in the study was done through snow ball sampling. In Norway, first we started to approach a course lecturer who teaches an Open Source course at the department of Informatics, University of Oslo. That lecturer helped us to identify municipalities which have a substantial installation of OSS products. Similar approach was followed in the Tanzanian case study. In all research settings, data were collected through different methods: unstructured and semi-structured interviews, documentation analysis, participant and passive observation. These sources of data are presented in order to illuminate how data were collected, with which criteria and in what quantity.

Interviews: Walsham (1993) submits that probably the most important source of information for interpretive study is constituted by interviews. We have conducted 38 interviews where each interview session lasted for 45 minutes in average but interviews with system administrators (IT professionals) took longer than non IT processionals. In each organisation we visited, the informants were from lower to upper carders. Again informants were selected strategically in order to interview those who are involved in OSS implementation and use. An interview guideline questionnaire we used in this study is attached as appendix.

Observation: In some organisations we visited, we were able to observe users using OSS products including email client programs. We were also shown servers where OSS server side software are installed. Observation was an important part of the study since it confirmed what we have been told by the informants.

Documentation Analysis: While visiting the organisations, we have collected documents: Organisational ICT policies, ICT Project documentation and ICT project proposals. Also we have collected meeting resolutions which approved installation and use of OSS products.

This triangulation of data collection provides multiple perspectives on issues, more information on emerging concepts, allows for cross-checking, and yields stronger substantiation of constructs (Glaser & Strauss, 1967; Orlikowski, 1993). Data collection focused on the topics of ICT policy, FOSS products, performance of FOSS Products, ICT Expenditure, key players, and change process, and sought information on, among other things: type of software application domain, number of users/stakeholders, and impacts associated with use of the FOSS. Data collection, coding, and analysis proceeded iteratively (Glaser & Strauss, 1967) with the early stages of the research being more open-ended, and later stages being directed by the emerging concepts, and hence involving more strategic selection of informants and more structured interview protocols. In this study the primary unit of analysis was the organization or organizational department where the software is installed. To complement users' views towards open source products, the interviewees of the study are from different occupations in their respective organisations. Table 5 presents occupation and number of interviewees involved in the study.

POSITION/OCCUPATION	Informants
University Vice Chancellor	1
University Chief Academic officer	1
Dean of Faculty	5
Director/Head of Units	6
Project Manager	2
Systems Administrator	13
Office Secretary	4
University Students	6
Total	**38**

Table 5: Type of Interviewee Involved in this Study

Other sources of data are from our own experiences as IT professionals working at higher learning institutions: University of Oslo and University of Dar es Salaam. Our past experience provided insight in evaluating informants' conversation and analysing the documents from the fields. The first author is a young faculty member at the University of Dar es Salaam also involved in several OSS project such as the University of Dar es Salaam Student Information System known as ZALONGWA[10]. His experience was valuable in this research while conducting interviews with project managers and systems administrator on the potential and limitations of OSS products. The second author is a long experienced professor of Informatics at the University of Oslo. Being in the IT profession for years, he was able to link OSS development from the time when OSS was a just a hype to when OSS products delivers real achievements. As academicians, the authors were able to bring theories and practical experiences to the study.

4.0 FINDINGS AND DISCUSSION

Generally this study revealed an increasing interest of the public sector towards OSS. At the beginning of the fieldwork, we were motivated that since many workers in public sector depend on the central government to pay for ICT infrastructure and software in particular; individual workers can never feel the pressure to lower ICT expenditure. Also, we assumed that since OSS becomes an alternative method of the long lived concern for realising software projects, the public sector would perceive OSS products immature with un-acceptable performance in large and critical systems of the public sector. The research findings inform our two earlier premises as untrue: OSS products perform better and now large systems are migrated to Open Source based products; and yes, individuals in public sector feel the pressure to lower ICT expenditure and they make use of any opportunity available including adopting and using FOSS products.

4.1 Open Source Software Development Produce High Quality Software

In this study, we sought to find out availability of established ICT Policy and where ICT policy/strategy exist we evaluated its content to determine whether it addresses the ICT

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[10] Website: http://www.zalongwa.com

infrastructure. The evaluated ICT policies/strategies were found to address ICT infrastructure to some extent. We identified that the most Open Source based Infrastructure Software products in use are Linux, MySQL, PostgreSQL, PHP, Java, IMAP Server (Sain) and Apache. The main Application Software Products include OpenOffice.org, Mozilla/Firefox, Squirremail and Mozilla Thunderbird mail client (Norwegian version). This implies that OSS products are of high quality. This study confirms the maturity of OSS products when it reveals that there are large and critical systems being powered by Open Source Products.

In Tanzania, the Tanzania Commission for Universities (TCU) currently uses Microsoft Spreadsheets and Tally Software to manage student records and to detect duplicates of records respectively. However, TCU has contracted a private company to develop its first student record database using Open Source technologies. At the University of Dar es Salaam (UDSM), KiLiNuX is an exclusive open source software project which translates OSS products like Linux into local Kiswahili language. Also, UDSM in collaboration with international partners runs other FOSS related projects, for example the Health Information Systems Project (HISP). As an academic institution student records are vital and critical data. UDSM uses FOSS based software to manage its student records known as ZALONGWA. The National Council for Technical Education (NACTE) was known for having large database in Oracle database management system, but its recent switching to an open Source database management system, MySQL, is a clear indication that OSS are dependable products. NACTE confess that the administration of oracle servers is complex when compared to MySQL which delivers satisfactory performance.

Since 1985, the National Examination Council of Tanzania (NECTA) has been running its database on a main-frame computer, WANG. In 2006, NECTA saw its WANG as an obsolete technology and a threat to loss of data. Alternatively, NECTA is investing in Linux Servers and has already trained its systems administrator on working with LAMP (Linux, Apache, MySQL, and PHP) systems. When asked why LAMP now, the director said the following:

> *"…the way we are locked to WANG we do not like it to happen again. We need a flexible system that will allow us to have large pool of expertise. The current technology is locking us to depend on one developer"* (Director, NECTA, 14.07.2006).

In Norway, we found large cases of OSS deployment. The e-learning system called ClassFronter[11] was migrated from Oracle Database to MySQL database. While the motivation of migrating ClassFronter System from Oracle to MySQL was because of lack of support of Oracle database, one informant narrated:

> *"The system administrators observed that the performance of the system in the MySQL outweigh that of Oracle database, now it have fewer downtime points than before"* (Director, UiO, 3.2.2006)

The student information systems (StudentWeb), also hosted by the University of Oslo but being used by all higher learning institutions in Norway is powered by MySQL database. StudentWeb stores students' examination results, among other things, and is the only system which informs all students about their examination results. That is to say each student has to have an account in the StudentWeb. While MySQL database management system can be installed cross platforms, this study found that all systems using MySQL (both in Tanzania and Norway) are stored in Linux servers. Explaining the performance of Linux servers, a database administrator at the University of Oslo narrated:

> *"All our mail servers and many database servers run Linux operating system. Linux Servers are stable and do not re-boot frequently"* (Database Admin, USIT, 2.2.2006).

This feature of Linux servers was also noted in Tanzania:

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[11] Website: http://fronter.info/com/ (NB: classfronter is not open source but it uses MySQL database)

> *"Linux servers are hard to configure, but once they are, they work better for they do not crash frequently even in case of viruses"* (System Admin, UDSM, 16.06.2006).

In Norway, there is a project making use of Open Source Products in schools. This project is called 'SkoleLinux' has over two hundred schools using their products.

4.2 Open Source Software Products Lowers ICT Expenditure

In Tanzania, the main justification of launching and running the KiLiNux project is that, with OSS, Tanzania will leap frog the digital divide for it will afford cheap yet effective IT solutions (Suárez-Potts, 2004). The argument is that customised software and translated in Kiswahili language in order to be used in Tanzania could have been very expensive if they were proprietary software. In an action research study on implementation of OSS in education and health sector, it was established that the education sector made large serving of money (Lungo, 2005b; Lungo & Sahay, 2005). It is reported that, a total amount of USD $ 414,000 was served when a prominent university switched to OSS (Lungo, 2006).

In this study we found that OSS lowers ICT expenditure in three main aspects: hardware, software and support. Linux Operating systems delivers desirable performance like other specialised server side operating systems like UNIX and HP, yet it runs on less demanding hardware. While specialised Server Operating Systems require specialised hardware which are produced at high cost and thus become expensive, Linux operating systems run on low level servers and hence on cheap hardware. This results into lowering of hardware expenditure, as one interviewee commented:

> *"The best thing with Linux is the fact that it runs on any Intel inside servers which are produced in large quantity and thus become cheap"* (System Admin, USIT, 2.2.2006).

Thunderbird and Squirremail (the free OSS mail clients), has been a substitute of Eudora mail client at the universities studied. OpenOffice.org, though in limited use, but it serves some significant money which make a difference compared to using Microsoft Office 2003 in all PCs at the organisations studied. While MySQL is now replacing Oracles in powering critical systems, MySQL is free of charge (sometime comes already pre-installed in Linux servers), while Oracle license stands in the order of thousands US Dollars, see Table 6. Most of the organisations studied have thin-client computers. The client PCs can boot with windows or Linux operating systems. However, with Linux the client PCs can use free bios system to connect to the server and boot, thus lowering the hardware purchasing costs. When asked to estimate the percentage of which OSS lowers ICT expenditure in his municipal, the Manager of IT operations at Sarpsborg municipal simply put it, '50%'. This confirms that OSS do lowers Software expenditure.

Supporting OSS requires validating and testing the authenticity of software updates and releases due to frequent updates and quick bug fix model of software development. It may be seen that this could make software support services to become more expensive than proprietary software. Surprisingly, all visited sites appreciate the low costs offered in supporting software products. At the University of Oslo, they have signed supporting contracts with Redhat to support Linux operating system and MySQL AB to support MySQL databases. These contracts ensure that the University gets authentic versions and updates of the respective products. The University of Oslo also has comparative support contracts with Microsoft and Oracle on Windows Operating System and Oracle Database respectively. An interviewee in this study revealed that, although academic institutions have best deal with Microsoft and Oracle corporations, the amount being paid to MySQL AB and Redhat is negligible when compared to that being paid to Microsoft and Oracle even when divided into the same number of servers. At Hurum municipal, they also have a support contract with a small company called FreeCode. Again the interviewees there claimed that, FreeCode is an Open Source company which offers good service at low costs than any other company. We

therefore conclude that, ICT expenditure related to Software support could be lowered at large if an organisation switch to FOSS products.

Category	Proprietary Product		Free Open Source Software	
	Software	Price (USD)	Software	Price (USD)
Operating System	Windows 2003 Server	3,919[12]	Redhat Enterprise Linux AS 2.1 Server	1,545[13]
Office Application	Microsoft Office 2003	499[13]	OpenOffice.org	0[14]
Database Management Systems	Oracle Enterprise	40,000[15]	MySQL	4,995[16]
	Microsoft® SQL Server Enterprise Edition 2005 Win32 English CD/DVD 1 Processor License	24,999[13]		
Web server	Microsoft Internet Information Server		Apache	0[17]
Email Client	Microsoft Outlook		Mozilla Thunderbird	0
	Qualacomm Eudora	19[18]	SquirreMail	
Programming Languages	Microsoft Visual Studio2005	799[13]	Java	0
			PHP	0
			Perl	0

Table 6: Price list of open source software products and proprietary software products

4.3 Importance of Software Dealers Due to the Bazaar Model of Software Development

In this study, we investigated how the public institutions acquire OSS. The study informs that all OSS serving a serious mission in the institutions were obtained from trusted software dealers and companies. To mention some, Linux operating system is distributed by Redhat, MySQL comes from MySQL AB, SkoleLinux and FreeCode are another sources of open source products. The impression we got here is that, OSS has to pass through dealers/agents, who test, validate the performance and authenticity of those products. The tendency of using agents to get open source products empower public establishments to approach OSS with confidence, as they believe that somebody is responsible for ensuring the quality of the software. At Agder University College, one interviewee explained:

> *"when a windows application crashes, it sends a lot of information to Microsoft, and I doubt if they make use of all that information to track application bug, if it was open source we could know what all those information is all about. This is because with open source, we can check the codes, even if I don't check the codes, but someone out there is checking the codes"* (Systems Admin, Agder College, 3.02.2006).

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[12] Price list as at http://www.microsoft.com/products/ [accessed 24th October 2006]
[13] Price list as at http://shopping.msn.com [accessed 24th October 2006]
[14] Price list as at http://www.openoffice.org [accessed 20th October 2006]
[15] Price list as at http://www.cintra.com/us_licensing_price.html [accessed 20th October 2006]
[16] Price list as at http://shop.mysql.com/enterprise [accessed 20th October 2006]
[17] Free download from http://apache.org [accessed 24th October 2006]
[18] Price list as at http://www.eudora.com/ [accessed 25th October 2006]

This narration emphasises the importance of OSS agents to check the codes of the application. Users need to be assured that the software has been tested and is working fine by someone they trust.

4.4 Open Standards Add Value to Open Source Software Applications

The organisations manage large number of PCs and Servers which come from different vendors. It is impossible to force all departments and units of the organisations to implement the same Application Software, say Office Application and Operating Systems. Due to diversity of the ICT infrastructures in these establishments, inter-operability is a key issue. On the one hand, systems administrators interviewed agreed that organisational units can buy hardware from any vendors, but in all cases administrators encourage interoperability among the hardware. On the other hand, in publishing information, 'pdf' and 'html' documents are used instead of '.doc' and '.ppt' format in order to support access to all users with different computer platforms. Thus, since OSS supports open standards, this adds values as they are seen as a means of overcoming interoperability dilemma in organisations. For example, OpenOffice.org ships with a PDF converter capability.

4.5 Open source software Promotes use of Local Languages in ICT Products

In Tanzania, two projects studied at the University of Dar es Salaam are engaging in translating software to local languages. KiLiNux project translates several OSS including OpenOffice.org Office suit, Mozilla Fire Fox web browser and Linux operating system. The project is a success story which won a prize in the Stockholm Challenge 2006 in Education Projects (SCA, 2006). The University of Dar es Salaam also runs a Health Information System Project (HISP) in collaboration with other partners. In the HISP project, the software used as a health data storage and analysis tool is developed and translated into Swahili. At the time of writing, the HISP software is installed in all district medical offices and some hospitals in Zanzibar as well as few district medical offices in Tanzania Mainland. The study also found Thunderbird main client in Norsk language in Norway. The skolelinux project in Norway has its school application software bundle in local languages. This concludes that, OSS facilitates the use of local languages because those who translate the software are not necessarily the ones who developed the software. As long as the software source codes are available, translation to local language can take place when need arises.

5.0 CONCLUSION

The study reveals evidence that organisations using open source software find the performance of their products satisfactory to do the intended job. OSS products are cheaper software which avoids proprietary software standards lock-in. The results further indicate that, open source makes its way into public organisations through software dealers. These software dealers offer their services in cheaper price compared to proprietary software and organisations have the possibilities of changing to other dealers. In addition, we found that infrastructure products especially MySQL and Linux are the most used products and OpenOffice.org, Firefox browser, Thunderbird mail clients are most used application software. Thus, organisations have a credible alternative to proprietary software infrastructure and application software products. The Cathedral and Bazaar theory offers a valuable insight on our understanding of open source software. We further highlight that, although the organisations studied are from two different contexts: high income country and low income country, they are on the same level with regard to ICT issues like total cost of ownership and avoiding vender lock-in. The implication of this study is to confirm that OSS products are not always hyped. There are vivid evidence of the success of OSS performance which encourages continue use of OSS products in the public sector as well as the private sector.

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Scalability as Institutionalization - Practicing District Health Information System in an Indian State Health Organization

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ABSTRACT. This paper is based on an analysis and of the introduction and scaling processes of a health management information system in the public health care system of an Indian state. The system is developed and implemented by an international action-research network in close collaboration with the local health department. The purpose of the system is to improve health information circulation and use within the health system by establishing action-nets to get institutionalized into organizational practices. Data is being collected by directly participating in this project within an action research framework. This ongoing initiative is presented by introducing the two main organizations involved (the health services and HISP, the implementing organization), and then focusing on the way they are interweaving part of their activities around the health management information system. The conclusive part discusses how this process is relevant for learning and the scaling up of these kinds of systems.

Keywords: information system scaling, institutionalization, practices, action-net, health organization, organizational learning.

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         Like composers, we cannot write music for which there is no instrument
                                                                    Howard Becker
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1. Introduction

The initial quotation makes metaphorically clear the nonsense of information system design without considering the contexts of implementation. Thus, the approach of this action-research is rooted into the Mahatmapradesh state[1] (India) health system, where an information system is being developed and implemented into the local organizational routines.

We assume that development is the sought result of a goal-oriented organizational change, as institution-building suggests. Information and Communication Technologies (ICT) hold the promise for rural areas development as they allow distant coordination, and make remote organizing more viable. In spite of that, *it is not unusual that health information systems (HIS) fail because their design and implementation are based on explicit organizational structures and formal requirements*. In order to avoid such reductionism, several issues have to be considered, such as: software and electronic network functionality, institutions, learning, practices, labor and support – these comprise what we term as an action-net (complete definition in the theoretical section). These elements will be considered in the presented case in order to describe two action-nets produced by an information system's implementation, and conclude with some ideas to take stock of ICT in 'development' contexts, specifically in the sector of public health. Theoretically, the issue of scalability of a health information system will be examined in institutional terms.

The plot of this submission begins with presenting a large bureaucratic organization where the HIS is being implemented. On the other side, the trajectory of the non-governmental organization "Health Information System Programme" (HISP India) responsible for the HIS being implemented, is a premise to introduce the intersection of those two organizations and the implications that it has for scaling up the HIS and the associated processes of institutionalization.

This paper is organized as follows: after presenting the research approach (§ 2), the Mahatmapradesh health care system is described (§ 3) as the context for the HISP India health information system (§ 4). After that, the theoretical framework is delineated (§ 5); this helps to bring in a theoretically informed account about two required (sub-) information systems (§ 6). Implications for scaling and institutionalization are discussed in the conclusions (§§ 7, and 8).

2. Situating Research and Authors

In an action-research approach which is characterized by a continuous process of adaptation of theory and practice, it is relevant to make explicit some reflexive issues that inform this initiative. They will be presented starting from the research question, then presenting what methods are chosen to look for appropriate answers, and then briefly introducing the role of the authors in the project.

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[1] All names except of HISP India are disguised.

2.1. Research Questions

We propose to start by looking at the action-net that the information system attracts and supports. *This perspective is rooted into the idea that informal organizing is as important to understand the design, implementation and organizational processes as the formal and official structures*. Such a standpoint presents a point of departure from the mainstream approach to information systems and organizations which tend to be conceived as linear implementations of rational designs, and requires special attention for the cycle "theory - action - modified theory - modified action".

The general question about how 'development' can take place and be backed through information systems is proposed in this IFIP 9.4 conference by the following question: "What new organizational forms are possible?" On this line, we specify that question by asking:

"*How can action-net -related to an information system- be constructed and institutionalized?*"

More specifically, it can be broken down into sub-questions:

- What is the action-net 'provoked' by the District Health Information System (DHIS 2.0, the specific HIS in question) as being implemented by HISP India in Mahatmapradesh?
- Who and what is this action-net constituted of?
- What boundaries exist around and within the practices?

Last but not least, this broad question will also be kept in mind: "What is beyond the HIS but relevant to understand the system itself?"

2.2. Methods and Approach

Answers to these questions are affected by authors' roles and viewpoints, which need to be made explicit. One of the authors is the founder of HISP India, and initiated the Mahatmapradesh project. The other is carrying on a participant observation within this project. Although this is not a grounded research, it is our purpose to keep it open-ended by remaining sensitive to what the project and research processes suggest. This does not exclude an intention to develop and clarify a normative stance, by discussing and pursuing what "should be". Before introducing data and presenting our answers to the previous research questions, it is necessary to explain the main reasons that justify our theoretical and methodological choices. That is relevant to clarify how the cycle of mutual affection theory-action is understood and kept coherent or, in other words, how learning takes place. The data collection lines and roles correspond with these two research inquiries:

- How the Mahatmapradesh health care organization and HISP India are interweaving their activities by working around a HIS; and,
- How feedback loops within the health care system can be developed by analyzing the data provided by the system to improve planning and take organized action.

This study is based on qualitative data collection, and interpretative approach within an action research framework. Quantitative data are used as empirical material as far as they affect the field of study.

The HISP action-research in Mahatmapradesh has started in February 2006, and has been enriched by individual and group level semi-structured interviews. A focus group around the

'dashboard' (a collection of critical indicators for the health management) has recently been organized to coordinate its definition and implementation. Shadowing is another method used to follow health personnel, officers, software developers. Another important component of the participant observation concerns the online activity of the HISP group (email, mailing list, chatlines, and phone calls), which is very important for the coordination, and understanding of activity. A number of government records and reports were also analyzed to further gain an understanding both of the Mahatmapradesh health organization and its ongoing processes of its partial intersecting with HISP India.

3. Mahatmapradesh Health Organization: The Context of Implementation

Mahatmapradesh state population was estimated at about 50 million in the 2001 census. That state public health care system is constituted of 1070 Primary Health Centers (PHCs), 253 Community Health Centers (CHC), usually situated at the taluka (sub-district) headquarters. The Block Health Office (BHO) is a concept particular to Mahatmapradesh state to enable the coordination of various administration tasks at the sub-district level, and between the levels of the district and community, including activities around the HIS. In the HISP project, the computers are placed at the BHO, and all the PHCs and CHCs included in the Block came to the BHO for their information processing activities (including data entry and report generation).

The Mahatmapradesh health activity reporting system follows the organizational structure: each level aggregates data from the lower one, adds new data and produces its own reports as per predefined national formats. The formal organizational structure is represented by the scheme below.
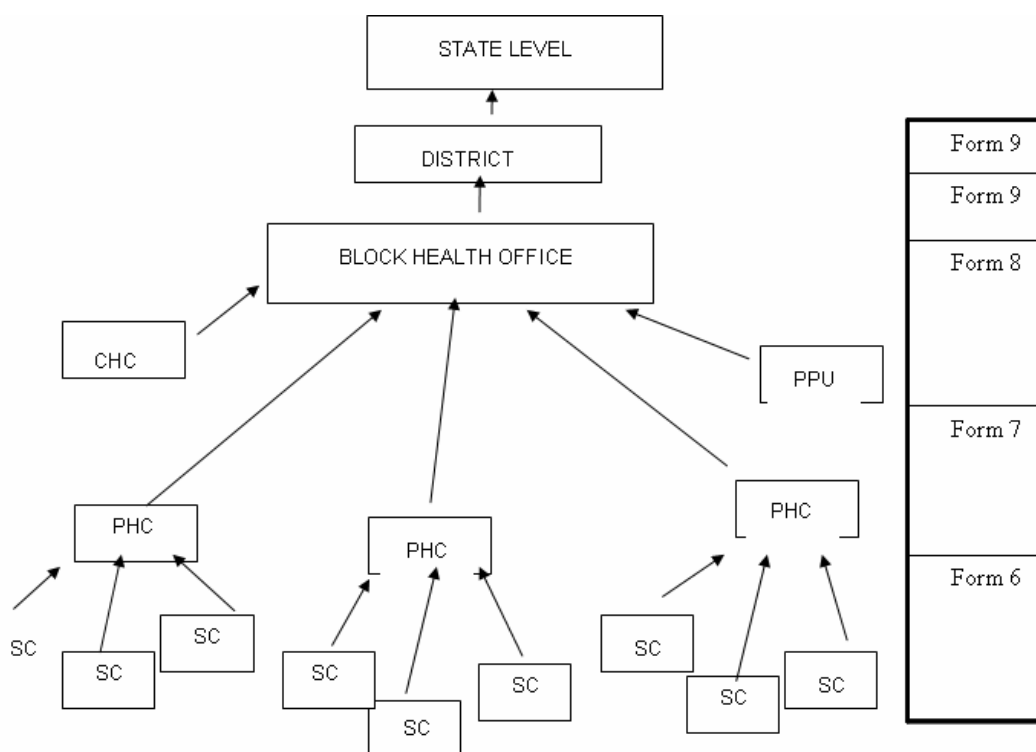
Figure 1. Information flows within the health care system. The table on the right shows the main existing routine reports [forms] that have been incorporated into the DHIS.

Figure 1 represents the bureaucratic domain of information flow within the health department. HISP started from the automating these flows, and is increasingly working on the managerial use of information (whose flow partially mismatched with that), as it will be clarified through the case study.

4. HISP India's Trajectory

The Health Information System Project (HISP) is a global network on HIS design, development and implementation established around 1994 by the Department of Informatics, University of Oslo, Norway. This global network is working in various countries including South Africa, Mozambique, Botswana, Malawi, Ethiopia, Tanzania (and Zanzibar), India, and Vietnam. HISP aims at strengthening HIS to support public health management, especially for the district and sub-district levels, by enabling health personnel to use their information and to improve the coverage and quality of health services delivered. HISP is based on action-research, and seeks to create linkages between various activities around health conditions, their improvement and research.

The DHIS 2.0 version of the software, based on a free and open source framework, is currently being implemented in Mahatmapradesh. The project implementation started in March 2006 with a pilot in Parsinagar, a district in the southern part of the state. In July, a positive evaluation (by the state authorities and a prestigious national management institution) opened the door for the "scaling up" of the system. In mid August, heavy monsoon rains proved disastrous for the region, with hundreds of deaths and enormous material damages. This delayed the system implementation because the health care administration was dealing with other priorities. Anyway, at the end of that month, the Health Commissioner assigned four more districts to HISP for implementation. These districts were in the northwestern part of the state, not directly affected by the floods. Through 2007, all the 25 districts in Mahatmapradesh are expected to use the DHIS 2 within the framework of HISP.

4.1. Parsinagar Implementation

The pilot project in Parsinagar district needs to be situated within the Mahatmapradesh public health organization. The focus is on the BHO level for three main reasons:

- Very limited data collection takes place upwards (at the district);
- It is between the health care system and district/state administration;
- Health staff routinely comes to the BHO for various administrative tasks like salary collection.

The following are some of the characterizing aspects of the information system:

- It is mainly focused on reporting – both routine and for analysis (e.g. indicators),
- It is being implemented at state, district, and BHO's levels, and in the future can be extended to the PHCs (below the BHO level) if computers and related infrastructure are made available there,
- It is integrated with the paper based information system, and -through that- to other public administration procedures (such as resource allocation – although more in theory than practice).

The Parsinagar implementation has established the premises for further institutionalization of the system, both through the expansion to new districts and also by incorporating additional system requirements. Two examples are presented in this case, one concerning a Graphic Analyzer (a 'dashboard' of managerial indicators) and the second of a Geographical Information System (GIS).

5. Theoretical Frame: Scalability as Institutionalization

This section introduces concepts to look at what is taking place within the Mahatmapradesh health system, specifically related to the HISP initiative. More specifically, the scaling up of the DHIS as institutionalization will be seen as a process of both formal and tacit negotiations taking place between the involved actors, or -in other words- as a process of integration of various formal and informal practices. The presentation of the case starts with the description of the Parsinagar pilot, and continues with the description and analysis of the institutionalization processes that is taking place at state health system headquarters, where HISP has been assigned office space, which has both material and symbolic implications. The "dashboard" and the GIS are described as they help to understand the processes of intersection between the two organizations, and its implications for institutionalization. These two systems are looked at as "boundary objects", i.e. as artifacts on the points of encounter of different groups, which can establish relations through those kinds of objects. Boundary objects have different senses for the different social worlds they intersect.

As the design-implementation process is not taking place linearly, nor within a single and stable organizational structure, we need to rely on theoretical concepts which are able to account for the empirical context. The idea of the action-net looks at organization as the result of different and interwoven individual and group actions. They do not axiomatically take place within one formal organization, and can comprise a wide variety of recursive and temporary actions by very different actors. So, the action net is composed by the actions needed to perform organized action.

Lindberg and Czarniawska [2006] propose clear distinctions between action net, organization fields, social networks, and actor-networks (all concepts widely used in information systems studies). The organization field, originated from the New Institutionalism, denotes the frame of reference for organizations engaged in a specific activity, their interactions constituting a recognized area of activity. Czarniawska notes that the concept may fail in capturing the interactions actually occurring (organizations in the same field, like universities in the higher education field, may have no direct contact among them, and be characterized by relationship with other entities).

A social network is based on the connections between actors, rather than between actions: "in an action net perspective, actors are exchangeable, whereas in a network perspective it is actions that can be so described. The Mafia is a network: when one type of action fails to be profitable, Mafia members take some other action—but the same actors are involved." [idem, p. 3]

As an action-net, the actor-network approach assumes that actions constitute actors. In Czarniawska's view, the difference between these two concepts is about the time of the study: "ANT studies begin when translations and connections between actions in an action net have already begun to stabilize." [idem, p. 3] This makes the action-net concept particularly relevant for this case, which is studied during its realization.

Scalability is usually referred to a technical system's characteristic of being extendable in functions, or its ability to do more work, and to cover larger areas. The meaning has also an economical sense: a system is scalable when new purchasers bring incremental advantages to the system itself or, from the other perspective, when higher production reduces the cost per unit, increasing the marginal profit. Scaling up an information system has been described as a strategy to achieve sustainability and more relevance [Braa, Monteiro and Sahay: 2004]. In this paper, the term scaling is used from an institutional perspective: scalability will be seen as the ability of the information system to get recognized, accepted and used within normal

courses of action. Thus, it would get subsequently scaled through institutions. This means both that the system aims at getting embedded into existing practices and enacting new routines, which are expected to become normal in local construction of organized action (as described later).

The concept of institution needs to be introduced: "all human societies are characterized by more or less complex and overlapping net-works of regular social interactions and social practices. Whether economic, political or cultural, such repeated interactions require agreed and predictable rules about ways of doing things. Such sets of rules constitute institutions" [Leftwich: 2006, p. 1], which can be both formal and informal. Formal ones "are normally established and constituted by binding laws, regulations and legal orders which prescribe what may or may not be done. Informal institutions, on the other hand, are constituted by conventions, norms, values and accepted ways of doing things, whether economic, political or social." [Ibidem] This definition is in line with the New Institutionalist view [Powell and DiMaggio: 1991]. Through this paper, the micro-level of institutions is seen in form of practices [Miscione: 2007], and will be linked with the concept of action-net through the next paragraph.

5.1. Action-Nets and Institutions

This submission approaches scalability in terms of institutionalization. Therefore, it will consider the consolidation of action-nets in institutional practices. Through the paper, the accepted working definition of practice is: "*I define a practice as a mode, relatively stable in time and socially recognized, of ordering heterogeneous items into a coherent set.*" [Gherardi: 2006, p. 34]. This definition:

- helps in fully including the artifact into the organization description,
- moves action-net concept towards institutions (being more stable and recognized courses of action),
- avoids a taken-for-granted rationalistic standpoint,
- goes beyond formal organizational belonging of actors, as organizing actions and belonging to organizations are decreasingly congruent,
- situates practices between fluid action-nets and institutions.

To sum up the use of the concepts proposed:

- *action-net* is a set of actions performed by a variety of actors to perform a collective action. If it is socially recognized and stable, it can be labeled as 'practice',
- *practice* is a socially consolidated mode of ordering heterogeneous items,
- *institution* is a social model embedded into normal patterns of action.

The use of these concepts aims at rethinking the way we look at socio-technical processes, going around some limitations involved in the traditional focus on places, people, or issues. This is important when we deal with (community of) practices [Wenger: 2003] engaging rather diverse actors, such as Mahatmapradesh health care administration and facilities, Oslo University Informatics department, computer programmers from different continents, local system facilitators.

The most relevant practices in which HISP Mahatmapradesh is currently involved are:

- Software development (mainly constituted by HISP developers and coordinators, state health programme managers, University of Oslo developers, bureaucratic procedures shaping for example who is responsible for providing requirements);
- System implementation (system facilitators, training processes, BHOs, hardware vendors, connectivity providers, DHIS users, reporting requirements and routines);

- Health care activities reporting (auxiliary nurses, system facilitators, supervisors, officers who consolidate reports, paper-based information system),
- Health activity planning and policy-making (health programme managers, Health Commissioner, national directives, district officers, district programme coordinators); and,
- Cultivating a culture of information use (HISP public health specialists, health officers and managers, data validation tools embedded into the DHIS, training courses, awareness raising of data reliability importance, practical links between information and health delivery).

Each practice involves several actors that perform the various actions required under varying constraints and support mechanisms. *An action-net denotes actual connections among actions, the DHIS serves as a boundary object within and between those actions, and their performers.* Star and Griesemer [1989] state that boundary objects are in tension between different viewpoints and the necessity of collaboration around them. *Boundary objects do not require consensus on the intersections of different social worlds, cooperation around/through boundary objects require mutual understanding on the boundary, but not necessarily a common rationality. Mutual understanding and sense-making is considered on the collective rather than individual level* (Puri [2007] proposes a relevant example). This characteristic of boundary object is central in making the concept suitable to this case, which comprises such a variety of dispersed actors.

To link back scalability and institutionalization, we look at (and work within) the action-nets which are being constituted into the health care system. This acceptance and legitimation into local practices are the way for getting the system institutionalized and therefore scaling it up.

6. The 'Dashboard' and GIS, Knotting Organizations

In this section, the 'dashboard' and GIS's developments are presented as examples of two different processes through which actors establish action-nets by engaging in activities around a common boundary object with the aim of institutionalization.

6.1. Reporting: the Premise for the 'Dashboard'

Development and customization of the electronic routine reporting system within organizational levels of the health care system had been carried out at Parsinagar following the principles of participatory design. This has been the way to 'tune' the system to the local requirements and needs, and to keep design and implementation closely interwoven. This is producing an *ongoing institutionalization process made up not only of formal agreements, but of relations of interchange and mutual involvement, that we can call action-nets*. The positive evaluation of the Parsinagar project (at least partially) legitimized HISP Mahatmapradesh within the state health care system and set the basis for its scaling up to 4 further districts.

More specifically, the state health care organization -relying on the existing organizational routines- invited HISP to develop the HMIS. The existing formally required routine reports provided the point of departure for further requirements. The need to establish connectivity of health reporting between the lowest levels and the state was seen as a key ingredient for making the health system more effective. In spite of this apparent common agenda, and a general agreement about means (implementing the HMIS at different levels, from state to blocks), divergent accountabilities can be noted, both with respect to the responsibility of the persons in charge, and shared sense of what are the routine activities. For example, a software developer's activities are expected to be accountable to HISP, while the health program manager -whom the programmer is temporary working for- is responsible for her/his specific health program, in addition to the overall state health department. This may create

divergences, for example, in synchronizing the priorities of the developers with the pace required for the implementation. Similar divergences are normal when different organizations engage in the same action-net (merging part of their activities). These interactions need to be managed to avoid disruptive discrepancies, and to build new stable practices. It is not secondary that this action-net's consolidation can potentially be made easier with HISP being assigned an office space within the health administration building in the state capital: as jointly engaging in everyday activities can be of great help in developing mutual understanding, coordination, and alignment.

6.2. Action-Net for the "Dashboard"

The need for a 'dashboard' (or a "Graphic Analyzer" for visualizing managerial indicators) was proposed by the State Health Commissioner to routinely gain an overview of the state health situation while focusing on a limited set of relevant indicators. Developing such a focus is not easy in an organization where the history is one of collecting a large number of data-elements with little emphasis on how they relate to the computation of indicators, their use to understand health situation, and their use for activity planning.

Also, the 'dashboard' signifies the need for relating diverse data sources (bureaucratic forms, vertical surveys, etc) and presenting it to the managers to be used accordingly to action needs of different organizational levels. *Such action-net required performing data linking, planning and consequent activity, which are not part of existing organizational practices,* and cannot be reduced to the formal role of specific officers. It can be noted from HISP experiences in other Indian states that this poor relation between data-elements, indicators, and planning is a general problem, and in this sense, Mahatmapradesh can be seen to be more progressive than other states, as it is currently engaging in the discussion around indicators, even though they are not currently used.

The need for the dashboard was expressed emphatically by the State Health Commissioner who criticized HISP for focusing primarily on the routine reports with limited value to his management needs. He did not want a system that merely automated the existing inefficiencies. The slow progress on this front (indicators) in creating the dashboard from both the state health officers and HISP team was reprimanded by the Commissioner who declared "we need a 2-3 pages report, to take action on." This direct demand from the Commissioner and his dissatisfaction with the state of progress helped to galvanize some action from both sides (the Health department and HISP). The Commissioner designated one of his senior officers to oversee the dashboard implementation process, and HISP from their side deployed one senior medical doctor to interact with the Health department. This led to a process of negotiations and meetings, starting off with defining the indicators starting from the Reproductive Child Health program. As a result of these negotiations, three successive versions of the indicators were produced, and the final list has been approved by the Commissioner. These indicators have been inscribed into the DHIS 2, which is now able to provide the required reports on a routine basis to the state authorities, and hopefully will lead to the initiation of actions concerning the review and use of these indicators to improve health care service delivery. Similar processes of indicators definition and their implementation are also planned for other health programs and also with other levels of the health administration (District and BHO).

While earlier attempts to create similar indicator lists were ongoing in the organization, they did not fructify into something concrete and useful for the Commissioner because of the separation between the managerial and the bureaucratic domains. The actual challenge is how this action-net can be institutionalized into the organizational practices. For example: the

calculation of managerial indicators will require data from different sources and departments (such as those conducting health surveys and the routine systems), which thus creates the potential of horizontal information sharing, very useful in an organization in which divisions "have the population in common, only" (as a programme manager declared). While the historically existing bureaucracies will impede such sharing processes, the action-net created can try and provide the impetus for the establishment and institutionalization of these new practices.

At the time of writing, the dashboard is functional and in use, although it is still not fully part of the health department routines. It would probably take months or more to get embedded into consolidated practices, therefore to enact an organizational change. The first step on this way is the improvement of reliability of data provided. The validation rules embedded into the software, and the training courses organized for medical officers have positive effects on health personnel ("eye opener training", "we get to see things which we had been unable to see on paper, somebody brings paper and we simply sign", "what we have done before was not visible, today it is becoming visible, we're blindly signing so today we are feeling guilty" are some of the medical officers' quotes reported by one of the trainers).

A concrete obstacle to institutionalization is the personnel high turnover at all levels. The health department's IT consultant who contacted HISP left after a few months the project started, when she was still acting as a catalyst for the action-net constitution. A few weeks before the contract to scale up the system statewide was to be discussed, HISP's reference within the health department left. All those months have been characterized by the concern about the displacement of the health commissioner before a Memorandum of Understanding would have been signed.[2]

As action-nets are initially based on tentative, informal, and several times improvised connections, the frequent change of people is a continuous challenge for the establishment and consolidation of action-nets. This is particularly relevant in a context, like the Indian, where hierarchies are strict, and new personnel are not always available to engage in alliances not completely congruent with the structures already in place.

Through this process, HISP is learning, too: HISP action-research, in India and in other countries as well, is based on its ability to learn through the theory-intervention continuous interplay. Indeed, more empirically, the new action-net focused on medical and organizational issues is increasingly reflected in HISP India software design and development. The result of this learning in software development practices is making HISP more scalable, in institutional terms, and aims at contributing to information system research, for example through this article.

6.3. Action-Net around a Geographical Information System

Various research studies and practical examples have established the potential that maps hold to improve public health delivery, and also the challenges in developing effective GIS applications for this purpose [for example, Lewis: 2005]. The challenges come from a variety of reasons including the complexity of the technology, the non-availability of maps, and a weak culture around the use of maps in general in India [Walsham and Sahay: 1999]. These

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[2] Anticorruption rules in Indian public administration impose frequent and sudden displacements of high officers. Moreover, HISP state implementation coordinator left after seven months of implementation, and the development team always risks people move to the higher-paid and rapidly growing Indian IT private sector.

challenges thus provide a high threshold for organizations like HISP to overcome, seeking to develop HMIS in which GIS is integrated. The capability to transcend this threshold thus provides a useful mechanism for locking in HISP, as a successful provider, into the everyday routines of the workings of the state health organization.

In Mahatmapradesh, the potential to transcend the inherent complexities came through collaboration with Geo-Info which was suggested by the IT consultant in the state health department. Geo-Info, a quasi government organization, has an established significant expertise in geo-spatial applications, and has the official mandate of the state government of Mahatmapradesh to develop such geo-databases and applications. Moreover, they are the agency designated with the ownership of the spatial databases, for which in Mahatmapradesh -because of security restrictions for bordering with Pakistan- is nearly impossible to obtain high-resolution maps with village level boundaries and the required layers. In a sense, it would have been impossible for HISP India to have developed a GIS for a public health application without Geo-Info. On the other hand, with a formal collaboration HISP had the potential to become an integral part of the institutional routines surrounding the use of spatial data. From the Geo-Info perspective too, the collaboration with HISP was beneficial for two reasons. Firstly, HISP had the public health expertise, something which in Geo-Info was missing. Secondly, for Geo-Info to effectively provide a GIS solution to the state health department, they needed the non-spatial routine health data, which was being collected through the DHIS 2.0. This mutual advantage situation arising from the collaboration was also facilitated through informal means due to an existing friendship between a senior HISP India researcher and the Geo-Info Director, which helped to establish the trust in each other's intentions and capabilities. Given this context for the creation of the action-net, the linkages were pursued through two key strategies. Firstly, a clear separation of the DHIS 2 and GIS applications, with HISP and Geo-Info independently responsibility of their respective applications. Secondly, a "loose integration" was made by establishing a technical linkage only at the database level, where software routines were created so that the routine data being collected through the DHIS 2.0 would be made available in the appropriate format to the GIS application, which could then use this data and display it on the maps.

In spite of these positive premises, the collaboration has not really produces the expected results in terms of actual use on the ground. A number of causes can be addressed:

- their software was not open-source, therefore all the adaptations for programmes and different organizational levels had to be done internally by "Geo-Info". The chair assured that necessary human resources would have been available, without considering their real entity;
- Although a joint HISP / Geo-Info team was appointed, HISP and Geo-Info code writers where in different places, both coping with other priorities. So, the collaboration was simply left aside in daily activities;
- The friendship between the members of the two organizations has facilitated the establishment of the connection, but the IT consultant's departure removed the facilitator for a formalization of the collaboration (at that point, the GIS was working on a limited set of data, and more resources than those which could have been informally made available were needed to carry on the development).[3]

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[3] Unavailability of source code implied that Geo-Info should have had adapted their import tool to DHIS, and to the requirements of diverse organizational entities (districts, blocks, vertical health programmes)

We propose this counter-example to the dashboard as relevant to highlight the need of establishing action-nets rather than only abstract plans to design and implement an information system.[4]

7. Scaling Health Management Information Systems by Institutionalization

An important aim of this action-research is to explore the potential to provoke *organizational change within a bureaucratic system* such as an Indian state health care system. In this, the role of *HMIS is central, as far as information can be used for learning and action*. This section draws from concrete examples, to make the point of creation of action-nets, their institutionalization as the way to scale up a HMIS.

As far as we focus on social networks or organizational fields, we cannot make much sense of the differences between the two cases described previously. The main reason we provide to explain why the Dashboard is on the path of institutionalization, and the GIS is not is that the former has been built by constituting an action-net, whereas the latter's implementation was designed in abstract terms and not on existing and potential courses of organizational action.

On the other hand, institutionalizing a HMIS does not mean accepting organizational routines as they are. Since the concept of use of indicators was a relatively new concept in the health department, there was an inherent ambiguity from the state side on who should be involved in the discussions and who has the responsibility and authority into taking decisions around "what is the accepted and official list of indicators." If new action-nets reproduce existing routines, learning is not likely to take place. So, in a sense this ambiguity has allowed cooperation, as it would not have been possible otherwise because of fixed procedures that regulate the flow of information and the establishment of interchanges. This process of negotiations around the indicators definition -facilitated through the external agency of HISP- can be seen as catalyzing the creation of an action-net which aims at reducing department's inner compartmentalization, based on the argument that fundamental information flows need to be integrated. Unlike the boundaries of formal organizations, which are formally and officially defined, the boundaries of the managerial action-net supporting the 'dashboard' tend to be more fluid.

The process of negotiations -and varying institutional conditions in which the implementation is taking place- helped in constituting the dashboard's action-net. The DHIS acted as a boundary object between those actors and their practices. This introduces the need to highlight the main boundaries that have been encountered until now, where activity is more fluid, therefore where other-than-hierarchical alliances can be more easily established:

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[4] As an example of the plan for the GIS, we can quote an our own excerpt from our previous submission (five months ago): "the interesting feature of the GIS is that, there has been no need for ongoing and continuing negotiations to institutionalize and scale up the processes, but the inscribed technical routines are "speaking on behalf" of the two organizations, and holding them together. The institutional conditions, including the issues of expertise and ownerships of mutually required data (routine non-spatial and maps respectively from HISP and Geo-Info) promise to provide the framework with which the action-net can be institutionally consolidated, thus sustained. However, it is important that the application is effectively taken up by the user departments (specifically by the medical fraternity at all levels). Only when the system proves useful in their practices, will the mechanism for scaling be provided. Towards this end, Geo-Info and HISP are planning to run long term and intensive training programs for the users." (This quotes underpins the importance of reflexivity to produce learning)

- State health care department/HISP India: the public administration and the NGO rely on different sources of accountability, meaning that the patterns of action considered normal in a bureaucracy and in a not-for-profit organization are not always aligned.
- Geo-Info/HISP India: they kept complete autonomy and tried to interact nearly exclusively through developing the software linkages.
- BHO, district and state: information flow should meet more precisely control and planning activities. DHIS 2 is being positioned as the "obligatory passage point" through which all reports need to flow.
- Computer-based / paper-based information system: the reporting system is currently mixed, with the vision of slowly reducing the paper component at the expense of the other.

The *action-net fluidity can be a potential site for organizational learning to occur*. The example of the 'dashboard' development illustrates the potential that such artifact has as boundary object, to facilitate the creation of action-nets which subsequently can contribute to processes of institutionalization.

8. Conclusion

The existing organizational structure *tends to support a separation of the two lines of information and action within the health organization: the bureaucratic and the managerial*. For example, the people who understand the content of what the indicators are, and how they can be used, often are not fully included in the decision-making processes involved in defining the functioning of the HMIS. This means that relevant information risks not going beyond closed circles, being accumulated as a fulfillment for bureaucratic duties, rather than being used for planning. This keeps information availability dependent on particular power and interests, and is challenged by the establishment of action-nets oriented towards learning and organizational change. Former tendencies could potentially impede information systems' design and implementation as a 'development'-provoking practice. On the basis of this, future research will continue to consider if the system under development is producing learning, organizational change and institutionalization (as far as it enacts and/or produces recognized practices, it gets institutionalized, therefore spreads out and scales).

While it is still relatively early to evaluate the effectiveness of this project, participant observation reveals that some taken-for-granted routines have been addressed, and changed, initiating new action-nets. They are, and need to be, more fluid then the bureaucratic reporting activity in order to keep adapted to the changing health needs from the environment the health care system is dealing with.

A non-definitive answer to the research question is that, in order to get institutionalized, action-nets need: a) to find entry points into existing organizational procedures (it can be easier to get into them if they are fluid to a certain extent), b) to intersect different practices and leverage on the boundaries between them, c) to be continuously followed when they emerge, oriented by situated actions, rather than abstract plans [Suchman: 1987]; therefore, managed locally.

It is difficult, at this point at least, to define some typology of effective (and institutionalizable) action-nets. The main contribution this article aims at making is to argue the relevance of looking at scalability as an institutionalization process, which needs to take place constituting proper action-nets. Any achieved result would be, the process is showing that *organization through information systems is a practical accomplishment, rather than a linear implementation of a rational design*. This posture is in line with Orlikowski's [2000], who argues that, in order to be enacted, *technology should be learned rather than transferred (the two cases show different aspects of learning processes)*. This case suggests that

institutionalization requires the ability and attitude to learn, and this depends on the ability to reflect and also to unlearn (paper based report practices, for example), *on both sides*. Rather than a list of recommendations, we think that this practice-based approach is the main contribution to the broad community engaged in information systems in developing contexts.

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EXPLORING THE SPACE AND PRACTICE OF E-BUSINESS IN THE FAIR TRADE SUPPLY CHAIN

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Abstract: Fair Trade and e-business have been topics of growing academic literature. However, very little is known in terms of the utilization of e-business in Fair Trade. This paper aims to address this gap and explore the opportunities, current utilization as well as challenges of e-business in the Fair Trade Supply Chain (FTSC). The paper makes a unique contribution to the wider understanding of the social and developmental implications of e-business. It identifies some of the issues of implementing e-business in Fair Trade, a sector which has poverty alleviation and equitable development rather than profit and share holder value maximization as its key performance indicators. It offers some perspectives that organizations in the FTSC and others that support the Fair Trade scheme can use to make better use of e-business to improve the FTSC and the value it delivers to developing countries.

Keywords: E-business, Fair Trade, Developing Countries, Supply Chain, E-development

EXPLORING THE SPACE AND PRACTICE OF E-BUSINESS IN THE FAIR TRADE SUPPLY CHAIN

1.   INTRODUCTION

The role of information and communications technologies (ICTs) in development has been debated at both theoretical and practical levels. Lately, ICTs have been recognized both as tools for achieving developmental goals (such as those related to improving government, health, education and business processes and services) and as development targets (such as those captured in e-readiness and digital access index indicators). Particularly, the potential of e-business to increase market access for firms in developing countries and by-pass some if not all of market intermediaries has been widely touted. Extant research, however, suggests that there is little evidence to support that e-business has actually delivered these benefits (Molla, 2004a; Moodley, 2003; UNCTAD 2005). Where there is evidence, it suggests that e-business can only improve the efficiency of market information flow in an environment where the market has already been accessed.

The reasons for the shortfall in e-business benefits are complex. However, most researchers highlighted that developing countries firms' access to market is significantly constrained not only because of lack of access to market information and information flows, but also because of (a) regulatory constraints that restrict market access; (b) commodity subsidy policy of the West that makes competition unfair; and (c) the collusion of trans-national corporations that eliminates price negotiations from the market (Brown, 1993; Kastrine, 2006; Nicolas, 2005). This implies that for firms in developing countries to extract e-business value, the structural and systemic challenges that inhibit trade should be addressed (Hinson and Sorensen, 2006; Molla 2004b; Pare, 2003). Further, while businesses at a firm level might capture some benefits of e-business, it is not always clear how those benefits trickle down to address real development issues of the sort identified in the millennium development goals.

The Fair Trade model offers unique opportunities to tackle some of the structural challenges of trade and to link the benefits of e-business for development. Fair Trade represents a trading scheme that aims to create better trading conditions, market access and fair price for producers in developing countries (Wilkinson, 1996). It is proposed as one of the mechanisms to address some of the structural challenges commodity dependent developing nations face in global trade. Since its beginning in the 60s, Fair Trade has experienced some social and economic prominence. In 2004, global sales of all Fair Trade products amounted to US$ 1 billion up from an estimated US $500m in 2003 and US $ 335m in 2002 (FLO, 2005; Vidal, 2004). There are now more than 500 *Fairtrade* certified producer cooperatives, 270 Fair Trade organisations and over five million people in Africa, Asia and Latin America benefiting from Fair Trade (FLO, 2005; Wills, 2005). In Europe, there are more than 70,000 Fair Trade outlets including 3000 world shops, 33000 supermarkets and 50 supermarket chains (Wills, 2005). In some countries, Fair Trade commodities constitute a recognisable proportion of imported commodities. In the UK, for instance, where half of the population is aware of Fair Trade, 15% of the imported bananas, tea, coffee and cocoa are Fair Trade products (Moberg, 2005). In Switzerland, Fair Trade bananas have a 50% market share (AgroFair, 2004).

As the Fair Trade model is intended to by-pass traditional intermediaries, to save on transaction costs associated with those intermediaries and to plough back the savings to producers, it appears to be in synch with some of the systemic competencies of e-business. The use of e-business (with its inherent potential to by-pass some, if not all, of the market intermediaries; to reduce transaction costs, and to improve market access and the information

content of products) in Fair Trade (which is designed to bypass traditional intermediaries and create a direct link between producers in the South and consumers in the North) is intuitively appealing. It can potentially link the benefits of e-business to poor communities (Batchelor et al, 2002). It can also enable Fair Traders to improve their coordination and reduce the high marketing cost they usually face.

Although there is a lot of literature on Fair Trade and an equal number on e-business in developing countries, very little is known in terms of the utilization of e-business in Fair Trade. The purpose of this paper is therefore to explore the opportunities as well as the extent of utilizations of e-business in the Fair Trade Supply Chain (FTSC). The main research questions include (1) what are some of the challenges that Fair Trade organizations face? (2) which of these challenges can potentially be addressed through judicious implementation of e-business (3) what is the current state of e-business use in the FTSC (4) what are the specific challenges of using e-business in FTSC and (5) how can current practices be improved?

2. RESEARCH METHOD

Both Fair Trade and E-business have been topics of growing academic literature. However, their intersection remains an interesting but not researched area. This research therefore takes an exploratory qualitative approach. Data were collected from multiple sources of evidence. To explore the opportunities of e-business in Fair Trade, we draw from the mainstream e-business, e-business in developing countries and Fair Trade literature. To understand the activities of Fair Trade organizations, in addition to books and journals, we relied on their Websites, and other trade and professional magazines. These latter sources can often be biased about their claims and researchers should handle the data critically.

To examine the extent of e-business utilization, we conducted an artifact evaluation of Fair Trade Websites. We used a set of e-business maturity criteria developed in previous works (Molla and Licker 2004) and applied it to a sample of Websites. The sample was neither random nor accidental. First, a Google search was used to locate the e-business sites. Then, 24 were selected based on their position in the FTSC (see figure 1 below). Data were collected from a total of 10 producers, four umbrella structures and 10 traders Websites. The data were then summarized in order to identify the e-business features.

Additional data were collected through key informant interviews. The interviewees were identified through prior knowledge of their involvement in Fair Trade. The invitation was sent out to 15 contacts and only three of them agreed to participate in the interview. The three are not random informants or trivial players. One of the interviewees has been actively involved in consulting Fair Trade umbrella structures, the second has extensive experience in working with Fair Trade producers and setting up producer cooperatives and the third works for one of the labeling and certification bodies. Although the exploratory nature of the research doesn't provide sufficient ground to make any generalization about the research questions, it however enabled us to get some preliminary insights about e-business in Fair Trade.

3. BACKGROUND

3.1 About Fair Trade

Conventional trade is structured based on the premises of Recardian model of comparative advantage and neo-liberal philosophies of free flow of goods, services and finance among countries. Free trade has a significant impact on the growth of global trade that the level of trade in 2000 was 22 times more than what it was in the 1950 (Ransom, 2001). However, more trade has not always meant better economic growth, income and development. In particular, there have been concerns that commodity dependent developing countries are not benefiting as much as they should from the conventional free trade scheme. This is largely attributed due to the absence of market conditions such as perfect access to markets, access to

credit, and fair trading conditions, that classical and neo-liberal models inherently assume in the global market (Nicholas, 2005).

Against the backdrop of unfair market conditions, the 1960s saw the emergence of the movement of Alternative Trading Organisations (ATOs) linked to churches and development groups in Europe (Wilkinson, 1996). ATOs created a network of shops (also known as Worldshops) to bypass traditional middleman and to market commodities, primarily agricultural, textile and handicraft, produced by poor communities in the South to consumers in the West (North). The main goal of Fair Trade is economic development and to make trade and its distributional impact fair. However, Fair Trade does also imply environmental protection, gender equality, and better working conditions (Witkowski, 2005)

Since its humble beginning, Fair Trade has gone through a number of developments in terms of advocacy, public awareness, creating umbrella structures and labelling and certification bodies and developing Fair Trade standards. For instance, the formation of the Fairtrade Labelling Organisation International (FLO) in 1997 and its subsequent introduction of the "*Fairtrade*" logo in 2002 had resulted in two channels of Fair Trade- labelled and unlabeled. FLO aims to be a worldwide standard setting and certification organisation responsible for defining Fair Trade standards, labelling products that fulfil Fair Trade conditions and auditing the trade to ensure compliance to the standards. IFAT's (International Federation of Alternative Trade Organisations) registration of the "FTO mark" in 2004 can be seen as an attempt to identify "true" Fair Trade organisations and protect the niche market from commercial poachers.

The Fair Trade scheme focuses on the fairness of exchange systems, production relationships as well as environmental consideration. In terms of exchange, Fair Trade is hailed as one of the most effective supplement to free trade for ensuring sustainable and fair relationships between producers in developing countries and consumers in the developed countries (Brown, 1993; Hudson and Hudson, 2004; Witkowski, 2005). The system leverages the solidarity network of producers and importers to bypass a number of middle links (the likes of Proctor and Gamble, Chiquita, Cadbury's) in the conventional trade supply chain network (Moberg, 2005).

Practically, this implies that downstream Fair Trade consumers pay a premium price for ethical and social calls, that is, to contribute towards sustainable development in developing countries (Moberg, 2005). Producers receive a protected and stable price for their products rather than one that fluctuates with seasons and market conditions (Renard, 2003). In turn, they are expected to pay a living rather than a minimum wage to their employees and/or members and invest a certain proportion of their earnings for protecting the environment (Hulm, 2006; Willis 2005).

Although Fair Trade organisations rhetorically aim to cut out intermediaries by handling most of the supply chain and retailing operations themselves, in reality, the FTSC management is a complex process that involves a number of organisations and functions spread across geographical areas. These processes include production, transportation, labelling (either at the farm-gate for fresh fruit or after manufacturing for non-fresh fruit), exportation, importation, manufacture and distribution. For the purpose of analysis, we can identify primary, secondary and tertiary members of the chain. Primary members include producers, traders, manufacturers, licensees and consumers and are involved in the actual flow of Fair Trade goods and products. Secondary members include certification, labelling and standard setting bodies and national umbrella structures. The secondary members coordinate the activities of primary members and ensure that the entire chain operates within the shared principles of Fair Trade. Tertiary members offer transaction fulfilment services and include agents and subcontractors. Figure 1 depicts the FTSC. Unlike conventional supply chain, however, the whole philosophy, of the FTSC is governed based on the Fair Trade principles of commercial

relationships that emphasise fairness, trust, respect, transparency, accountability and gender and environmental considerations (IFAT, 2006; FTF, 2006). The monitoring and certification process at the core of the system guarantees that the supply chain is built on and functions according to the above standards and principles.
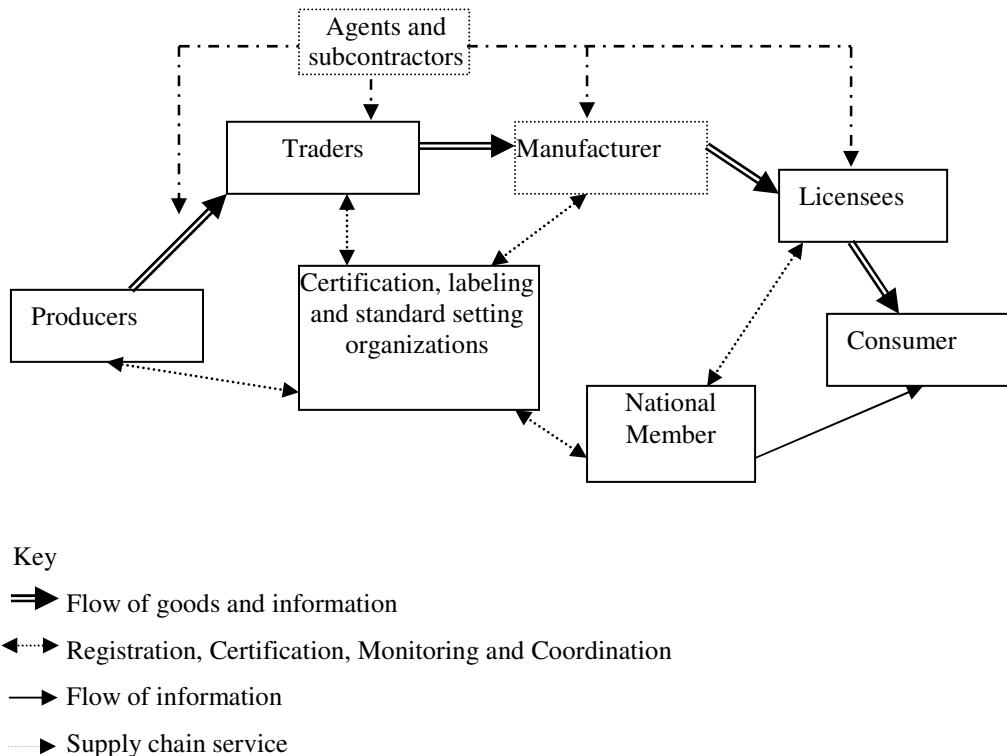

Key

⇒ Flow of goods and information

◄┈┈► Registration, Certification, Monitoring and Coordination

──► Flow of information

┈┈► Supply chain service

Figure 1. The Fair Trade Supply Chain

Despite the promises of Fair Trade to improve the market conditions and earnings of commodities for the benefit of producers in developing countries, the FTSC face a number of challenges.

1. Fair Trade products and brands generally lack visibility (Toulouse et al, 2006). Most members of the FTSC are small and medium enterprises or charity organizations and lack the financial resources to promote the Fair Trade brand as much as their mainstream competitors. It is therefore instrumental that product and brand promotion must consider cheaper alternatives.

2. Fair traders are increasingly facing high marketing costs which affect the extent of Fair Trade premium they can realistically plough back to producers (Kasterine, 2006). Although fair traders can bypass exploitive intermediaries, transaction fulfillment and logistic services still need to be performed along the chain and need to be paid for. Research indicates that importers and wholesalers of Fair Trade are increasingly finding it difficult to pay for these services, pay higher premium to their suppliers and offer competitive services to mainstream retailers (Witkowski, 2005). This dictates fair traders to seek for alternative ways of improving the efficiency of the entire supply chain.

3. The niche market of Fair Trade requires detailed and up-to-date information to educate consumers about the social and ethical characteristics of the products (Kastrine, 2006; Witkowski, 2005). In addition, Fair Trade consumers increasingly seek for information as to how the premium price they pay make it back to improving the livelihood of producers (Toulouse et al, 2006). This poses additional challenges of

collecting, aggregating, distributing and customizing the information to meet the requirements of consumers.

4. Management of the FTSC requires building trust among the various players of the chain and coordinating their activities. There are a growing number of labeling and certification organizations. For example in Europe Fair Trade labeling is underway in 15 different countries and more than 3000 grass root organizations and umbrella structures are scattered over 50 countries (Hulm, 2006). Coordinating the activities of all these players and ensuring that they operate within the principles of Fair Trade and satisfy quality standards and delivery schedules demand an innovative way of increasing the information content and efficiency of the supply chain (Raynolds, 2000).

5. Most fair traded commodities such as coffee and banana are marketed without real added value (Kastrine, 2006). On the other hand, historical evidence appears to suggest that growth and wealth creation are associated with adding value to a product and then exchanging it (Ibid). The future growth of Fair Trade therefore depends more on market development and less on product development.

6. A number of mainstream businesses are now involved in some sort of upstream Fair Trade activities. They tend to exploit the social conscious of consumers in the West without actually adhering to the principles of Fair Trade (Caserta, 2001; Redfern and Snedker, 2002). Hence, true Fair Traders need effective tool to educate their clients and protect the market from scrupulous commercial entities.

E-business offers Fair Traders unique opportunities to address some of the above challenges (Batchelor et al, 2002). The following section reviews background concepts of e-business.

3.2 E-business

For the purpose of this paper, we define e-business as the use of the Internet and other information and communication technologies (ICTs) to conduct business transactions. Thus defined, e-business can contain three areas: consumer oriented activity, business oriented activity, and e-business technology infrastructure (Swaminathan and Tayur, 2003).

Consumer oriented activities include those that are designed to provide end consumers with information, products and services in either business-to-consumer or consumer-to-consumer domains. Businesses can propose value to their consumers using e-business models such as e-shops and e-malls. The sophistication and functionality of these models can vary from those that are purely informational to those that allow online transaction, to those that are knowledge enabled, and that recognise repeat purchase and account management (Molla and Licker, 2004). Consumer oriented e-business activities can allow firms to overcome some of the geographical barriers of trading globally and to access markets that would have otherwise been impossible to them (Molla, 2004a). In addition, it can enable them to by-pass some of the traditional market intermediaries and hence save on market transaction costs. On the other hand, consumer oriented activities can also include new forms of intermediation (or re-intermediation) thorough information aggregation (infomediation), sellers' aggregation and other transaction brokering services that improves the efficiency of the on-line market. Further, firms can use e-business as a comparatively cheaper and richer medium of advertising to increase their global exposure and brand visibility. Overall, effective deployment of e-business in consumer oriented activities has been found to be positively associated with better brand recognition and greater financial performance (Barua et al, 2004).

Business oriented activities consist of electronic interactions among enterprises and between a government and businesses. They facilitate inter-business communication, coordination and collaboration (Premkumar, 2000). The Internet opens new venues for organizations to create flexible supply chains by offering high-speed communication and tight connectivity. It allows

supply chain members to digitise their business processes (such as through e-catalogue) and to address problems of information access, information asymmetry and uncertainty (Barua et al, 2004). Better information flow in supply chain facilitates effective coordination and collaboration with other members of the chain (Premkumar, 2000). Through effective supply chain collaboration and administration, firms can improve their planning and execution, reduce cost, minimize overall risk and improve customer satisfaction (Premkumar, 2000; Swaminathan and Tayur, 2003). Further, firms can either set up their own seller controlled e-markets or participate in either buyer or third party controlled e-markets to facilitate their procurement. Such systems can reduce the cost of searching and locating a supplier and improve a firm's sourcing and procurement decisions. Overall, business oriented e-business activities can influence (a) procurement and supplier management, (b) visibility and information sharing (c) pricing and distribution and (d) customization and postponement (Swaminathan and Tayur, 2003).

E-business infrastructure covers both the hard infrastructure of network technologies and the soft-infrastructure of e-business applications (Molla and Licker 2004). The hard infrastructure represents the electronic infrastructure of organizations that provides the backbone for the soft infrastructure supporting eCommerce. This incorporates computing and telecommunication networks including intranets, extranets and Internets. The soft infrastructure, on the other hand, refers to application solutions that run over the hard infrastructure and make it technologically feasible to build business models and perform business functions electronically. These include electronic messaging, electronic data interchange, electronic payments, electronic publishing, enterprise-wide applications and security applications

4 E-BUSINESS IN FAIR TRADE

4.1 E-Business Opportunities in the FTSC

The advent of e-business has enormous potentials to improve the Fair Trade supply chain in both consumer and business oriented activities. From the opportunity to exchange information to securing orders online, to improve coordination and collaboration along the supply chain, the possibilities and potential benefits of e-business are enormous. By drawing from the mainstream e-business and Fair Trade literature discussed above, we identified e-business opportunities in Fair Trade as summarised in Figure 2.
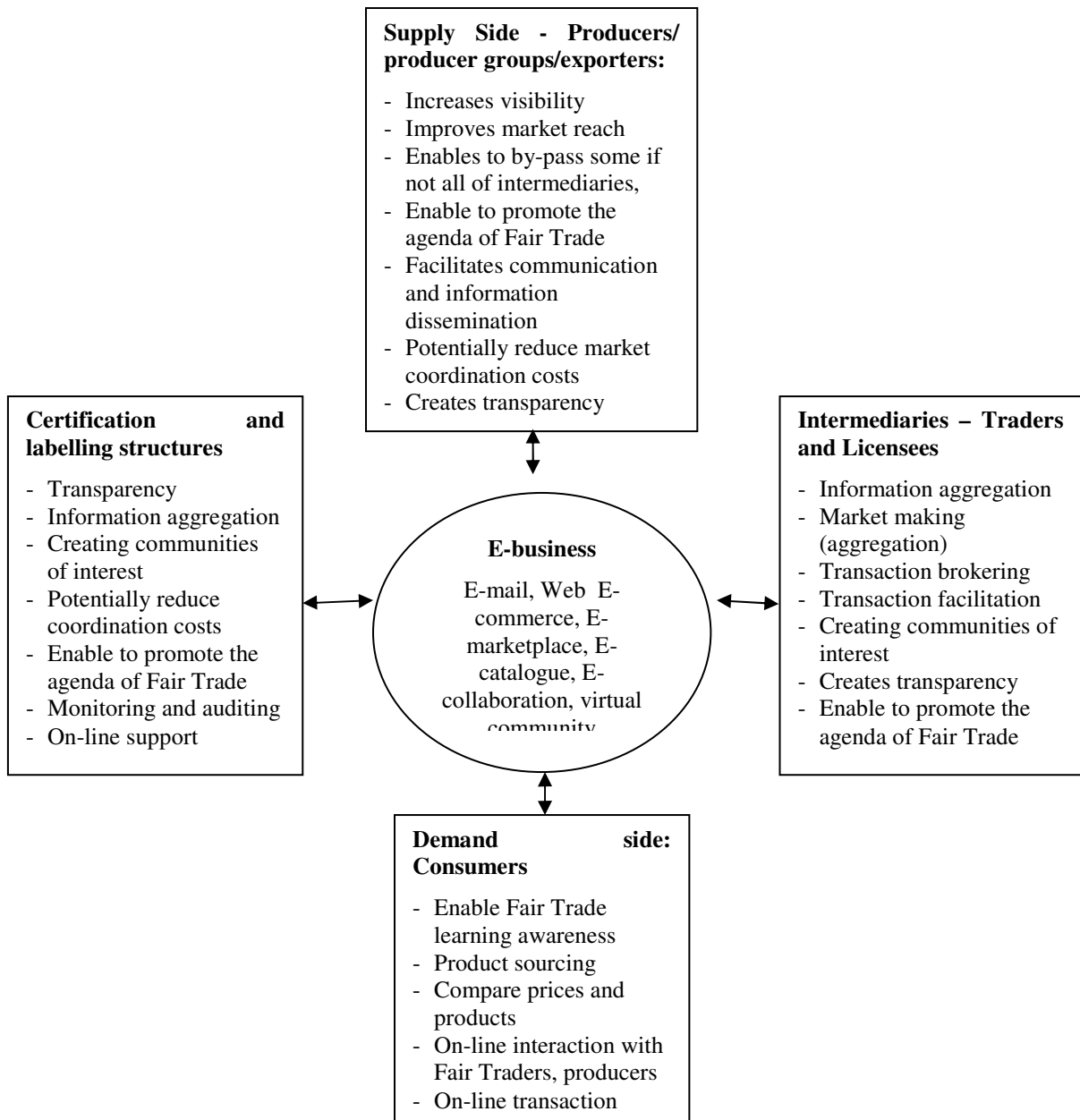
Some Fair Trade producers and many Fair Trade wholesalers and retailers use the Internet to realise the Fair Trade commitment. In assessing the current application of e-business, we focus on the three activities of e-business defined earlier- consumer oriented activities, business oriented activities and e-business infrastructure.

4.2. Consumer-Oriented Activities of E-business in FTSC

Among the different business to consumer e-business models, e-shop is the most popular model currently applied in Fair Trade. Often, e-shop is combined with traditional marketing channels. This is true in Fair Trade too. Most Fair Traders who engage in on-line trading operate in a 'Brick and Clicks' model. An increasing number of producers have established their own Websites. Nevertheless, not all Fair Trade commodities are suitable for direct on-line selling. For instance, it is not feasible to sell commodities such as cocoa, rice and tea. Such commodities need further process, package or even branding before they become final products. Although an increasing number of producers and producer groups are building their own Websites, the functionality is limited to providing basic company and product information. Table 1 provides a sample summary of ten producer Websites. From the sample, only one producer supports on-line transaction, three provide the function of email order, and the remaining does not have transactional functionality. In addition, many of the producers' Websites lack attention to Fair Trade visibility. Only two of the ten sampled producers provide some sort of information about the Fairness of their trade. Six provide some stories

about who they are, what their background was and the poverty level of the producers. Consumers may wish to know if the Fair Trade products were produced and developed in an environmentally friendly manner. However, only four provide some information about their product development. Moreover, although all of the 10 sampled Websites provide email contact as an interaction tool, only one producer provided 'customer review' information. This can be interpreted as either few producers had regular customers, or most of them were not customer oriented.

Supply Side - Producers/ producer groups/exporters:

- Increases visibility
- Improves market reach
- Enables to by-pass some if not all of intermediaries,
- Enable to promote the agenda of Fair Trade
- Facilitates communication and information dissemination
- Potentially reduce market coordination costs
- Creates transparency

Certification and labelling structures

- Transparency
- Information aggregation
- Creating communities of interest
- Potentially reduce coordination costs
- Enable to promote the agenda of Fair Trade
- Monitoring and auditing
- On-line support

E-business

E-mail, Web E-commerce, E-marketplace, E-catalogue, E-collaboration, virtual community

Intermediaries – Traders and Licensees

- Information aggregation
- Market making (aggregation)
- Transaction brokering
- Transaction facilitation
- Creating communities of interest
- Creates transparency
- Enable to promote the agenda of Fair Trade

Demand side: Consumers

- Enable Fair Trade learning awareness
- Product sourcing
- Compare prices and products
- On-line interaction with Fair Traders, producers
- On-line transaction

Figure 2. E-opportunities in Fair Trade

Some Fair Trade producers and many Fair Trade wholesalers and retailers use the Internet to realise the Fair Trade commitment. In assessing the current application of e-business, we focus on the three activities of e-business defined earlier- consumer oriented activities, business oriented activities and e-business infrastructure.

In the context of Fair Trade, it is unrealistic to expect from the majority of producers to acquire the necessary skills, build the required infrastructure and sell directly via B2C e-commerce. In addition, considering the variety of Fair Trade commodities, it might be hard for producers to independently market commodities such as cocoa and rice. In reality, if producers have independent Websites, it is unlikely that they will be able to get the search engines to rank them high enough to catch the eyes of new customers. Customers are more likely to find the international sites that have invested the time and expertise in getting high ranking in search engines. As a result, it is instrumental that producers affiliate with Fair Trade labelling and certification bodies and umbrella structures in order to increase their visibility.

There are a number of Fair Trade advocacy groups and labelling and certification structures. Chief among them are Fair Trade Labelling Organisation International (FLO), International Federation of Alternative Trade Organisations (IFAT), The Network of European Worldshops (NEWS) and The European Fair Trade Association (EFTA). These four institutions have formed an umbrella network known as FINE.   The Fair Trade umbrella structures under FINE host producer Websites and provide infomediation services (Table 2). This allows producers to gain better visibility and consumers to search and access producers easily. In addition, IFAT provides details of its monitoring system on its Website. Consequently, customers who purchase from the producers' links IFAT provides may have a better trust in the system.

Name of the organization	Web site Address	Own Website	Catalog host	Offering	Country of Origin	Certi-fied ?	Product developme nt	*Pro-ducer stories	** Msg of Fairness	***Cus-tomer review	on-line transaction enabled
Sindyanna of Galilee	http://www.sindyanna.com/	Y	IFAT	Olive oil products	Israel	Y	N	Y	Y	N	N
Fair Trade Producers Socieity	http://www.getradefps.com/	Y	IFAT	Handicraft products	Ghana	Y	N	Y	N	N	email order
Machakos District Co-op Union Ltd	http://catgen.com/machakos/EN/0.html	N	IFAT	Handicraft products	Kenya	Y	N	N	N	N	email order
Sadhna	http://www.sevamandir.org/Sadhna/	Y	FTF	Clothing, Bed cusions	India	Y	Y	Y	N	N	email order
Agbanga Karite	http://agbangakarite.com/	Y	FTF	Palm oil products	Togo	Y	Y	Y	N	Y	Y
Manos	http://www.fairtradefederation.com/membio/macre.html	N	FTF	Handicraft products	Peru	Y	N	N	N	N	N
Base	http://www.basebangladesh.com/	Y	IFAT	Handicraft products	Bangladesh	Y	Y	Y	Y	N	N
Xochiquetzal	http://www.laneta.apc.org/xochiquetzal/	Y	NEWS!	Handicraft products	Mexico	Y	N	N	N	N	N
CIAP	http://www.ciap.org/	Y	NEWS!	Handicraft products	Peru	Y	Y	Y	N	N	N
YWCA	http://www.catgen.com/home/ywca/EN/0.html	N	IFAT	Handicraft products	Bangladesh	Y	N	N	N	N	N

* Producer stories could be an introduction of producers, what they do and why they choose Fair Trade

** Message of Fairness means: What is Fair Trade? Why producers go for Fair Trade? What producers do with the money they earned from Fair Trade?

*** Customer Review is a review of who are the customers, why they purchase the products and what was their comment on the products they bought.

Table 1: Sample Websites of Fair Trade Producers

FTO	Web site address	Main Services	Commodities
FLO	www.fairtrade.net	• **How to get Fairtrade certification** • **Product development** • **Producer networking**	**Coffee, tea, banana, rice, juices, cocoa, sugar, honey, sports balls, flowers**
IFAT	www.ifat.org	• **Virtual community to members on-line** • **Membership application** • **Provide links to producer organisations**	**Giftware, household goods, furniture, jewellery, food products and beverages**
NEWS	www.worldshops.org	• **Links to other Fair Trade organisations,** • **Links to importers, retailers (world shops), & small number of producers (most links don't work!!!)** • **Provide links to access world economic statistics and trends** • **Virtual community to members**	**No specification**
EFTA	www.eftafairtrade.org	• **Provide links to importers** • **Provide Fair Trade information, education materials, research documentation**	**Coffee, rice, cocoa, sugar, garment, hardwood, tea, banana**

Table 2.   FINE Services to Producers

4.3. Business-Oriented Activities of E-business in FTSC

Of the various business-oriented activities, e-catalogue, e-marketplaces, e-collaboration and e-administration are most common in Fair Trade.

E-catalogue. Many of the umbrella organisations and some of the producers provide catalogues to facilitate sourcing of Fair Traders and Fair Trade products. However, the services they render are buyer-centric rather than seller or transaction centric. For instance, IFAT hosts an online catalogue of its trading and non-trading members with a link to their Websites. For those that haven't generated their own catalogue, it plays an infomediary role of broadcasting trade opportunities through its fortnightly member update services. The

catalogue is searchable by region, country, product type, organisation name and keyword or any combinations of these. It also offers a list of Fair Trade organisations that passed its monitoring requirement and that can use the *FTO mark- a mark that symbolises true Fair Trade organisations.* Other similar catalogues are hosted at Peoplink, NEWS, CatGen and in almost all National Associations. Businesses that seek Fair Trade suppliers and products can use these and other catalogues hosted by National Associations to get names and addresses of potential suppliers. But actual relationship is to be established off-line by contacting suppliers directly.

E-marketplaces. The most common e-marketplace activities in FTSC are the seller and third party controlled e-marketplaces. In seller-controlled marketplace, Fair Traders can use producers' catalogue to identify business prospects and order products and services. In FTSC, the transactions between the Fair Trade FTOs/importers/wholesalers and retailers are examples of seller-controlled marketplace. Fair Trade retailers can order commodities through importers, wholesalers or sometimes producers Websites. In terms of third party controlled e-marketplaces, NEWS and FTF (Fair Trade Federation) provide e-marketplace services (limited to catalogue and portal) that bring together producers, wholesalers and retailers of Fair Trade products.

Another example of a Fair Trade e-marketplace catering for the handicrafts sector is Peoplink (www.peoplink.org). It services Fair Trade artisans and purchasers all over the world by offering storefronts, product development, market research, and catalogue development and hosting. It features details of Fair Trade products on its Website with images and descriptions from over 100 artisan groups from 30 countries. The site also links to the homepages of many producer groups. Peoplink had the classic first mover advantage and was able to bring artisans to the world market. However, according to one of the key informants, the volume of sale from its site has been disappointing and overtaken by three commercial sites from the US- Novica, Worldstock and The Hungersite. Nevertheless, PEOPLink is the premier IFAT recognised Fair Trade handcraft e-marketplace.

E-collaboration. A number of supply chain activities are conducted among FTSC members. These include receiving producers' information about new products (such as pictures, product samples); receiving transaction information (such as invoices and shipping orders); receiving the evaluation of commercial relations by producers; sending feedback to producers on sales and market trends and general information about the importing organisation. According to our key informants current collaboration along the supply chain is not as effective as one would expect and lacks a clear Fair Trade value and focus. Further, we sampled 10 Websites of Traders and assess the level of supply chain collaboration. The result is summarized in Table 3. The finding indicates that none of the Websites provide links to producers. Only five of them provided stories about producers along with the products they promote and four have information on product development. Moreover, even though seven of them provide Fair Trade information, only four provide links to FINE.

organisation	Website Address	Category	Offering	Certified	Link to producer	Link to FINE	Fair Trade Resources	Producer profiles/ stories	Product develop-ment	Fair Trade Infor	Customer review	Member ship	On-line transaction enabled
Shared Earth	http://www.sharedearth.co.uk/html/retail.html	Wholesaler/ retailer	Handicraft	Y	N	N		N	N	N	N	Y	Y
Pachamama	http://pachamamaworld.com	Importer	Handicraft Coffee, Chocolates	Y	N	Y	Y	Y	N	Y	N	N	Y
Oxfam	http://www.oxfam.com/eng/	Importer/ Wholesaler/ Retailer/	Food and handicraft products	Y	N	Y	Y	Y	N	Y	N	N	N
Bridgehead	http://www.bridgehead.ca	Importer	Coffee	Y	N	N		N		Y	N	Y	Y
Coffee Exchange	http://www.coffeeexchange.com/	Importer	Coffee	Y	N	N		N	Y	N	N	N	Y
Urbanblands	http://www.urbanblends.com	Wholesaler/ retailer	Coffee/tea	Y	N	N	Y	N	N	N	N	Y	Y
Divine	http://www.divinechocolate.com/	Importer	Chcolate	Y	N	N		Y	Y	Y	N	N	N
EshopAfrica	http://www.eshopafrica.com/	wholesaler/r etailer	Handicrafts products	Y	N	Y	Y	Y	Y	Y	N	N	Y
Onevillage	http://www.onevillage.org/	Importer	Handicrafts products	Y	N		Y	Y	Y	Y	N	N	Y
Fair Trade on-line	http://store.yahoo.com/fairtradeonline-uk/	Wholesaler/ retailer	Food and handicraft products	Y	N	Y	Y	N	N	Y	N	N	Y
Garuda	http://www.garudainternational.com	Commercial	Food and handicraft products	N	N			N	N	N	N	N	Y

Table 3. Sample Website of Traders

E-administration. To gain international recognition and credibility, improve quality of service and promote the Fair Trade agenda, there should be a harmonisation of efforts and activities. For instance, FLO and IFAT's Websites provide details of Fair Trade criteria for those producers and traders who seek certification. However, as of January 2006, if any Fair Trade producer-based organisation wished to establish relations with importing organisation or membership network, they must fill their request on a number of virtually identical questionnaires. This duplication decreases the efficiency of all members in the Fair Trade supply chain. NEWS, on the other hand, provides massive amount of information and links to Fair Trade movement in Europe. EFTA runs an e-library on its Website, which provides exclusive information about Fair Trade, its movement, commodities offering and producer stories. Such open information platforms facilitate better collaboration and understanding of the Fair Trade movement. In addition, FINE members use a member only platform to facilitate communication among themselves and their members. This can increase the efficiency of handling administrative events, and lead to better management of the Fair Trade system.

4.4. E-business Infrastructure in the FTSC

Although the FTSC members are investing in ICTs--buying computers, digital camera, creating Websites and on-line catalogues-- because of its charity-driven root, most members are very conservative towards embracing ICTs. One of our key informants stated that "*the Fair Trade movement is quite conservative and tends to adopt new ideas and tools very slowly. It is still too much "charity driven" and not ready to use technologies to improve their work and bring benefits to the producers*". In addition, the infrastructure shows greater variability depending on the realities of specific countries.

Overall, small producer organisations use fax, and telephone to communicate and coordinate along the supply chain. However, even these technologies are hardly accessible to producers in some countries. E-mail is the most important application that has a significant impact on Fair Trade supply chain. In the crafts sector, it is used to upload local products on Peoplink's e-marketplace. Upstream, it is used to convey order and delivery information including ideas about product and market conditions. It is particularly important in certification, monitoring and auditing of supply chains. According to our key informant, investing in email has been one of the most cost-effective benefits of the Internet for producers, bringing both cost savings and improvements in efficiency and speed of communications. However, in some of the poorer countries, telephone lines and services are obsolete, unreliable or easily affected by the economic crisis. Internet bandwidth is limited for multimedia data transmission. Larger producer groups and many traders have developed a Website ranging in complexity from simple to complex functionality. However, all of these systems that laid the technological foundations on which online trading exchanges could be built are isolated and lack integration to draw supply chain efficiency.

Two e-business technologies worth mentioning in Fair Trade are the CatGen of Peoplink and ITU's ECDC (e-commerce in Developing Countries). CatGen (for "Catalogue generator") is an e-business platform that allows Fair Traders globally to create and maintain their own credit-card enabled on-line catalogue. It offers 24/7 support, search optimization and eBay listing tools. According to the information on the CatGen Website accessed November 2006, more than 2000 enterprises from 42 countries directly benefiting over 200,000 individuals are posting more than 20,000 items and services on CatGen.

The ECDC initiative of ITU is another technological infrastructure that supports some Fair Traders. Trust is a major issue to any business in general and e-commerce in particular. By providing secured payment and transaction services, ECDC is offering a useful e-commerce service that makes critical e-business service accessible for businesses in developing

countries. The list of implementation requirements that ECDC outlines can also be used as a decision tool to identify e-commerce impediments and risks (Molla, 2004b).

5. CHALLENGES OF E-BUSINESS IN THE FTSC

There are a wide range of issues that influence the effective utilisation of e-business in the Fair Trade sector. Some of these issues are generic and common to e-business application in any sector. Here, we focus only on issues that are relatively specific to the FTSC. We divide these issues as configuration and implementation issues of FTSC. Under configuration we cover issues related to e-business value, and e-business models. Under implementation we discuss supply chain members, and technology issues.

5.1. Configuration Issues

5.1.1. Value proposition

The Fair Trade market environment has significantly changed over the last number of years. Although the Fair Trade movement has been traditionally spearheaded by charity organisations, many other organisations and companies are now playing in the Fair Trade market. Following the entrance of mainstream supermarkets in Fair Trade retailing, some of these entrants are building their own supply chains outside IFAT and FLO by leveraging the use of information technology. For instance, Peoplink's founder admits that three commercial on-line vendors in the US sell more than the total value of crafts sold by IFAT members worldwide. This is threatening the secured Fair Trade market. It is taking away the moral high ground of organisations like FINE and opening the sector to operate in an increasingly competitive environment.

The ever growing awareness of consumers to trade inequalities and Fair Trade not only presents opportunities to more markets, but also represents challenges of defending the market against "poachers" from the commercial system. Therefore, the "true' Fair Trade sector should aim to differentiate its supply chain through better branding (such as *Fairtrade* and *FTO*), provision of beneficiaries' stories and information around the Fair Trade products, and through increasing the informatisation, transparency and efficiency of the supply chain. Strategic embracing of e-business can enable the sector to deliver these impacts. This might require at least three critical decisions from the umbrella structures. First, Fair Trade umbrella structures need to clearly articulate the role and value proposition of e-business in the Fair Trade supply chain. E-business value proposition needs to be defined within the context of the wider global and Fair Trade markets and should incorporate the social, economic and technical realities of their constituents. Second, there is a need to secure the commitment of the parties to achieve critical mass of participants. Without a critical mass of e-business users and suppliers, Fair Trade e-business may not move from having comparative advantage (low cost of production) to gaining competitive advantage. Finally, members' e-business capability needs to be build to allow effective collaboration.

5.1.2 E-Business Model Issues

Most of the B2B Fair Trade e-markets were buyer-oriented. Buyer focus has been one of the major causes of failure for early e-markets. The Fair Trade e-markets placed too much focus on buyers and offer them with a choice of Fair Trade suppliers. Although FLO and IFAT regulate prices, buyer-centric models inherently make price the key differentiator between competing products and remove some of the branding individuality that Fair Trade suppliers may have worked to develop. Another feature of a buyer-centric model is that fees are charged to sellers rather than buyers. This implies that in the long run the poor producers that Fair Trade is trying to help have to pay the fees.

A buyer-centric model also shifts the power from the seller to the buyer as buyers are able to choose a wide range of sellers' profiles. Even if such models can increase sellers' market

reach, buyers' control of information doesn't appear to sit well with the producer empowerment theme of Fair Trade. In addition, current Fair Trade business-to-business online markets provide limited trade facilitation and their service doesn't go beyond basic catalogues. In some cases, the catalogues are static without a database structure or search functionality and can only be searched thorough a browser's "find" facility. It is instrumental that the umbrella structures invest in e-business models that are seller-oriented and offer buyer aggregation services.

5.2. Implementation Issues

5.2.1. The nature of agents in the supply chain

The majority of the producers and trading partners in the FTSC are small scale producers in developing countries. These types of organisations suffer form multi-layer digital divide. First, they are in developing countries, where the constraints for e-business are many and the drivers a few. Second, they are mostly rural industries and stay on the negative side of the urban- rural digital divide. Some are in remote regions with no or limited access to either analogue or digital information technology and market information. This makes e-business in the up-stream FTSC very challenging.

Other members of the FTSC also suffer from limited professionalism and lack of business-oriented approach. For a long time, Fair Trade has been a "charity-driven" model, with low attention paid to long-term market sustainability. Only few fair traders have succeeded in combining solidarity with a professional approach, creating a new model of alternative economy (Wills, 2002). For the majority, the changing environment represents a threat to their charity model, rather than an opportunity. While the charitable approach has helped many small-scale producers to find new market opportunities, it is no longer enough to help them to find their way out of poverty (Batchelor and Webb, 2002). It does not sufficiently strengthen their capacity to mainstream their products and compete in the current dynamic and competitive international market. Nor does it make full use of the high potential of the Fair Trade "niche" market. Due to the scarce inclusion of ICT in the working procedures of Fair Trade organisations, a number of these new producers' needs remain unfulfilled. Relevant data are not collected or not shared, the communication flow remains slow, the gap between producers and consumers remains unabated (Caserta 2002).

5.2.2 Technology

Setting up an e-business infrastructure is a complex task even for large companies with technical know-how. For smaller companies with less expertise and resources, the complexity can be overwhelming. The conservative approach towards ICTs among the Fair Trade agents implies that members are very concerned about the cost of technology change and ownership. Fair Trade needs open source tools that produce savings without imposing significant financial outlays.

6. SUMMARY AND CONCLUSION

Fair Trade is established as an alternative supply chain model to enable producers in developing countries to benefit from the opportunities of global trade. The rational of Fair Trade is in part a political reaction to the rise of free trade, capitalism and the power of multinationals which would lead to the poor and marginalized being exploited or excluded. Therefore, a strong theme of Fair Trade has been parallel to the conventional trading system. The objective of Fair Trade is to ensure that poor producers receive a price which reflects an adequate return on their input of skill, labour and resources, and a share of the total profit commensurate with their input.

This article demonstrates how a supply chain approach may provide a holistic and robust tool for an academic research in understanding Fair Trade in general and e-business in Fair Trade

in particular. Analytically, this paper highlights the complexity of the Fair Trade chain and the extent of involvement of Fair Trade middleman in the chain despite the rhetoric of disintermediation. The parties in Fair Trade can be categorized into the supply side (producers, producer groups), the intermediaries (exporters, ATOs, wholesalers and retailers) and demand side (consumers). There are also certification and labelling organisations, umbrella structures and supply chain servicing agencies and subcontractors.

The different entities in the FTSC share a common ideology of making international trade fairer for poor producers in developing countries. However, the chain is not free from supply chain problems of poor information flow and lack of coordination among the different parties. These problems can lead to several inefficiencies in the FTSC including lack of visibility, inaccessible market and producer information, limited producers' capacity to access market, and high cost of trading. To address some of these challenges and to achieve the Fair Trade goal, e-business offers enormous opportunities.

In terms of e-business, the paper demonstrates how the specific nature of upstream members can influence the extent of e-business utilization mid and downstream members can enforce in Fair Trade. In the conventional supply chain, powerful market players can force their smaller suppliers to implement certain standards and technologies. However, the essence of Fair Trade and its principles make such market push forces unlikely to exert any significant influence.

In addition to its analytical contribution, this paper provides insights regarding the unique opportunities that e-business offer to fair traders as well as the challenges different members of the chain face. This analysis also reveals, albeit preliminarily, the extent of current e-business practices in the Fair Trade chain. Assessment of current applications of e-business indicates a growing number of FTSC members making use of Web-based marketing techniques to target niche markets as well as to coordinate business-to–business activities. Producers and importers are increasingly using Internet to do their business. Still it is limited, in many cases, to having a website and communicating by email. But there are also interesting experiences of on-line assistance in product development. Umbrella structures offer some e-sourcing services but tend to operate on the buyer-seller beware basis without value-add services. In addition, their Web systems are not interactive to facilitate on-line applications, product support and learning. The Wolrdshops appear to be the weakest link with very limited interest in the use of e-business and its benefits. For instance, a proposal for building a Fair Trade Global Information Exchange Systems couldn't take off the ground because of lack of commitment and support[1]. In terms of the technology infrastructure, platforms like CatGen offer affordable and viable alternative to expensive commercial solutions. However, its real benefits have yet to be seen.

Finally, this paper represents a preliminary investigation of e-business in the FTSC. Although the exploratory nature of the research doesn't provide sufficient ground to make any generalization about the research questions, it however enabled us to explore the space for and practice of e-business in Fair Trade. In addition, the bulk of the data is collected from Fair Trade organizations Websites. The content and functionality of the Websites are continuously changing. This makes the validity of the research finding temporal. More commodity specific and empirical studies are required to get a deeper understanding of e-business in Fair Trade.

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ICT for development and commerce: A case study of internet cafés in India
[Research in progress paper]

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Abstract

The paper, drawn from on-going studies of internet cafés in India, reports interesting localization of information and communication technology (ICT) offerings in shared public spaces. These are in some disjuncture with the ideology of digital inclusion striving to integrate hitherto excluded and 'information poor' communities. We find context specific and commercial localization of ICT services contributing to their immersion in underserved contexts, introducing technology as significant part of everyday commerce. If 'non-developmental spaces' using ICT are more open to entrepreneurial activities, multiple players, especially the government, could creatively engage with them to promote ICT interventions in everyday civilian life. We indicate some curious and interesting examples strictly belonging to the commercial realm nevertheless bearing the potential for expansion of ICT services.

Keywords:

ICT, Internet/cyber café, ICT for development, Localization,

ICT for development and commerce: A case study of internet cafés in India
[Research in progress paper]

1. INTRODUCTION

The paper, culled out of research in progress, looks at a particular configuration of ICT's to provide critical accounts of developmental initiatives in India. We report from an ongoing ethnographic study of urban and peri-urban internet cafés and rural PC kiosks. We have covered, thus far, 12 villages in rural Western India hosting a PC kiosk and ten cafés distributed amongst the suburban Mumbai metropolis, the city of Surat and Alibag town, all in western India. Our initial findings are pointing towards interesting localization of ICT offerings in these public spaces and are, probably, in some disjuncture with the ideology of digital inclusion integrating hitherto excluded and 'information poor' communities.

At his stage in our study, we are exploring 3 related issues raising debates about disjunctions between information and communication technologies for 'development' and for 'commerce' as mutually exclusive social processes and ideologies. Firstly, ICT configurations in fairly mature urban IT ecologies display barriers to commercialization and immersion not far removed from their resource stressed rural counterparts. Secondly, context specific and commercial localization of IT services equally contribute to ICT immersions in hitherto underserved contexts. Thirdly, how multiple players, especially the government, can creatively engage with ICT driven commercial spaces to promote ICT interventions in everyday civilian life.

It seems pertinent to ask here, are ICT for development discourses coding the commercial and non-commercial as development and non-development? Is information also coded into what is good/superior or bad/inferior information? If 'non-informational spaces' using ICT are more open to creative entrepreneurial activities will these be termed ICT 'not' for development? Is ICT for development by definition, rendered non-commercial? Debates in terms of welfare economics posit the state as major player. How does the state tap into or engage with market impulses while driving development initiatives? Commercial spaces, especially where information technology is playing out, become important nodes for entrenching these technologies and extending state role in shaping these spaces.

2. FOREGROUNDING DEBATES

Information and communication technologies are viewed as heralding the onset of an information society in nations and communities historically excluded from the fruits of development and progress. ICT's are widely recognized for the contradictory twin roles they simultaneously play in society: the immense potential to meet development goals and to widen the gulf between information rich and poor communities overlapping with existing socio-economic divides. They also cover a broad range of meanings, approaches and practices from curing perennial poverty through capacity building to mushrooming back-end processing offices (BPO's) in urban sectors generating rapid employment. But, it is universally regarded as a 'good thing'. ICT for development is the new mantra for initiatives

to transform developing nations to superpowers or underdeveloped countries to clean and healthy ones[1].

India is witness to rapid IT driven socio-economic boom with its GDP growth reaching all time high[2]. Indian urban landscapes are dotted with IT parks, global support centers and special economic zones. The government introduces pro-active policies to quicken the pace of economic upswing in the country. But this is barley a portion of the overall scenario. Despite a booming economy, the majority of suburban, peri-urban and rural India is yet to experience the fruits of prosperity.

Seeking to gain momentum through India's mission of digital inclusion, many such ideologically driven processes (even those driven by government and private sector partnerships), find inconsistent adoption and sustainability in communities aspiring for entry into the larger information culture[3]. Nevertheless, consumption of ICT value-oriented services is growing, with 6.6 million mobile phones added in October 2006 in India[4]. In this backdrop of increasing Indians interfacing with market driven ICT, we argue that the notional preponderance of development in challenging digital exclusion, evade or turn way from social processes, not in alignment with presumed development goals, where ICT's find better routes of immersion.

To recollect a brief history of internet in India, the government introduced the first international telecom carrier in 1995. The Indian Government has been propelling towards "information age" and "convergence" by announcing enabling policies toward development and progress with an ultimate goal of "Internet for All"[5]. However, implementation of some of these policies have been beset with various operational, procedural, regulatory issues and supporting legal framework, which is inhibiting the reach and benefit of the Internet to masses in the country[6].A current survey by the Internet and Mobile association of India, IAMAI, puts India's Internet User Base At 37 Million touching 54 Million By March 2008. The e-Technology group at Indian Market Research Bureau, IMRB, felt "The next round of growth

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[1] Following the development of India's national strategies for ICT, the government made a concerted effort to bring low-cost connectivity and ICT enabled services to the 'rural masses' (Pohjola 2002). Along these lines, a public-private collaborative effort has launched the ambitious 'Mission 2007-Every village a knowledge centre' for achieving a knowledge revolution in India http://www.mission2007.org/mission/ and http://www.mssrf.org/

[2] For a quick overview of India's economic mobility, http://www.indianindustry.com/indian-economy/indian-economy-overview.html

[3] What is ignored is the actual process of development, its structural exclusions of populations, lack of committed resource supports, and personnel who eschew development to corner personal gain, in short, deeper questions of socio-political contexts aiding or thwarting the actualities of progress. Kaushik and Singh (2004) Pringle (2002) speak about specific case studies in India (Thompson 2004) (Licker 2001) discuss ideological underpinnings of ICT for D. Slater and Kwami (2005) report that new media practice in Ghana is significantly opposed, or unconnected, to ICT- driven poverty reduction logics through which they are understood by those in governance and policy. Kurien 2005, point to case studies from Kerala, relating to socio- political tensions in the implementation of ICT's for development and capacity building, particularly tensions faced by ICT entrepreneurs hoping to make business out of these initiatives.

[4] http://www.iht.com/articles/ap/2006/11/12/business/AS_TEC_India_Mobile_Phones.php

[5] The Times of India editorial, 'Unwired World: WiMax promises high-speed mobile data and telecom services', November 18, 2006 reported Chennai to be the first WiMax enabled city in India.
[6] The Internet subscriber base grew very slowly from 0.01 million subscribers (1995) to 0.14 million (1998). The end of VSNL's monopoly in 1999 led to phenomenal surge in subscriber base growth from 0.28 million (1999) to 3 million (2001). However, from April 2001 onwards, growth rate started declining on all over India and reached 3.23 million (against a projected target of 4.5 million) in 2002 and 3.5 million in 2003. The declining was due to low PC penetration, high Internet access costs and steep PC prices, besides poor connectivity. Despite ongoing deregulation of India's telecommunications sector, its national teledensity is one of the lowest in the world, improving slowly from 0.06% (1990), 2.86 (2000), 3.58 (2001) and 5 (2003). The rural and urban teledensity were 0.93 and 10.16 (2001) and 1.49 and 15.16 (2003), respectively. Internet subscriber base in 2004 was 0.4%, in sharp contrast to Asian countries as Korea with 58, Malaysia with 11 and China with 2% (Telecom Regulatory Authority of India, 2004).

will be driven by new and innovative applications such as blogs, P2P, video on demand and online gaming. While the old favorites such as email, chat and IM will drive first time users to the medium"[7].

With PC penetration being low and the bulk of urban population living and working in make shift and non-formal economies, cafés are prime spaces that initiate first timers and bring technology into their everyday. It is no coincidence that similar issues hindering ICT deployment and immersion in rural India act as barriers in peri-urban and deep suburban regions. Power cuts are frequent and there is little by way of e-government services that co-opt civilians with ICT. It is evident doing small business with ICT's develop a certain public character dependent on larger policies, state initiatives and a techno-friendly climate unlikely to be critical for non-ICT start up businesses.

In India Cyber cafés and PC kiosks have allowed new forms of context-specific social networks to emerge. Studies from countries report specific and unconventional social formations around public configurations of ICT's. We noted a spurt of ICT activity around communicative functions in ethnographic findings from Ghana and Jamaica reporting different assemblages of media dependent on local needs for information flows. Existing networks are often built around maintaining kin relationships bound with patterns of economic migration (Burrell and Anderson, 2006 Burrell, 2006, Slater 2000). Local demographics played a critical role in the usage of public internet assemblages in London (Wakeford 2003). A study of cyber cafés in the city of Bangalore, India, speaks of active appropriation and shaping of shared ICT spaces by youth going beyond communication agendas (Nisbett 2006).

3. SHARED PUBLIC CYBER SPACES IN INDIAN SOCIAL ENVIRONMENTS

Our study of cyber cafés in urban cities and towns in India show alternate uses of café space, in low-middle class locales, some with poor housing conditions and infrastructural facilities[8]. The internet user base co-exist with high levels of mobile telephony, public consumption of cable/satellite TV, and the emerging FM radio audiences. This constellation of mixed media happens within a strictly commercial and entrepreneurial framework of very small businesses with little interest in promoting ICT for development, as we understand the term. Almost all Cafés operate under commercial business licenses no different form those required for running, say, a fast food joint. After 3 months of observations in 10 urban cafés we found three interesting activities a buzz: the chat room, stock trading and networked gaming. Each of these gain prominence in a specific social environment of a café.

Our study of rural PC kiosks amidst a resource stressed and mixed communicative ecology, show continuity with certain urban consumption patters. Rural India with 600,000 strong officially defined villages is a potpourri of farming villages and village like towns with varying degrees of urbanity and infrastructural amenities. By some estimates, there are as many as 150 rural PC-kiosk projects across India. Such projects could provide the first

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[7] http://www.iamai.in/section.php3?secid=16&press_id=1210&mon=9

[8] Cyber cafés numbers are dynamic constellations with no authoritative figures available. The 2004 figures put it around 50, 000, Caslon Analytics (2004) cited in Haseloff, 2005. Since debates are formulated from early results we have yet to configure demographic and social profiles of users

computing experience for as many as 700 million people in India (Toyama 2004). A village is characterized by its farming communities but is occupationally diverse and contains a mixed communicative ecology with higher mobile coverage than landline, huge national /satellite TV viewership and the local cinema theatre. India has a robust rural ICT policy and action and has initiated multitudinal projects to augur development initiatives through ICT. Impact assessments by various government and non-governmental agencies, are unclear about the degrees of progress in receiving communities.

The 12 villages under our purview have a fairly uniform story to tell with regard to ICT for development and ICT for commerce. While Internet café and kiosk entrepreneurs have mixed interests in developing more expansive potentials of ICT driven media, the government and NGOs in developing nations are focused on ICTD as mantra for progress and rhetoric for forums. The inconsistent provision of communication infrastructure including ICT hardware and maintenance without attention to the institutional and practical contexts of use of technology has resulted in skewed ICTD deployments showing little progress, empowerment or ICT literacy among the populace hoping for a take-off towards technology enabled social prowess. In their two year study of 300 rural telecentres across India, Kiri and Menon (2006) find that usage of development-oriented services, such as e-agriculture is much lower, while functioning PC kiosks are more like communication centers of the PCO/STD/ISD kind. One of our subject kiosks, a beneficiary of combined developmental efforts by the state/NGO/corporate found the experience of running an internet kiosk in his village the most frustrating experience and stopped on-line activities. However, the kiosk operator, who runs a small Photo studio in his village, found a new mode of employing his PC! He supplies digitally made over pictures in Photoshop to many clients in his village and surrounding villages. He says"… *my PC has finally come to use and I make good profits selling a single post card size print for 20 cents each…"* In this little village, commerce has somewhat overtaken development efforts to diffuse digital technology!

4. REPORTS FROM THE FIELD

4.1 Barriers despite Boom

Our initial findings in Mumbai suburban and deep-suburban cafés report a kind of 10 year local history of the internet. Café entrepreneurs began running these as small business, enthused by the on-set of IT driven economic boom in India. Some switched family professions, trained themselves in IT networking and hardware and began shop in earnest. Amongst our case studies, all 10 urban and 10 out of the 12 Rural entrepreneurs had an IT degree or associate diploma, one of them learnt hands-on. All are comfortable handling and networking multiple PC's, hardware trouble shooting. The initial boom driving the mushrooming of urban cafés has waned. Urban café operators report falling client and browsing rates, while rural kiosk operators find lack of power and infrastructural crunches having debilitating effects on ICT dispersion and services.

An important concern expressed by café owners is the improbability of managing a multi-PC café with little knowledge of computing software and networking. They simply cannot afford maintenance! This seems to be a recurring theme in the type of person/s who does business with IT. Here, skill, like doing business with any craft, is a major resource and, in this case, not bound with family or social tradition that is passed on intra-generationally but modern,

secular and attained through expensive packaged fees. Cyber café's primary investments in computers and hardware not with standing, standing costs are the killer. It becomes indispensable that the owner is a hardware/networking/ trouble shooting specialist! Bhavesh, one of our subjects running a suburban Mumbai café, recalled his small profits, *"I am an IT engineer. … I don't have to depend on any engineer to set up the all the things I have here. …. we have to adjust the capital and costs as well. There are internet charges. There are electricity charges. The telephone bill…, and then you will be able to decide whether you've had a profit. … It is impossible to pay for professional help. We are the help….."*. A crucial issue that comes to light here is ICT in small businesses promote the same kind of barriers excluding the information poor populace. ICT related entrepreneurship, no more than a cyber café, demands technology related skills. The specificities of acquiring ICT related skills initiate a break from traditional intra-familial passing of skills, often requiring formal training with an acquired aptitude for technology coupled with expensive tutoring fee. The economics around acquiring IT skills excludes certain social-economic groups in developing nations like India augmenting the digital exclusion debate.

Rural regions face acute infrastructural pressures to maintain on-line services. Kiosk operators experience severe constraints in ways their ICT ventures depend on extraneous players and agencies. The internet becomes a very expensive and frustrating experience to both owners and clients of kiosks when hardware break down coupled with huge connectivity and trouble shooting issues collide with periodic power cuts. In and around Pabal district in Western India, our focus of study, 34 internet kiosks were begun in as many villages in 2001, most of them making use of government subsidy in the drive to entrench internet technologies. By the time of our study, in 2005, there are 12 functioning kiosks, 7 of them from the original 34 and 5 new. Kiosks ceased operations for various reasons: Some people who wanted PC's at subsidized rates had posed as future operators and housed computers. Others sighted connectivity/hard ware issues and poor follow ups from donor agencies as promised. Many expressed serious doubts about flagging off a new and expensive technology on a population with out serious technical and market support structures (Rangaswamy, 2006).

4.2 Commerce despite Barriers

In this section, we highlight commercial transactions in public and shared cyber spaces that take specific, context-related forms.

Multiple players have staked claims to shape the course of kiosk development in the country. Corporates players like n-logue, Drishtee, and ITC's e-chaupal program have drawn on for-profit business models for long term sustainability. Meanwhile, several non-profits in this space argue for large government funded infrastructural investments in the diverse communication ecologies of 600,000 villages in India[9]. Based on our studies we argue that 'imagination around ICT needs to go beyond its singular role as a developmental tool, to address a broader spectrum of needs in the complex socio-cultural world of rural communities' (Rangaswamy 2006). ICT's as commercial tools are bringing profits and hope of sustainability. We are seeing PC services supporting demand for image/visual services like digital photography and videography rather than provide conventional 'information' services.

[9] Kumar 2004, Dhawan 2004, Jhunjhunwala 2000, 2001

Kiosk operators have shown immense drive in sniffing out commercial possibilities that were though non existent. As an example, the operator in Kendur village, Popu 12,000, has attached the printer/Xerox/scanning suite to his PC with no on-line activity bringing money. But his main profits come from digital mixing. He uses pirated Photoshop and has a good consistent clientele for these pictures. He charges 20 Cents for a post card size digitally mixed photo. "My *clients love the mixing work. They are now giving me ideas to change the look and feel of their photos…"* Another KO in the urbanizing village of Uruli Kanchan, Popu 50,000, said '*There are 9 hour power cuts here… what kind of on-line services I can offer… I have a flourishing computer training institute…. I use a generator during power cuts".*

Our on-going research in urban Western Indian regions, cyber cafés reported untenablility of stand alone business. Initial enthusiasm and excitement around internet cafés have waned to accommodate these as secondary business. At least 6 out of the 10 cafés we looked at ran a small PC assemblage and maintenance attached to café business, while 2 had mobile retail services. These businessmen viewed the twin engagements as complimentary bringing steady clients and easy propaganda for selling PC's via the internet clientele. Vinod, who runs a suburban Mumbai café, assembles PC's for a small neighbourhood market said, *"Definitely it is unviable…. Only a cyber café is not a revenue earner. You have to have another business in place. If you want to earn good money, difficult. Yes, you can break even. It will over come cost. But just a cyber café is not a good revenue earner. You have to have some other business in parallel. For example, in my case hardware would bring me profit and café earnings would manage the expenses…".* Bhavesh added *"Café is more like a supplementary business apart from my hardware business and would be an additional source of revenue. In the sales phase I can do hardware selling, sales, plus café …"* Vinod articulates reasons, *"….. People are becoming more internet savvy. Schools introduce computers at a very early grade…. They all want a home PC. In a city like Mumbai where connectivity is good and broad band rates are crashing cyber cafés are loosing out. I switched to assembling PC's and that is doing better business. I sold 50 the last year… and my browsing rates have come down by 30 % …"*

There is a second example of internet cafés transforming to residuary business. A café in south Mumbai, close to the stock exchange hub, is run by Pankaj, another IT engineer who opened the café to trade stocks "…. *Our prime business is trading with the National Stock Exchange and the Bombay Stock Exchange (NSC, BSE). And the cyber café is actually part time business. ….it is not just the cyber café that we operate here… the 4-5 PC's are idle after 4 PM, because the market is open for trading up to the time,… so to utilize the PC's we started the cyber café. …This is a market place. In this locality you won't find any cyber café. At least around 5 to 10 meters. So we expect income, though it's just a month old café..."*

A third and prominent scenario is the cyber café cum gaming centre making business from individual or networked PC gaming. Radhe, who manages and owns an internet café in a Mumbai suburban slum speaks about his business maneuvers "…, *I started a communication centre, PCO/STD/ISD and thought of beginning internet. We got 5 PC's. …. Not much came by way of income from internet. We still made money only from telephony, especially long-distance….The space opposite our house is occupied by a coin operated gaming parlor with a huge rush for games from local children and youth. I thought of the potential for LAN based games. Now we have lots of children and youth coming to play games. This is a lower middle class neighbourhood with the University situated close by and we keep charges low for both gaming and internet. We are finding clients only for games…The odd client comes for internet…"*

Lastly, and curiously, the internet, more then catering to purposive clients for browsing, searching, mailing, has spawned a growing 'chat room' user base, particularly in suburban Mumbai. It is still too early in our research to delineate the social character of the chat room interactive space and its user protagonists but early results are generating interesting social profiles of users[10]. Thus far, the users are predominantly male, 18-22, showing habitual chatting with 'new on-line friends' and tending towards enacting/performing an alternate, imagined 'on-line personality'. Pankaj, the café owner, comments on why chat rooms differ from normal face to face friendships *"…You can't call any one or just talk to a stranger on the road. …. But in a chat room you can ask for 'arbitrary introductions' and if any one is interested then he/she will reply. But the problem with personal interaction is that there is always that fear of it back firing. And in personal interaction what happens is that you can see the other person and vice versa, but here you can describe yourself at first to be Brad Pitt and then the reality could be that you are Danny Di Vito… but by then you are already friends"*.

Here is a conversation we had with Sagar, a frequent chat room visitor, living in a deep-suburb of Mumbai. He had something to say about 'taking' identities on-line,

"Interviewer- Ok. You are telling me that through chats like this it is easier to approach boys or girls because we don't know the person and he/she is prone to giving false ID's.

Sagar - Yes it is easy to do so….. It's not real.

I - Then what is the use if the ID is not real?

S - You cannot depend on it ever… That you'll find someone true to what he projects. …because one friend had told me that he himself has made an ID with a girl's name and uses it to chat up with boys just for 'time pass' (to kill time).

I - What are you saying?

S - Yes he stays just here, in this neighbourhood. Though I will not tell you his name"

5. CONCLUDING REMARKS

Contextual adoption of ICT's is perceived to be somewhat off-beat seen through a 'development' lens. These are real adoptions in the face of inconsistent and irregular infrastructural supports. What lessons do they have for those of us alert to IT diffusion in varied social environments? Where ICT's are engaged in everyday life through small businesses cropping around its usage, a good example being the independent cyber cafés, what can government initiatives do to augment these further? Can commercial offerings around ICT's be given special status through special licenses or promotional regulation to aid business prepositions. This way the government ensures pro-active engagements with market impulses converting these to viable spaces both for commerce and diffusion of technology.

These are early inferences and articulations in the hope of making fuller and robust recommendations based on in-coming data and reflections from on-going field work.

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[10] The Times of India, November 19, 2006 (Sunday supplement) reports social networking sites going beyond the usual dating/business networking to giving voices to otherwise suppressed issues, and the 'young and restless', getting confident about their sexual profiles.

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SCALING OF HEALTH INFORMATION SYSTEMS IN NIGERIA AND ETHIOPIA - CONSIDERING THE OPTIONS

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Abstract: This paper addresses the IFIP 9.4 conference theme for papers that take stock of the development of ICT in the health sector, and in particular how infrastructure and human resource factors influence the implementation of e-development initiatives. Using case studies from the Health Information Systems Programme in Nigeria and Ethiopia, the interdependencies between three spheres are identified as being important in scaling health information systems. The three spheres that are explored are the volume of data collected, human resource factors and access to technology. We draw on concepts from mindful innovation with technology to illustrate that a cultivation approach is appropriate to bringing about change. We suggest that a balance needs to be achieved between the three spheres if scaling initiatives are to succeed, and identify a number of factors that can be used to achieve and maintain the balance. Three flexible standards are identified as being critical strategies to global health information scaling initiatives, namely an essential data set, a scalable process of information systems collection and collation consisting of gateways between paper based systems and hardware and software which can be interfaced with one another, and a cultivation approach.

SCALING OF HEALTH INFORMATION SYSTEMS IN NIGERIA AND ETHIOPIA - CONSIDERING THE OPTIONS

1. INTRODUCTION

The scaling of information systems (IS) is a field which has been explored for a number of years in relation to the internet (Monteiro, 1998, 2000) and with respect to the effects of globalization (Rolland & Monteiro, 2002). In the health sector, scaling of health information systems (HIS) is a "pre-requisite and not just a luxury" because in order to make sense of for example immunization coverage data, data from all facilities and services in a region, province, or country are needed (Braa, Monteiro, & Sahay, 2004, p. 341). Yet, despite this imperative for sustainable information systems (IS), this field of study has not been explored in depth. In this paper, we explore the choice of solutions in scaling HIS in one region from each of Ethiopia and Nigeria, and draw lessons for scaling of IS in general. The selection of these countries is purposeful – they represent the two most populous states in Africa, and together represent almost 30% of the sub-Saharan population. Scaling HIS in these contexts is about scaling of large scale systems so as to achieve an appropriate coverage of the population to make meaningful sense of the data. We address the request in the call for papers that papers take stock of the development of ICT in the health sector, and in particular how the infrastructure and human resource factors influence the implementation of e-development initiatives.

Although scaling of HIS has been alluded to in three papers related to the Health Information Systems Programme (HISP) network (Braa, Hanseth, Heywood, Mohammed, & Shaw, Forthcoming, Braa, Monteiro, & Sahay, 2004, Sahay & Walsham, 2005), little detail exists about the choices when implementing (and scaling) large scale HIS. Sahay and Walsham (2005) describe the tension between globalization and localization, and the need to consider which parts of a system are scaleable and which require local customization. This challenge is central to the scaling of large HIS in complex environments, and is the focus of our research. We address this by exploring the role that human resources and technological components play in influencing the type and volume of data that can be collected and processed as HIS are scaled.

IS should be designed in a manner that allows them to be scaled through an evolutionary process (Braa et al., Forthcoming). In this paper we build on the concept of cultivation of IS by drawing on the concept of "mindful innovation of IT" (Swanson & Ramiller, 2004). Mindfulness, is characterized by an openness to novelty, alertness to distinction, sensitivity to different contexts, implicit or explicit awareness of multiple perspectives, and orientation in the present (Weick, Sutcliffe, & Obstfeld, 1999). We suggest that for successful scaling of HIS, mindfulness is required to balance the available human resources, access to technology and the type and volume of data collected by the HIS. By paying attention to these spheres and their interdependencies, rational choices can be made regarding which aspects of the IS can be unproblematically scaled and which require specific attention and local adaptation.

This paper proceeds as follows. The literature review addresses the scaling of HIS, and the use of mindfulness as an appropriate strategy for cultivation and scaling of HIS in complex organizations. In section three the methodology is presented. Section four describes the case of HIS development in Jigawa State of Nigeria and Amhara Region of Ethiopia. The discussion section follows and lastly concluding remarks and acknowledgements are presented.
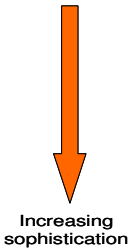
2. THEORETICAL CONSIDERATIONS

2.1. Scaling of Health Information Systems:

The scaling of information systems can be viewed along two axes (Table 1). The horizontal axis reflects the replication of processes across geographic spaces, or across new functional areas. (Braa et al., Forthcoming). Scaling along the vertical axis occurs through increasing the "depth" of penetration of the health system, or increasing the technological sophistication of the IS. Sahay & Walsham (2005) point out that scaling is not only about the technical aspects, but also about the people and processes, and escalating complexity. Not only does scaling require the implementing team to be cognizant of the needs that should be addressed by the scaling process – technical as well as human resource needs, but they also need to be aware that as scaling occurs, complexity (linked to "institutional practices (and) politics" (ibid, p. 51) is likely to increase. Building on this understanding, a third dimension to scaling IS is presented as the extent to which the system is rooted in people and work practices, and which describes how well the system is working (Table 1).

As IS are scaled horizontally or vertically, heterogeneity is likely to increase (Sahay & Walsham, 2005). Flexible systems are required to accommodate differences and changes (Braa, Hanseth, Heywood, Mohammed, & Shaw, Forthcoming). Flexibility is achieved in different ways. Along the horizontal axis, common data standards are used to provide uniformity across the geographic scope – for example the "essential dataset" (EDS) (Braa & Hedberg, 2002). The EDS is "a set of the most important data elements, selected from all primary health care programs, that should be reported by health service providers on a routine basis" (Shaw, 2005 p.632). Using the concept of the "hierarchy of information needs", the local users can expand the essential dataset to address their specific needs, while still reporting on the essential data required at the central level. In this way a dynamic balance is achieved between the local and the global information needs (Jacucci, Shaw, & Braa, Forthcoming; Rolland & Monteiro, 2002; Sahay & Walsham, 2005). The data standard is thus a "flexible standard" that allows "integrated independence" – the ability to experiment and develop local indicators while maintaining the data standard (Braa et al., Forthcoming).

Along the vertical axis, the challenge is to seamlessly integrate the flow of information between incompatible systems represented by the geographic periphery, and different technological systems, while also accommodating the need for change. To do this, gateways are used. Gateways are of the following types: paper-to-paper, paper-to-computer, and computer-to-computer, and will typically consist of simple software solutions and/or procedures. Utilizing gateways in various combinations accommodates flexibility and heterogeneity in that sub-systems of the IS can be changed or replaced without affecting the flow of information through the whole system. As access to technology in the periphery improves, computers can easily replace paper-based systems without negatively affecting the whole. Gateways provide flexibility as they are replaced and adjusted as sub-systems change.

Despite these insights, there is a need for practical guidance on strategies to effect scaling of IS. The cultivation approach is presented in the next section as an approach that is sensitive to the ever changing dynamics of the health sector environment.

Axis	Horizontal Axis (Dimension 1)		Vertical Axis (Dimension 2)	
Aspect of the health IS	Data standards - what data?	Geographic scope	Depth of penetration of the health system hierarchy	Technology standards (sophistication of the technical components)
Explanation	The message. From whom does the message come? Both geographic scope and spread across different programme areas.		How is the message communicated between levels, or from one system to another?	
	Essential data set	One facility	State/Region	Paper based systems
	Pharmaceutical data	Additional facilities till whole state included.	Zone/Gunduma	Stand alone computer
	Notifiable diseases	Additional states till whole country included.	LGA/District	Networked computers
	Other types of data, e.g. survey data	One country	Health clinic and hospital	Internet based IS
			Community	
			Individual patient record	

Dimension 3: The extent to which the system is "rooted" in the social system, information use & ownership – this drives the imperative to scale HIS vertically and horizontally

Increasing sophistication

Table 1: Understanding the different aspects of the Health Information System

2.2. Scaling HIS as a cultivation process:

The study of complexity within health organizations suggests that adaptability is an important characteristic (Begun, Zimmerman, & Dooley, 2003). It recognizes the ability of organizations to accommodate changes in their environment through a process of adaptation. This can be seen as a survival mechanism, and explains how organizations gradually adopt new ways of working as for instance technology changes. Change that occurs through incremental steps is appropriate in organizations because it accommodates change with minimal disruption to the existing processes (Bergqvist, Dahlberg, & Ljungberg, 2002).

The distinction between cultivation and construction dates back to Aristotle. For example, cultivation is seen as helping nature produce more perfectly things she could produce of her own accord, while construction entails reforming nature to produce things not found (Mitcham, 1994). "Another version of this distinction might contrast technological actions that are in some way in

harmony with nature with those that are not" (ibid, pp 211). By "replacing" nature in this quote with a social systems perspective on IS (e.g. Braa & Hedberg, 2002), we might say that cultivation as a strategy in this context will entail being in harmony with the social systems and building on the resources already there, although in a "progressive" bottom-up perspective of change. Not only has cultivation has been used to describe an approach to organizational change in which people are central to the information system (Bergqvist, Dahlberg, & Ljungberg, 2002), but it has also been used as an appropriate strategy for effecting change in information infrastructures (Aanestad 2002; Hanseth 2002). However, in considering the scaling of HIS in India, the bottom-up cultivation approach that was initially adopted needed to be complemented by a top-down strategy that provided legitimacy for further scaling (Sahay & Walsham, 2005), and similarly in South Africa (Braa, et al, Forthcoming). Yet, even when the systems are officially accepted, access to resources do not necessarily improve, and the further scaling of information systems has to occur within the existing resource constraints. This is often the dilemma of those involved in the implementation (and scaling) of HIS – how to accommodate the increasing demands (the "all or nothing" imperative (Braa, Monteiro, & Sahay, 2004, p. 340) or face the risk of the system being replaced by yet another alternative system that is perceived to be more useful.

Weick, et al (1999) has used the concept of mindful innovation to describe the adoption of IT in high reliability organizations (HRO's) like naval aircraft carriers and nuclear power stations. These organizations utilize "complex processes to manage complex technology" (Weick, et al, 1999, p. 83) because the consequences of failure in an environment that is vulnerable and subject to unexpected changes are devastating. Organizations wishing to survive in these conditions must be able to adapt to unexpected changes. Adaptive responses to the unexpected requires mindfulness, as characterized by a pre-occupation with failure, a reluctance to simplify interpretations, a sensitivity to operations, a commitment to resilience and a reliance on expertise over formal authority (Swanson & Ramiller, 2004). Mindfulness enhances the cultivation approach for scaling HIS by suggesting a number of specific characteristics that should be incorporated in the approach to scaling HIS. Three of these are summarized in Table 2. Using empirical data from Ethiopia and Nigeria, the importance of paying careful attention to these characteristics, especially as they relate to the complex interactions between the skills and capacity of people in utilizing technology to communicate and process health information, is demonstrated.

Characteristic	Brief description and application to HIS
Preoccupation with the possibility of failure	Through constantly being aware that IT projects are prone to failure, a pro-active awareness of opportunities that can be harnassed to support the successful scaling should be encouraged. (we use empirical data to demonstrate how an "awareness of the possibility of failure" can be used to guide which aspects of the IS can be unproblematically scaled and which require specific attention and local adaptation.
Commitment to resilience	It is impossible to identify every possibility that might arise during scaling of HIS – therefore improvisation will be required to complement plans, adaptation will be necessary, and effectiveness required rather than efficiency.
Sensitivity to operations	small faults can cause major consequences if not addressed. This is the processes of local customization to ensure that systems and procedures are locally appropriate. It also entails responding to seemingly small problems before they create larger problems.

Table 2: Brief description of some characteristics of mindful innovation

3. METHODOLOGY:

The empirical basis for this study is derived from the large scale and on-going HISP action research project which is engaged in the design, development and implementation of HIS in many developing countries including Ethiopia (Braa et al., 2004) and Nigeria. We have purposefully selected a single state/region from each of these countries based on the in-depth knowledge by the authors, and because the scaling of HIS in the two regions present similarities and differences which allow interesting comparisons to be presented.

The principle author's involvement in Nigeria began in 2003 at the initiation of the 5 year, Nigerian Partnerships for Transforming Health Services (PATHS) project funded through the British Department for International Development (DFID). The project is active in 5 of the 37 Nigerian states. He has in the last year spent about 90 days in Nigeria in these two states, supporting the improvement, and scaling of primary health care IS. The second and third authors have been involved in IS development in Ethiopia since 2003 when HISP activities began through a collaboration with Addis Ababa University and the University of Oslo. The second author, an Ethiopian national and member of the HISP-Ethiopia team, has provided support to the RHB's, and in particular to the Amhara Region.

Data sources accessed during project activities includes on-site observations, notes made in a diary kept specifically for the purpose, photographs, documents, tools and project reports. The research data has been analyzed in the interpretivist research tradition as described by (Walsham, 1993).

4. CASE DESCRIPTION:

In the case descriptions we initially provide a background perspective on the development of the state and the health system, and then describe particular aspects related to the development of the HIS. In each case we have tried to detail aspects related to the three spheres under consideration, namely the data collected, the technology, and the staffing.

4.1. Background

Jigawa is a new state, having been created out of the Kano state in northern Nigeria in 1991(Table 3). It is the sixth Nigerian state to introduce Sharia Law. The state is divided into 27 local government authorities (LGA's), and state and local government councilors are democratically elected. As in the case of Amhara Regional State, considerable effort is being directed towards decentralization of services.

The two case study sites have remarkably similar indices (Table 3). Both have poorly developed infrastructure, and (in terms roads, electricity, telecommunications), although in recent months access to electricity and telephones has increased remarkably in the periphery of Amhara Region State. Human capacity is poor in both states, and immense geographical distance (e.g. one of the zones is located at a distance of more than 700 km from the regional capital) hinders communication and supervision.

Health services are poorly developed in both states. In Jigawa, the maternal maternal mortality rate is estimated to be 1,700/100,000 live births in Northern Nigeria (Kano State Economic Planning Committee, 2004; Shiffman, Okonofua, & Ved, 2006) – several times higher than that for Nigeria. It is estimated that in Amhara Regional State, basic services are provided to only about 60% of the population (Ministry of Health, Ethiopia, 2005).

A key difference between the two case study sites is that in Amhara Region, access to ICT has increased dramatically in the last few months as part of a governmental initiative, while in Jigawa outside of the main centers ICT infrastructure is extremely week. However, in Jigawa the staffing levels are higher (even if skills are low), while in Amhara the staffing levels are extremely poor. These differences have required different approaches to the development of the HIS, as is discussed below.

Jigawa Statistics[1]		Amhara Statistics
23,154 km²	**Surface Area**	161,828.4 km²
4,9M vs 131,5M for Nigeria	**Population 2005 est**	19M vs. 74M for Ethiopia
49%	**Population under age of 15 years**	44%
22% for women and 51% for men	**Literacy Rate (2002)**	22% for women and 46% for men
US$290 vs. $1,188 Nigeria average	**Gross per Capita Income (2001)**	US$100 vs. $120 Ethiopian average
Table 3: Selected Statistics for Jigawa State, Nigeria and Amhara Regional State, Ethiopia		

4.2. Information systems development in Jigawa – limiting the dataset

In Nigeria, the PATHS project has been supporting health systems development through targeted program support, particularly to maternal and child health programs, malaria and tuberculosis and sexually transmitted infections. Supporting the HIS has been integral to these initiatives (Figure 1). HMIS development occurred in Jigawa and 2 other states as a parallel process based on the South African experience of HIS development using the DHIS software (Braa & Hedberg, 2002). Three aspects of the HIS development are highlighted. First, 8 of the 27 LGA's were identified to serve as pilots - allowing the implementation team to gain experience and learn lessons in the initial implementation. Secondly, an EDS was developed for use across the PATHS states. The process of developing and gaining acceptance of the EDS did not occur without controversy. Major

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[1] Obtained from various sources, including data used in the DHIS for population data

opposition to the EDS was received from senior Federal Ministry of Health (FMoH) officials who were advocating use of over 1000 data elements and a software product that provide little benefit to its users. Eventually, through high level negotiations, an agreement was reached that an EDS of 127 data elements, which could provide data on 74 indicators, would be used as a pilot in the PATHS states only. Subsequently (in 2005) a slightly modified version has been used as the standard across the country. Thirdly, the DHISv1.3 software was adapted to the Nigerian context, and used at the state level for data capture and analysis of monthly facility reports.
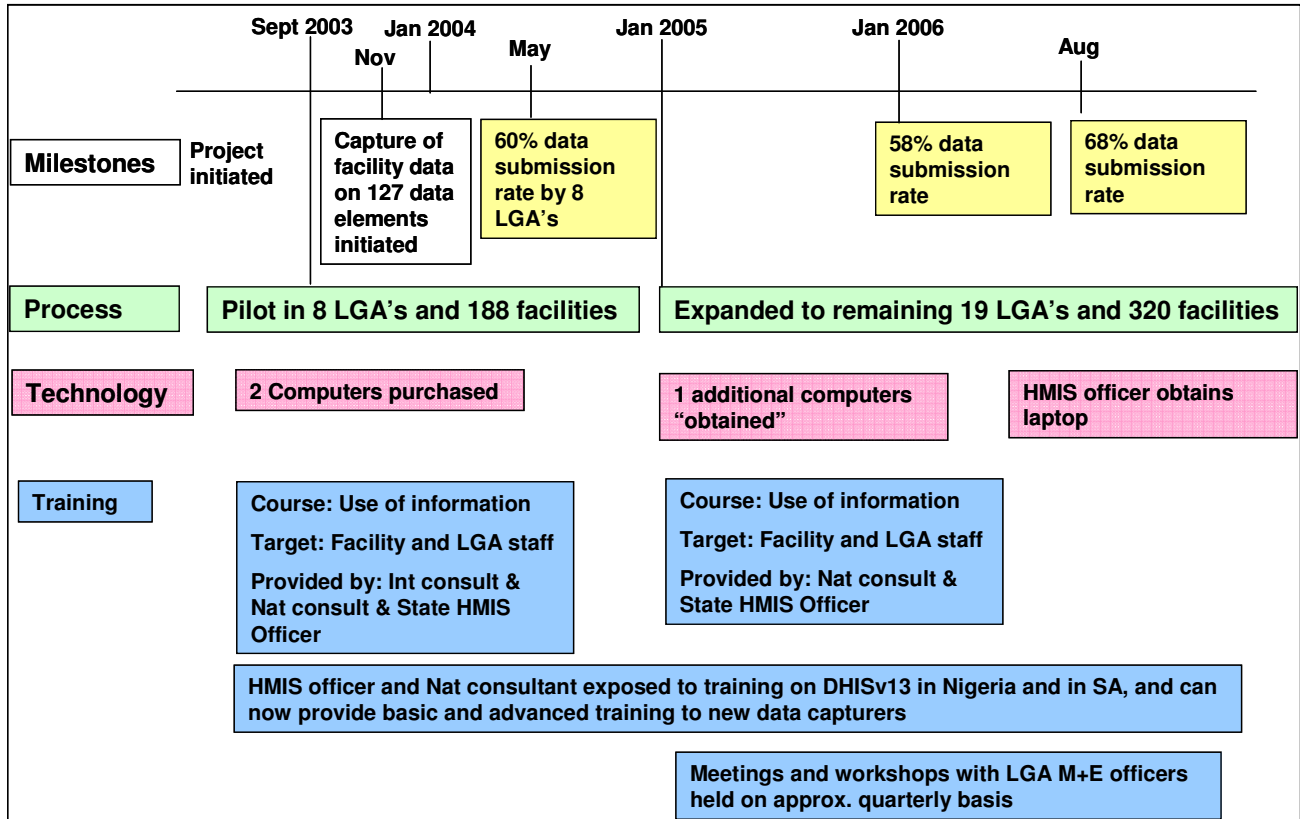
Figure 1: Timeline of initiatives in Jigawa, Nigeria

In the absence of technology, reliance is made on paper based IS for data collection and onward transmission, from facility, through local government authority level, and up to state level (Figure 2). Data capture occurs at state level. Gateways are used at two levels. A paper-paper gateway transfers data from patient registers to monthly reports (facility level), and a paper-computer gateway is used at the point of data capture (state level). Data is captured by two staff in the HMIS unit. The achievement of a 68% data coverage for the last 12 months (as at August 2006) is significant given the constraints (unreliable access to electricity, lack of funds for generator fuel and pressure on data capturers to perform other tasks), and only the PATHS states can claim similar data coverage rates.

Figure 2: Data flows demonstrating the use of gateways between incompatible systems
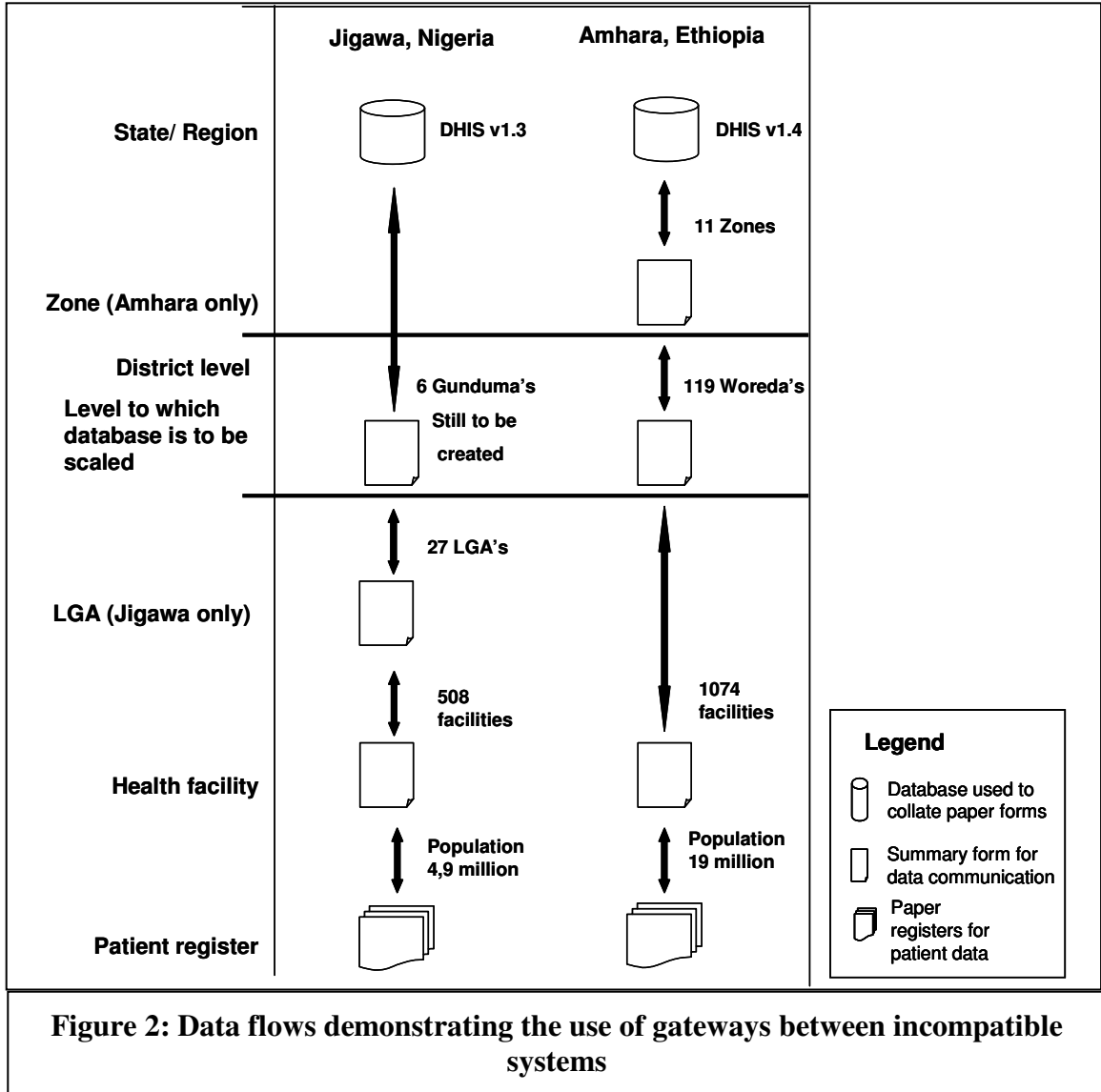
A strength in Jigawa is that staff exist at each level, and have received training related to the HIS (Figure 1 and Table 4). Through these processes the in-country teams have developed capacity to continue basic training on their own. International support is available to support the more sophisticated aspects of the software, and of HIS implementation. Institutionalization of training initiatives is to be strengthened through establishing links with a local university.

Hierarchical level	Numbers of staff	Staff involved in the HIS	Access to computers and electricity
Facilities	508	At least one person in each facility participated in training on use of information	Seldom have access to grid electricity. May have solar panels, which often are non-functional. Rely on paper based data collection, but paper itself is in short supply.
Local government	27	One PHC Coordinator (political level) and an Monitoring and Evaluation Officer[2]	Grid electricity is unreliable. Almost no computers at this level.
State Ministry of Health	1	State HIS Officer, and 2 data entry clerks	Grid electricity is unreliable, and more often than not reliance is on a generator which usually only runs "when certain senior officials are in the office". Three computers and one laptop
Table 4: Overview of access to staff and computers in the Jigawa Health System			

4.2.1. Summary:

The phases in the HIS strengthening initiatives in Jigawa are presented in Table 5.

Phase	Time period	Activity	Comment
I	Sept 2003 - Jan 2005	Pilot in 8 LGA's	EDS defined, data flow improved, new process of data capture using DHIS1.3 at state level introduced, intense training provided
II	Jan 2005 - Jan 2006	Horizontal scaling across geographic areas (LGA's)	EDS held static and data capture maintained at state level, increase in volume of data (additional LGA's), intense training by local team (demonstrating some capacity been developed)
III	Jan 2006 - Aug 2006	Consolidation period	Efforts directed at improving adherence to data flow and improving data capture process Efforts to encourage use of information Advocacy meetings with senior managers
IV	Nov 2006	Conversion DHIS13 – DHIS14	All else held static – training to be provided on new version of DHIS
V	Jan 2007 onwards	Decentralizing data capture to gunduma	Still to take place, but has been discussed, and planned for about 18 months.
Table 5: Phases in HIS Strengthening Activities			

Phases three through five require specific mention. Phase three is a consolidation period. A number of workshops have been convened where existing data (even if incomplete) is used as a means to encourage LGA's to ensure that at least 90% of their facilities report. Interestingly, the ability to present and analyze data has created huge interest amongst program managers at the State and Federal levels as, for the first time, comparative data has been presented across the five

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[2] In reality, there are more people involved at this level, as many of the vertical programmes have their own "M+E officers" – reflecting the constant battle between integration and verticalization (fragmentation) of services, especially in an environment which has a large donor driven component

PATHS states. The upshot of this has been that HISP-Nigeria has now been asked to implement DHISv1.4 and provide training to all remaining states in Nigeria!

Phase four involves the conversion from DHISv1.3 to DHISv1.4, and is currently underway. During 2003/04 a new improved version of the DHIS software, called DHISv1.4, was being tested in South Africa, Botswana and Zanzibar. In Nigeria though, the introduction of this more powerful and efficient version was delayed till late 2006, because at the time the team had limited capacity to absorb new initiatives. In August, Kano state began to use the DHISv1.4, and as implementation proceeded smoothly, training is currently being done in Jigawa (and offered to other states to attend as well). The process of transition to DHISv1.4 reflects the cultivation processes used so successfully – not only in that piloting in one region is initiated before larger scale implementation, but the translation to a newer version of the same software is also a cultivation process.

Phase five is still to be enacted, namely the decentralization of data capture to gunduma level. Ideally data capture should occur at the LGA level. But, in this case 27 computers accompanied by generators, UPS systems, and secure and dust free abodes need to be provided, as well as training and support to the 27 HIS Officers. This is not achievable given the current access to resources. Rather, the plan is to scale to gunduma's, and to provide an additional 6 computers, and generators, and to locate these at hospitals (where power supply would be more regular and a secure and dust free environment is more likely to be found). Each would capture data from about 85 facilities. Training on the use of the DHIS software will draw on those LGA HIS officers who are dedicated and reliable. New HIS officers from facility staff will be identified to support the LGA level. Scaling in this way potentially trebles the pool of data capturers, and also shifts the responsibility one step down the hierarchy in a manner consistent with resource availability.

4.3. Information systems development in Amhara Region State - increasing the data volume

The flow of information is similar to that in Nigeria (Figure 2). However, prior to the project initiation, the Woreda Health Offices compiled summary reports (using the health facility reports), and the aggregated report was submitted to the zonal office, which sent it to the ARHB (Amhara Regional state Health Bureau) and then to the FMoH. During the aggregation process, the identity and details of the original facility data was lost, making it impossible to trace data back to a single facility. Data capture occurred at the Regional level. Prior to the initiation of the HISP project, the existing HIS has been a one way reporting system designed to report data to higher levels and vertical programs without any feedback to the lower levels. An EDS was developed over an 18 month period (up to December 2005) using a participatory approach and with support of the RHB. Standardized reporting formats were developed, and the DHISv1.4 was customized for implementation at regional and zonal levels. The new reporting system brought about changes to the flow of information – facility reports would be captured instead of aggregated data. This created a tenfold increase in the volume of data, as instead of monthly reports from 119 woreda's, 1047 monthly facility reports were to be captured. As a result, there was a need to decentralize data capture to zonal, and possibly woreda level.

A survey of access to staff, computers, and internet was conducted (Table 6). This shows how access to computers, telephone and electricity both at zonal and district levels has improved remarkably in the last few months, although surprisingly the level of internet connectivity both at zonal and district level remains low (but is likely to be addressed through a large World Bank and

International Monetary Fund (IMF) funded project - WoredaNet). A critical problem though is the lack of assigned HMIS staff to specifically do HMIS related activities, and they do not have the skills and training with regard to modern information and communication technologies.

Zone	Districts (Woredas)	Districts with access to telephone & electricity	Districts with computers	Districts with internet (Dial-up) access	Districts with assigned personnel for HMIS
North Gondar	18	16	10	2	None (not even at Zonal level)
South Gondar	10	9	8	1	2
Wag Hemra	4	3	3	None (not even at zonal level)	0
North Wello	9	9	7	1	2
South Wello	18	14	11	1	None (not even at Zonal level)
Oromiya special zone	5	3	2	None (Not even at zonal level)	0
North Shoa	20	18	18	None	None (not even at Zonal level)
East Gojam	15	11	7	1	None (not even at Zonal level)
Awi zone	6	4	4	None (not even at zonal level)	0
West Gojam	13	12	9	None (Not even at zonal level)	None (not even at zonal level)
Bahir Dar Special zone	1	1	1	None (not even at zonal level)	0
Totals	**119**	**100**	**80**	**6**	**4**

Table 6: Analysis of access to computers, internet and staff in Amhara Regional State

To address the skills gap, a two week training course for staff from the 11 zones was conducted in May 2006 by the HISP-Ethiopia team. As many trainees had very limited computer literacy skills, the first three days were devoted to increasing their familiarity with MS Office applications, (specifically MS Excel and MS Access since they are linked to the DHISv1.4 for report generation and data analysis). The remainder of the training focused on the principles of data capture in DHISv1.4. At the end of the training, trainees were provided with installation CD's, and were instructed in the installation procedure for the software. However, shortly thereafter the HISP team started to receive phone calls from zonal health departments requesting support on the installation process. In July 2006, when a team of three HISP members (including one of the authors) conducted follow-up on-site training in the zones, they found that none of the trainees had managed to successfully install the software in their computers. This was due to the low computer literacy of the trained staff who had difficulty grasping the installation procedure. As the HIS focal person in one of the zones indicated:

> "…the training given for us in May 2006 in Baher Dar was good, but for most of us with less background and knowledge even on basic computer applications, the complex instructions and dialogue boxes popping up during installation of DHIS software makes it very difficult for me to successfully install and use the system."

We see in this example, how, the balance between the human resources (numbers, and skills levels) and the technology needs to be managed, otherwise the technology will not be used to its full potential. An alternative option that is now under consideration, instead of trying to achieve homogenous scaling to all levels at the same time, would be to scale to those woreda's that have the capacity to absorb the training and which have the technology available. We thus allow uneven development to occur, but through a cultivation strategy.

4.3.1. Summary:

In Amhara Region then, we can discern three phases to the HMIS strengthening activities (Table 7).

Phase	Time period	Activity	Comment
I	June 2004 - Dec 2005	Period of consultation and buy in	EDS defined, data flow changed with huge increase in data volume
II	Jan 2006 - current	Vertical scaling of data capture to zones	Training and support for data capturers
III	Oct 2006 – Jul 2007	Vertical scaling of data capture to selected districts	Training and support for data capturers
Table 7: Summary of HIS Implementation in Amhara Regional State			

5. DISCUSSION:

We see in these examples, an interesting interplay between what we have termed the three spheres of the IS, the data sphere, the technology sphere, and the human resource sphere. These are presented in a model (Figure 3). The three spheres are interlinked with one another in complex ways, and understanding and being sensitive to the complexities of these inter-linkages is important in "innovating mindfully" with technology. The oval shapes represent an assessment of the capacity of each state in relation to the three spheres. Jigawa and Amhara Region differ in their human resource capacity and access to technology and this has had implications on the volume of data that they can effectively manage, and the process for strengthening the HIS.

In Nigeria, centralized data capture was initiated because of the absence of ICT infrastructure in the periphery, and despite the presence of sufficient staff there. However, data capture of 508 facility reports in a central office is not an easy task. It was kept manageable by limiting the EDS to a small number of data elements. Decentralization (scaling along the vertical axis) is proceeding "cautiously" as ICT infrastructure improves. In Amhara, the process was driven by the need for disaggregated data (increased depth of penetration of the hierarchy) resulting in an explosion in the volume of data. Given the relatively good access to ICT, decentralized data capture was possible, despite the limited availability of staff. However, the implementation plan had to be re-assessed because efforts at improving staff capacity were hindered by their limited ability to absorb the training. As HIS implementation proceeds, so the capacity in each of the spheres changes (skills improve, access to technology improves, and data volume may increase), and a never-ending spiral results as the balance is maintained. As the process spirals the HIS is scaled.
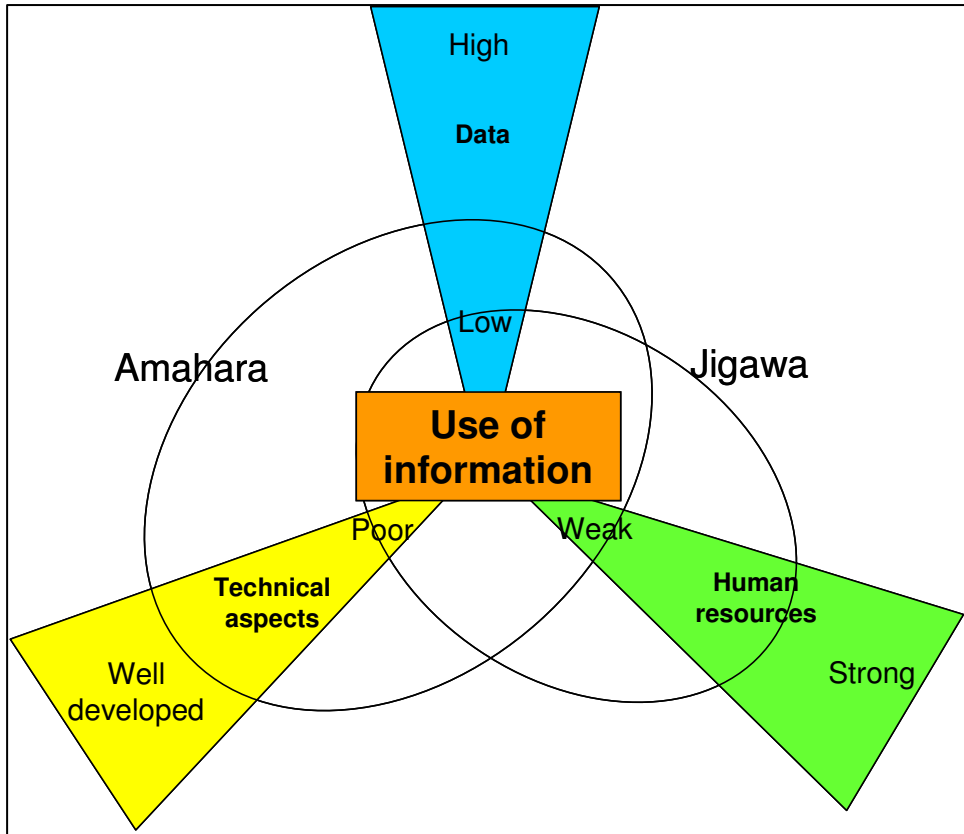
Figure 3: The influence of resource availability on HIS development

Based on an iterative process of analysis of the case material, the factors that affect each sphere are presented in Table 8. Given the importance of balance between the three spheres, this analysis is a useful checklist which can be used (in support of "a sensitivity to operations") to assess the strengths and weaknesses in an organization where scaling is planned. For instance in the Amhara example, the decision to capture facility data (meaning the depth of penetration of the health system by the HIS– Table 1) increased the volume of data to be captured, resulting in a need for increased data capturing capacity. How could this be achieved within resource constraints? Lead districts can be identified by assessing which best fit the criteria listed in the table. In this way, uneven development can be used to spearhead scaling of HIS. The analysis thus helps identify which areas can be successfully scaled ahead of others.

SPHERE	CONTRIBUTING FACTORS
Data components	Volume of data, affected by:
	Extent of integration from vertical programs (Jigawa)
	Geographic scope (e.g. In Jigawa, 8 of 27 LGA's piloted)
	Granularity of data (penetration of hierarchy from national to community and individual levels – the Amhara example)
Human resources aspects	Numbers of staff (Jigawa and Amhara)
	Skills level of staff (Amhara)
	Ability to provide support (Jigawa and Amhara)
	Ability to train and build capacity (Jigawa)
Technical aspects	Scalable processes integrated in the information system (Jigawa and Amhara)
	Software appropriate and scalable (Jigawa and Amhara)
	Access to computers (Jigawa and Amhara)
	Access to internet (Amhara)
Table 8: The Factors Contributing to Each Sphere	

The concept of utilizing lead districts to spearhead scaling and HIS development warrants further exploration. Development of the HIS and local commitment, the level of its use and quality of data, will typically proceed at an uneven pace between districts. Local champions and otherwise favorable conditions in individual districts may typically lead to "best practice" districts. An effective scaling strategy needs to support these lead districts and actively use these best practices in the horizontal scaling of the HIS to other districts. More concretely we have seen how best practices have turned into "attractors for change" (Eoyang, 1996) by creating support and interests and thereby sufficient momentum and "critical mass" to bring about changes also in other districts.

A cultivation approach, characterized by mindful innovation is required to maintain the spiral as HIS are scaled. In order to minimize the risk of failure then, careful attention to the context is required, and in particular to the ability to accommodate and absorb change (a sensitivity to operations). Inefficiencies may need to be accepted because of imbalances between the three spheres (in the case of Jigawa the inefficiency of centralized data capture, in Amhara the need for a reconsideration of the decentralization strategy). Further examples are summarized in Table 9.

Characteristic	Examples from case material
Preoccupation with the possibility of failure	Nigeria: Careful planning prior to implementation at Gunduma. Constant consideration of how sustainable IS are developed Ethiopia: Conducting survey to assess capacity prior to implementation.
Commitment to resilience	Nigeria: Delaying introduction of DHIS14 till conditions were favourable. Ethiopia: Follow-up training support provided when trainees did not understand instructions sufficiently
Sensitivity to operations	Nigeria: Decision to first decentralise to Gunduma before going to LGA level. Holding other changes back when introducing DHIS14 Ethiopia: Allowing uneven development to occur

Table 9: Brief description of some characteristics of mindful innovation

In reality, as HIS are scaled, and experience is gained, the relative balance between the three spheres is likely to change. The position of the Amhara spiral in Figure 3 reflects the average situation across the state, but in fact it could be composed of 11 very different zonal spirals, or 119 woreda spirals, each depicting differences in access to resources. As changes are brought about, whether by a need for increased data volume, or as additional staff are brought on board, or as access to technology improves, the balance needs to be reestablished. The challenge in scaling is to keep the balance between the three spheres. This can be achieved through a process of improvisation, using the available resources optimally, and innovatively. Plans and implementation processes need to be constantly assessed and adapted. In our cases, mindful innovation has entailed the synergetic interaction between the three spheres, but has also been influenced by the use of information. This is the third dimension depicted in Table 1, and is required for vertical and horizontal scaling. Improved quality of data and information, such as reports that address managers' (and other users, as in the Nigeria case) needs, are both caused by and causing improved human resources, which again lead to an improved system including the technical aspects. While the users are learning how the system can serve their needs and thereby sparking gradually more advanced requests, those involved in the systems development are learning how to meet these requests. Through this iterative process, the software and overall system are being gradually improved. As ownership and perceived usefulness increase, vertical and horizontal processes will need to be replicated at each level (e.g. district, state/region, national) of the health system as scaling occurs. IS development occurred through small changes and problems are overcome through adjustments of the "ideal" plan to one which is dictated by practicalities (the factors that affect the spheres).

This brings us to our research question, namely are there aspects of an IS which can be scaled unproblematically?

6. CONCLUDING REMARKS:

Considering the factors depicted in Table 8, we cannot say with absolute certainty that there was any single factor that was able to be scaled "unproblematically" – the nature of the local context, and the access to resources, required specific adaptations to be made for each of the factors. But, drawing on the case descriptions, and similar accounts in the literature (Braa et al., Forthcoming; Braa et al., 2004; Rolland & Monteiro, 2002), it is clear that certain strategies are central to successful scaling. The first is the concept of the EDS (and which will not be further elaborated here). The second is in the technical sphere, and is depicted in Figure 2 - a scalable process of information collection and collation consisting of gateways between paper based systems and hardware and software which can be interfaced with one another at various levels of the hierarchy as access to technology changes, and which can accommodate heterogeneous (uneven) development across geographic areas. The third represents the cultivation process – or the spiral itself – which includes improvisations and a variety of ways to develop, facilitate and motivate increased information use, local champions, commitment and ownership. We have seen that the development of lead districts, good examples and attractors for change are crucial elements in the cultivation and scaling strategy   These three strategies have been identified as "flexible standards" (Braa et al., Forthcoming), and as can be seen in Table 1, they support the scaling process (and the changes that accompany scaling) across geographic scope and depth of penetration of the hierarchy of the health system. We would thus conclude that "flexible standards" are strategies that can be scaled on a global level, but that for the successful scaling of HIS, it has to be accompanied by a local cultivation process that balances the spheres of volume of data, access to technology, and human capacity.

7. ACKNOWLEDGEMENTS:

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TOWARDS A POLITICAL PERSPECTIVE OF INTEGRATION IN IS RESEARCH: THE CASE OF HEALTH INFORMATION SYSTEMS IN INDIA

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Abstract: There is an urgent need to address the issue of fragmented health information systems (HIS) in developing countries. However, this is extremely challenging, and the existing literature on information systems (IS) integration is overly optimistic and prescriptive. Moreover it is predominantly technical in orientation, often touting new and better technical approaches to deal with the integration challenges. Our aim with this paper is to identify and build on critical literature that goes beyond the largely unchallenged consensus that integration is desirable (and doable). We are not arguing against integration per se, but discussing the challenges of actually achieving integration, and aim specifically at improving our understanding of the political aspects of integration. The empirical material is an ongoing effort to computerize the health care sector and integrate IS systems in India. We focus on the socio-technical and political aspects of integration of these systems. Our aim with the paper is dual, on the one hand to address the conceptualizations of integration within IS, on the other hand to indicate possible learning on how integration can or should be managed in practice. The key implication of this paper to understand the political-technical aspects of integration, has implications not only to health and India, but also to other domains of IS application in both developed and developing countries.

Keywords: integration, health care information systems, HISP, India.

1. INTRODUCTION

Lack of integration across distinct information systems is an all-too common and real problem. For instance, within the health care sector in developing countries, which is the empirical setting for this paper, fragmentation and lack of integration constitutes severe problems. On the one hand, it creates redundancy and additional workload for health workers as information regarding health status, disease incidence, prevalence and conducted treatments is often collected repeatedly (and also differently). Health workers may have to report the same information several times, both in the routine reports within the official system as well as in specialized reports demanded from quasi-independent, so-called "vertical" health programs (e.g. malaria, tuberculosis and HIV/AIDS). Both the health delivery and reporting are adversely influenced by this fragmentation of various reporting systems (Braa et al., 2004). On the other hand, services that should have been coordinated are often not adequately linked. For example, lack of integration implies that HIV positive, pregnant women who are enrolled in the ante-natal care (ANC) program, may fail to show up in the treatment under the Prevention of Mother to Child Treatment (PMTCT) program (see e.g. Shidende, 2005). Furthermore, statistics on HIV/AIDS prevalence rates are typically based on very small survey based samples, and may ignore a very key segment of potential positive cases (mothers under the Ante Natal Care program) which is under the purview of the district health system.

These practical problems emerging from lack of integration is also encountered in the ongoing, action-oriented research project called Health Information Systems Programme (HISP)[1], from which the empirical material in this paper is drawn. The project is in varying stages of implementation in more than ten countries in southern and eastern parts of Africa, Vietnam and India. A core practical issue for the project is the question of how viable and sustainable strategies of integration should be crafted and implemented. In current IS research, integration of IS is predominantly conceived of as a technical issue, and the emphasis is on different mechanisms and strategies for achieving tighter integration (Hasselbring, 2000, Grimson et al., 2000). This, we argue, is not sufficient for successful integration of various fragmented systems and services in the health care sector in developing countries. At the core of our analysis is the concern for emphasizing the need for political and institutional integration alongside the technical. When we consider the reporting systems of various vertical programs, the fragmentation can not be seen in isolation of the very diverse political interests of the donors, the countries and politics they represent, the money they bring in, and the particular diseases they are interested in. The various HISs are heterogeneous, both technically (application, platform, protocols, language), in relation to funding mechanisms (governmental/ national, donor agencies, universities, World Bank, local municipality) and with respect to institutional grounding (central ministries, district administration, local health clinics, vertical programs). This heterogeneity needs to be accommodated politically and institutionally, not abstracted from by focusing only on the technical aspects of integration (Chilundo and Aanestad, 2005).

In section 2 we discusses how integration has been generally conceptualized in IS research. Typically, the literature maintains a broad consensus that integration is desirable, although in recent years studies have emphasized the downsides, costs, risks and side-effects of integration. Information about collection of the empirical material is presented in section 3, before the case study is presented in section 4. Analysis and discussion follow in section 5 before concluding remarks in section 6.

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[1] See (Braa et al., 2004) or www.hisp.info for an overview of activities globally since 1994 and www.hispindia.org for activities in India between 2000-2006.

2. CONCEPTUALISING INTEGRATION IN IS RESEARCH

2.1 Traditional view: integration as a remedy

Within the informatics community "integration has been the Holy Grail of MIS since the early days of computers in organizations" (Kumar and van Hillegersberg, 2000, p. 23). Ever since the 70s, Western business organizations have struggled with the fragmentation of their collection of IS (McNurlin and Sprague 1997) and looked for ways to integrate them through defining standards for common services, shared information repositories, joint terminologies and shared technical platforms. Technically, integration refers to the degree of interoperability and interconnectivity among technical components, and relies on standardization at a certain level. Over the last decades there has been proposed a rich and expanding repertoire of technical mechanisms for integration, from low-level (e.g. database schema integration), middle-level (e.g. middle-ware like CORBA, Web services), to high-level (e.g. Service-Oriented Architectures (SOA)) 2solutions.

A poignant illustration of the need to address integration is the attraction of the so-called Enterprise Resource Planning (ERP) systems in large business organizations. As SAP, the world's market leader in ERP systems, points out on their web site, the essence is to have business processes "[integrated] ….across departments and functions". Yet, the actual realization i.e. organizational implementation lags significantly behind these promised returns (Goodhue et al. 1992, Hanseth et al. 2001, Kallinikos 2004, Pollock and Cornford 2004, Singletary 2004). The traditional approach to integration, in short, remains overly optimistic, prescriptive and programmatic.

2.2 The downsides of integration

There does exist, however, critical voices to the one-sidedness of the above position on integration. Goodhue et al. (1992) have emphatically called for a more nuanced approach to integration. Working out a pragmatically based contingency model, they identify conditions under which they argue that the costs (in terms of loss of flexibility, increase in development costs) may outweigh the benefits of integration. Similarly, and more recently, Singletary (2004) surveys practitioners' perceptions of downsides to integration including lock-in with vendors, costs and project risks (see also Markus, 2001). Empirically underpinned case studies (see e.g. Hanseth et al., 2006; Rolland and Monteiro, 2006; Perrow, 1984); demonstrate in more detail the form and implications of the unintended consequences of integration. Tighter couplings of information systems increase the complexity of the systems and with it the likelihood for unintended effects of the any action taken. As a result of these unintended effects, the wished-for integration may not emerge, and the attempt to increase control over fragmented systems may be more or less unsuccessful.

2.3 Political ecology of integration

The contributions cited above document the unintended consequences of integration but present little or no analysis of the political and institutional conditions that envelop the context and how these shape the dynamics of integration. Our aim is not to emphasize the political over the technical, but to emphasize the inter-connectedness of the two. A political perspective on IS in general and integration in particular highlights the importance of gaining, maintaining and expanding the political and institutional legitimacy and support for an IS (see e.g. Webster, 1995; Spinardi et al., 1997, Cox and Ghoneim, 1998, Chilundo and Aanestad, 2005).

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[2] See Chari and Seshadri (2004) for an overview of different standards for integration.

Nowhere is this perspective more appropriate than within the thoroughly politicised arena of the health care sector, especially in developing countries, given how these systems are embedded in the politics of diseases, donor money, national and local government agendas, the battle of vendors and systems, and the direct concerns of civil society. In this context, we cannot assume that integration is wanted, at least not in the same way by all actors. Consequently, the issue is transformed from a technical problem-solving exercise, to one of politically charged negotiations. Perhaps the term 'integration' may be less appropriate than other terms such as coalition making, building alliances, and achieving alignment of interests or mobilization of support. We however, use the term integration to focus on the need to conceptually analyze the political with the technical facets that shape integration processes.

3. RESEARCH METHODS

The empirical material reported here is drawn from the experiences gained during the implementation of the HISP projects in India. The major part of the empirical material comes from Andhra Pradesh, which is a state in southern India with a population of 75.7 million. The state has about 1,386 Primary Health Centres (PHC) and 10,568 Subcenters (SC) spread across 22 administrative districts covering an area of about 246,793 sq km. The material is supplemented with experiences that the authors have whilst working in some other states in India (Kerala, Gujarat, and Jharkhand)..

Data has been collected through a variety of means, intimately connected with the day-to-day running of the project. This includes a literally uncountable number of formal and informal interviews with staff at all administrative levels and observations and assessment during actual project management activities. Various evaluation reports have also been prepared for the state as submissions on the project status. The first author has spent most of his time during the last five years with HISP India, while the second and third authors have participated in altogether four field trips lasting 10-14 days during the last three years.

The data gathering, beyond more traditional field observations, interviews, document analysis, include, essentially, also an ongoing cultivation of political support for the HISP project. This takes the form of formal and informal oral and written briefings with key supporters. Maintaining and expanding these political relationships is a vital (yet 'invisible') prerequisite for HISP activities. In table 1 below, we summarize the time lines of the key events that have informed this case study and its analysis.

Key Events	Approximate time/period
Initiation of HISP initiative in India	December 2000
Situation Analysis in Chittoor district	January to July 2000
Pilot implementation in Kuppam	January to July 2002
Scaling project to Madnapally	February to August 2003
Scaling to the 22 district offices of the state	February to May 2004
Integration project (Chittoor and Nalgonda districts)	July 2005 to Januar 2006
Elections	May 2004
CFW terminates project	January 2006

Table 1. Key Events of HISP in Andhra Pradesh[3]

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[3] The gaps in the dates above concerns the period when we were negotiating with the health department to continue the project. Many months used to be spent in gaining permission. The FHIMS project also started around the same time as HISP.

4. CASE: INTEGRATION OF HEALTH CARE IS IN INDIA

In Andhra Pradesh, one of the southern Indian states, the former Chief Minister Chandrababu Naidu initiated various reforms aimed at 'good governance' during his tenure (1994-2004). These reforms were the backdrop also for health care related IS projects to help provide electronic support tools to the health staff.

A starting point for the various initiatives, was Naidu's vision of trying to create a social security kind of ID system for all citizens, which could form the basis for the delivery of integrated services, including health, education, delivery of bank loans, birth and death certificates etc. In line with this vision, an initiative was undertaken to establish a citizen specific database through a Multipurpose Household Survey (MPHS). This survey was extremely ambitious at the outset given the 75 million population of the state, and the fact that nearly no systematic identification system existed before. Although this database was created by the state revenue department for its own purposes, the government passed a directive that MPHS should be used as a standard database by all government departments, including Health. This database was then expected to provide the foundation for the Family Health Information Monitoring System (FHIMS), another ambitious attempt by the government to develop a health reporting system based on individual names, rather than numbers aggregated by facilities. The FHIMS project was seen by the health authorities (promoting HISP) to be in direct competition to HISP, and in the following sections we describe first the two initiatives independently, and then the attempts by HISP to integrate them as well as the associated outcomes.

4.1 The Family Health Information Management System (FHIMS)

Around 2001, the Commissioner of Family Welfare (CFW) within the Health and Family Welfare Department planned to embark on an ambitious project to develop a HIS based not on diseases per facilities but on registration by household names. The project started with a pilot at Nalgonda district (Dec 2001-Nov 2002) in 67 PHCs, and a state-wide replication was initiated since June 2003. The development of the FHIMS software was contracted to an IT company located in the state capital, at a cost of about USD 68,500. The requirements included 17 modules (such as family welfare activities, tuberculosis control, leprosy eradication, budget monitoring, personnel information etc). The health department mobilised about USD 7.3 million for the project through a consortium of funding agencies including the World Bank to buy about 1500 computers and install it in every PHC, district office and in the state office, and load them with Oracle (with a license fee of about USD 200 per computer) and Microsoft software.

The idea was that the MPHS data would be loaded in the FHIMS and be used to register data based on names. It was soon realized, however, that the MPHS data was unsuitable due to poor quality, and also because the survey was done by the revenue department, it did not include many health related parameters. In addition, the PHC as the fundamental unit for the state health department did not match with that of the revenue department, which was the village. As a result, many of the health parameters necessary for the health services were not included in the MPHS database and it had to be updated with these data subsequently. When it became clear that the MPHS data could not be used as the base for FHIMS, it was decided by the CFW to redo the entire survey through the health department.

This process was also challenging, as the starting point of the new survey was also the MPHS data, printed from the database and given to the health workers to go to every house, correct the existing data in the MPHS, and also fill in the missing parameters. Many health assistants complained that names of people were missing or inaccurate, ages of family members were wrong or sometimes data on entire habitations were missing. Also, since house numbers in the database were not arranged in an order in many villages, the health assistants had to rely on the names of people to locate their families. Health assistants were expected to do the survey

in addition to their regular work, and at their own cost and time. Also, since the list of names in the printed forms did not match with how people were physically located in the habitations, the health staff found it easier to buy new books (at their cost) and write the names by pen. Because of time constraints, the staff cut many corners to show the survey is complete, for example by simply writing "no" for all diseases.

After the house-to-house survey, the next stage of the project was to enter the data into the FHIMS database, a task outsourced to a private party. Data Processing Operators (DPOs) were thus hired at a salary of about less than USD 100 per month, and they operated as islands with little interaction with the health staff, or attempt to teach them to do the data entry or about the software. Data entry process was hindered by various bugs in the FHIMS software, and an evaluation conducted by HISP in 2005 indicated about 58 bugs which still existed, some not attended even after 3 years and regular complaints been made by the health staff at the PHCs. There were also some incompatibilities between the household survey module and the FHIMS database, and in exporting to the latter, many of the data (for instance, "antenatal women not resident" or "pregnancies leading to abortion") could not be entered into the database. This led to discrepancies when the health assistants found that they could not enter the services data because the elements were not there in the database.

Nearly 2 years over schedule, the household survey data entry was only 50-60% complete and the computers were lying in a state of general non-use, and some of them had already been stolen. The software vendor, because of contractual reasons, has stopped supporting the project, and even the question over the ownership of the software code (the health department or vendor) was unclear. The software developed was extremely rigid and even to introduce a new organizational unit required the vendor's intervention, which was not easily forthcoming. Also, the health department had limited technical competence to be able to handle such software modification issues independently or understand the technicalities involved.

4.2 The HISP initiative

The Health Information Systems Project (HISP) started working in Andhra Pradesh in 2000. Access was enabled through a prior contact of one of the researchers with the Special Secretary, IT to the then Chief Minister. A proposal to pilot the HISP project was developed and accepted, with the southern district of Chittoor being designated as the pilot site.

Initially, despite some scepticism of the health department and FHIMS vendors that the HISP project was very low tech (based on Access platform) and did not supply hardware and funding, we started the situation analysis. This involved understanding the organisational structure and health information flows by visiting various health facilities in the district and interviewing various functionaries and conducting participant observation. A key aim of the situation analysis was to rationalize the data flows and try to develop a Minimum Data Set (MDS), which would include the set of minimum data items that should be collected by the PHCs and SCs (as contrasted with the earlier program based focus). There was a high level of redundancy in the existing datasets; data was collected repeatedly to comply with the different report formats, and data was collected even for programs that had long been wound up (Puri et al. 2004). By September 2001 the existing more than 1200 data elements had been reduced to around 400, and the reports had been restructured and reduced to 10 (Puri et al. 2004).

The Minimum Data Set that emerged after the workshop was taken to the State Government for discussions with the CFW and the demographer. However, we encountered stiff resistance at this level, partly arising from the historical reason that HISP had been initiated through political channels, and not through the health department which is responsible for the operations. The CFW refused formal permission to implement DHIS, as it was said that the department had already committed to FHIMS, and felt that supporting both would confuse the implementation of the latter. After a lot of persuasion, the CFW consented to sanctioning one computer and sent a letter to the DMHO (District Medical and Health Officer) to permit us to

pilot the project in one PHC in Chittoor. We were subsequently informed by the district staff that the CFW had in fact told them not to allow us to make any changes in the report formats, and neither did the sanctioned computer ever arrive.

Subsequently, in the first week of September 2001, we were given the opportunity to make a presentation to the Chief Minister and his senior advisers from the health and IT departments. The CM was appreciative of the aims and approach of the project, and 12 computers were subsequently sanctioned, one each for the 9 PHCs of the Kuppam electoral constituency (of the Chief Minister) and the rest for the DMHO office. In January 2001, these reports were implemented in nine PHCs in Kuppam constituency in Chittoor district.

In September 2002 an official from the CFW visited Kuppam to evaluate our project, and ten days later we were informed the positive news that a Government Order had been sanctioned to extend our project in the Madanapally revenue division that included 46 PHCs. We were invited in October 2003 by the CFW to sign a formal agreement between her office and the University of Oslo, sanctioning USD 35,000 for the purchase of computers, hiring of trainers, and to support some development costs. However, six months after the completion of the Madanapally revenue division project, the CFW was again keen to stop HISP. However, again through persuasion from the political channels, and based on the positive evaluation of our work, we were granted another extension. This time the project scope included the implementation of DHIS in all the 23 district capitals of the state, and in addition to design and implement a system for monitoring maternal and infant deaths, providing implementation support in Nalgonda district to the FHIMS project, and the creation of a web-enabled state level database.

The conflict between FHIMS and HISP played out at various levels in different ways. From the CFW refusing us permission to proceed, to the district FHIMS authorities starting to uninstall the District Health Information System (DHIS) software from some of the computers, and the health workers being told not to use DHIS. As a result, the DHIS despite having developed very useful technical features (such as the integration of the routine data with maps) has remained practically unused and not owned by the state health department. To try and break this deadlock, the HISP team presented to the state a proposal to integrate DHIS software and FHIMS, This proposal was approved in June 2005.

5. ANALYSIS OF POLITICAL INTEGRATION

We will now analyze how HISP get attempted integrated with the existing system. In order to succeed, the integration had to preserve the concerns of both the FHIMS and the DHIS by combining the solutions. The underlying principle of the proposal was that while FHIMS would be used to enter name based data and generate the name-based reports (such as for field health workers to schedule which person needs what service when), DHIS could provide the facility level reporting and analysis, incorporating particular value adding functionalities such as GIS (Geographical Information Systems) and the web. Practically, the name based data is registered in the FHIMS, and the data aggregated at the end of the month by facilities, and converted to a text-file and imported into the DHIS, where facility-based analysis could be conducted. A schematic description of the proposed solution is presented in Figure 1 below.

This integration project, again with some persuasion from the political channels, and the fact that it was seen as relatively non-interfering with the FHIMS project, was approved to be implemented in two districts, in one (Chittoor) the integrated system was to be installed in all the 84 PHCs in the district, and in the other (Nalgonda) the integration was carried out at the district level. It was agreed that at the end of 6 months, both the implementations would be evaluated, and a decision would be taken to replicate one of the models to the other 23 districts in the state. Without going into the details of the project, broadly it was seen as successful because the HISP team were able to firstly, have the FHIMS database up to date in

all the 84 PHCs, and secondly to train the health staff to be able to generate the required reports. After 4 months of the project, nearly 75 of the 84 PHCs were generating the Form B (a key monthly report on Mother and Child health) and the computer generated report was sent to the district office. Such an achievement had not taken place in any of the FHIMS districts. Based on this success, we were asked to provide a fresh state wide proposal for a PHC based model of integration.

However, in the meanwhile, a number of political events had taken place which influenced our fortunes. Firstly, there were the State elections in 2004, and the CM who was a supporter of the project was dramatically voted out of power. With him, a number of his close confidants, including the IT advisor, who was our strong supporter also left for a posting in the World Bank. There was a new Commissioner, who was very conservative in nature believing that "a decision is a decision is a decision", and thus arguing that the original decision to implement FHIMS should be honoured, notwithstanding its serious implementation problems. He was also very anti-technology and told us "how will your computers help to prevent mothers from dying in the PHCs". Subsequently, he categorically asked HISP to leave the state, and quite rudely rebuked us from putting pressure on him from other sources like "a cheap consulting firm." We left Andhra Pradesh, but continued to have good relations with the Secretary Health, who believed in our project. In September 2006, he invited us to implement the project in 2 districts, using EU money, which could be independent of the CFW. However, before we could send in the proposal the next day, he was transferred to the Revenue department. He however, told the new incumbent about the value of our project, and we have been again invited to present a new proposal to the new administration. How this will unfold, only time will tell.
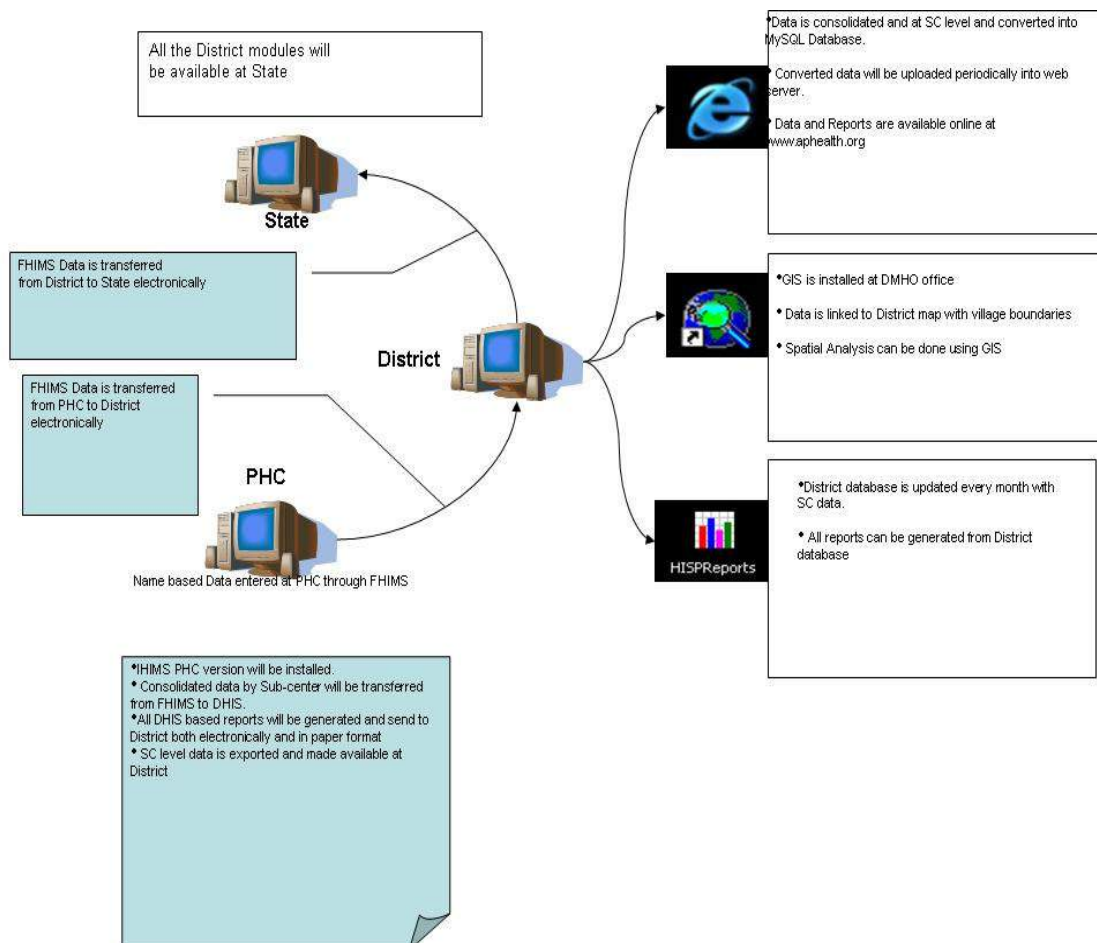
Figure 1: Sketch of the Integrated Health Information Management System (Chittoor)

6. DISCUSSIONS AND CONCLUSIONS

Our stated aim with this paper was to emphasize and appropriate the political dimensions of integration. We have described how the DHIS-FHIMS integration was technically successful, but still encountered problems. FHIMS enjoyed strong political support, partly because of a high level of investments and consequently prestige. Unfortunately this support did not "spill over" and transform into support for the joint working of the two systems. While technically successful, the integration was politically precarious. Politically, the DHIS was seen to undermine the success of the FHIMS application for various reasons. Firstly, it was seen to promote a number based system which the state was trying to abolish as it felt that it contributed to the manipulation of numbers by the health staff. "Numbers are easier to manipulate than names", we were once told by a state official. Secondly, DHIS was seen to be too low tech by the State officials, who argued for the superiority of Oracle over Access. The HISP counter view to these largely political (in the guise of technical) arguments was that our systems can be integrated with others if the need so arises, as was demonstrated in the integration project.

An illustration of strategies for mobilising political support, is the schemas outlined by Latour already in his initial book (1987, p. 120). The strategies include e.g. the detour, i.e. where you have to present the solution not only as your own solution to your own problem, but one which simultaneously solves your competitors' problem (see figure 2).
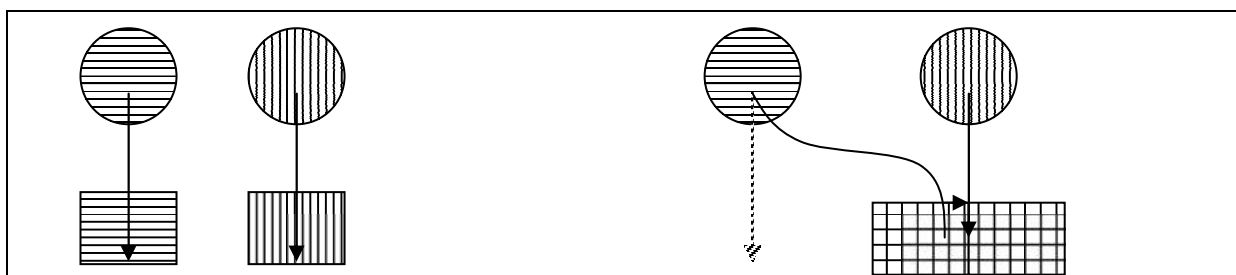
Figure 2. The detour strategy

The solution as initially intended (rectangle with horizontal stripes) by the actor on the left (circle, horizontal stripes), is replaced by combined solution to the right, simultaneously serving the concerns of the two actors (circles).

The HISP approach in Andhra Pradesh can be analysed as a following a "detour strategy" in this sense. The DHIS software was presented not as a standalone, competing system, but as something which together with FHIMS could add value to the overall problems that the health services were facing. A detour strategy implies a reformulation of the solution. In this case we also saw a reformulation of the problem. Initially the focus was on tools to facilitate better conducting of the routine services, but this was gradually changes to also aim at better analysis capabilities and usage of information, or from "automating" to also "informating" (Zuboff, 1988). The integration of FHIMS and DHIS was presented as the solution to this.

However, the attempt to sustain DHIS through integrating it with FHIMS was not successful. From this case study we see that the issue of symmetry comes into play when framing the integration issue. In the FHIMS-DHIS case, we will argue while there was a technological symmetry, politically the situation was one of asymmetry. Technologically, both DHIS and FHIMS had to gain through the technical linking of the systems. FHIMS provided the name based data which was very useful for the field level workers to develop their schedules. And arguably, the name based data was more reliable than number based one, as it could not be so easily manipulated as there was an element of fear amongst the health staff that manipulations (of names) could be traced. DHIS thus gained by getting better quality data as their inputs, which was then aggregated to develop facility based analysis. FHIMS too thus also gained through the integration, as it was weak in providing aggregate analysis, and could not provide

GIS or web based reports that DHIS could. However, politically, there was always an asymmetry as the DHIS-FHIMS battle was akin to David and Goliath, where the entire state machinery (resources and commitment) was behind the FHIMS and DHIS was seen as an outsider which was trying to intrude and needed to be kept at bay. So, even though the technological integration was a success, politically, there was no motivation to keep the link going. On the contrary, the attempt was to break the link as it was seen to undermine the political status of FHIMS. A key implication that then arises from this study is that technical and political symmetry are key components of an integration solution.

Our case study clearly shows that when it comes to integration of health information systems, the challenges are not primarily of a technical nature. As Silva (2002) has noted, politics, especially in the context of developing countries, is often taken to have negative connotations, but this does not necessarily have to be the case. Through the example of Guatemala, he argues how the upcoming political elections created a sense of expediency, which gave a push to the development of a hospital information system, which otherwise would have been in a state of inertia. In our case too, the examples of the involvement of the Special IT advisor to the CM, and the political pressure he could exert on the CFW, was a key to keep HISP going despite the departmental resistance. However, the flip side of this was that this support was transitory, and subject to the larger political conditions such as elections, whose result disrupted the entire HISP support network. Maybe, if the election results were not what they were, the DHIS-FHIMS would have been officially recognized as a success, and the state wide rollout would have taken place..

Integration requires adaptability and flexibility. An analytical implication of this case study is that the DHIS no longer is an artefact in the sense of being stable. It is rather what de Laet and Mol (2000) dubs a 'fluid' object: both the contents and the relationships with the context necessarily keep changing; an object needs to change to be the 'same' as the fluidity of the DHIS illustrates. Another implication is related to the fact that integration is politically laden. When the elements to be integrated come from various sources any alignment has to be painstakingly created and maintained. An integrated system may continue to be precarious with the risk of it easily being toppled. Or it may become more robust and sustainable, if it its political alignment is balanced and made more symmetrical between various actors. Consequently, we argue that a certain degree of flexibility and a minimum level of symmetry may be necessary conditions for integration to succeed.

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GLOSSARY

ANC	Ante Natal Care
CFW	Commissioner of Family Welfare
DMHO	District Medical and Health Officer
DPO	Data Processing Operators
ERP	Enterprise Resource Planning
FHIMS	Family Health Information Monitoring System
GIS	Geographical Information Systems
HIS	Health Information Systems
HISP	Health Information Systems Programme
HIV/AIDS	Human Immunodeficiency Virus/ Acquired Immuno Deficiency Syndrome
IS	Information Systems
IT	Information Technology
PMTCT	Prevention of Mother to Child Treatment
MDS	Minimum Data Set
MIS	Management Information Systems
MPHS	Multipurpose Household Survey
PHC	Primary Health Centres (PHC)
SC	Sub Centers
SOA	Service-Oriented Architectures

EXPLORING THE VALUE OF THE CAPABILITY APPROACH FOR E-DEVELOPMENT

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Abstract: E-development is often pursued with unquestioned assumptions about its contribution to human development. This paper draws upon Amatya Sen's capability approach to provide some theoretical reflections on e-development. It is argued that the capability approach allows us to take into account a variety of important issues surrounding ICT adoption for development. It also proposes the capability approach as a useful conceptual foundation for future research.

EXPLORING THE VALUE OF CAPABILITY APPROACH FOR E-DEVELOPMENT

1.   INTRODUCTION

E-development has been at the centre of political discourses across developed and developing countries, nationally and globally. Both the World Bank (2006) and the United Nation (2005) issued publications on strengthening efforts and creating an enabling environment for the adoption and diffusion of information and communication technology (ICT), further reinforcing the commitment of the international community on ICT for development. However, e-development is often pursued under simplistic assumptions about what and how ICT contributes to the elimination or alleviation of poverty and deprivation. There is also an unquestioned belief that investing in ICT is the path towards social and economic development (Avgerou, 2000). There has been decades of research which examines the experiences and lessons of ICT adoption for development, exploring and analyzing important issues in the field (see Walsham & Sahay, 2006). It is clear that technology does not always, in fact often fails, to serve intended purposes (Avgerou & Walsham, 2000; Heeks, 2002a), and that technological diffusion may not necessary lead to development. Walsham and Sahay (2006) calls for more emphasis in the "meaning of development" and ICT's role in this. This paper constitutes such an effort.

Understanding e-development cannot be complete without understanding development. Exploring existing development approaches is useful to explicate the role of ICT in development. There are a variety of human development approaches. Some address a specific aspect of human development, e.g. human rights, gender, and poverty. Others come with a broader agenda. For instance, participatory development strives to achieve empowerment, sustainability, and higher efficiency of development projects via grassroots participation (Cleaver, 1999). The rather diverse group of literature labeled new social movements (Evers, 1985; Touraine, 1988) also seeks empowerment and solving social problems through bottom-up collective endeavors.

These approaches, among many others, are certainly useful if applied to illuminate aspects of e-development. What is missing, however, is a philosophical and conceptual foundation of e-development. Towards such an end, this paper explores concepts from a philosophical framework of development, the capability approach (CA), developed by Nobel prize laureate, economist Amatya Sen. Unlike many development perspectives that focus on people's happiness or desire-fulfillment, or on theoretical and practical approaches that concentrate on income, expenditures, consumption or basic needs fulfillment, Sen's capability approach is concerned with people's capabilities, that is, what people are effectively able to do and to be. The capability approach has been used in the Human Development Reports (UNDP, 1990-2006) to discuss the "human development perspective". Rather than providing a directly applicable toolkit for development, the essential value of the capability approach lies in its usefulness as a "mode of thinking".

The rest of the paper is organized as follows. Section 2 presents key concepts of the capability approach, and section 3 draws implications by applying the CA perspective on e-development. Section 4 then contrasts the capability approach with existing and potential pitfalls of e-development, and suggests how the capability approach can be adopted as a conceptual basis for our understanding and exploration of e-development issues.

2.   THE CAPABILITY APPROACH

As an introduction to the capability approach, this section draws upon Sen's own publications as well as authors who have applied Sen's ideas in other fields. An essential analytical distinction in the capability approach is that between the means and the ends of well-being and development (Robeyns, 2005). Sen (1999) argues that individual substantive freedom - to lead a life we have reasons to value - is both the primary end objective and the principle means of development. Economic measures are merely the means to this end. Similarly, the pursuit of equality of resources is objectionable for its exclusive focus on means instead of ends (Sen, 1992).

2.1.   Functionings and Capabilities

The major constituents of the capability approach are *functionings* and *capabilities*. Functionings are the "beings and doings" of a person, whereas a person's capability is "the various combinations of functionings that a person can achieve. Capability is thus a set of vectors of functionings, reflecting the person's freedom to lead one type of life or another (Sen, 1992, p. 40)". The two concepts are interrelated and at the same time involve distinctive connotations.

> "A functioning is an achievement, whereas a capability is the ability to achieve. Functionings are, in a sense, more directly related to living conditions, since they are different aspects of living conditions. Capabilities, in contrast, are notions of freedom, in the positive sense: what real opportunities you have regarding the life you may lead (Sen, 1987, p. 36)."

In other words, the former refers to realized achievements and fulfilled expectations, whereas the latter refers to effective possibilities of realizing achievements and fulfilling expectations. What the approach concerns is not only with the functioning levels of people, but also with their capabilities, i.e., the space of freedom to achieve well-being and to lead a valuable life in their own terms. What these capabilities are, Sen intentionally keeps vague. It should be noted that in order to create conditions to develop capabilities, some capabilities will mainly require financial resources and economic production, but for others it also involves institutional settings and political arrangements, social or cultural practices, social structures and norms. Stressing one aspect does not mean negligence of the others (Robeyns, 2000).

2.2.   Means, Freedom, and Achievement

Of particular interest to the social study of ICT is the relationship between commodities (goods and services), functionings, and capabilities. Figure 1, simplified and adapted from Robeyns (2005), provides an illustration of this relationship using the key concepts of the capability approach. Sen argues that goods and services are important only in the light that their characteristics enable people to do and to be, namely, in the light of the capabilities one can generate from these goods and services (Robeyns, 2005).

The extent to which people can generate capabilities from goods and services are influenced by three sets of conversion factors – personal, social, and environmental characteristics (Robeyns, 2005; Sen, 1992). Personal characteristics, such as mental and physical conditions, literacy, and gender, influence the types and degrees of capabilities a person can generate from resources. Social factors are a number of characteristics of social settings, such as social norms (e.g. role of women, rules of behavior, materialism, religion, etc.), social institutions (e.g. rule of law, political rights, public policies), and power structure (e.g. hierarchy, politics). Environmental characteristics, including climate, infrastructure, resources, and public goods, are also important in the conversion from characteristics of the goods to individual functionings.
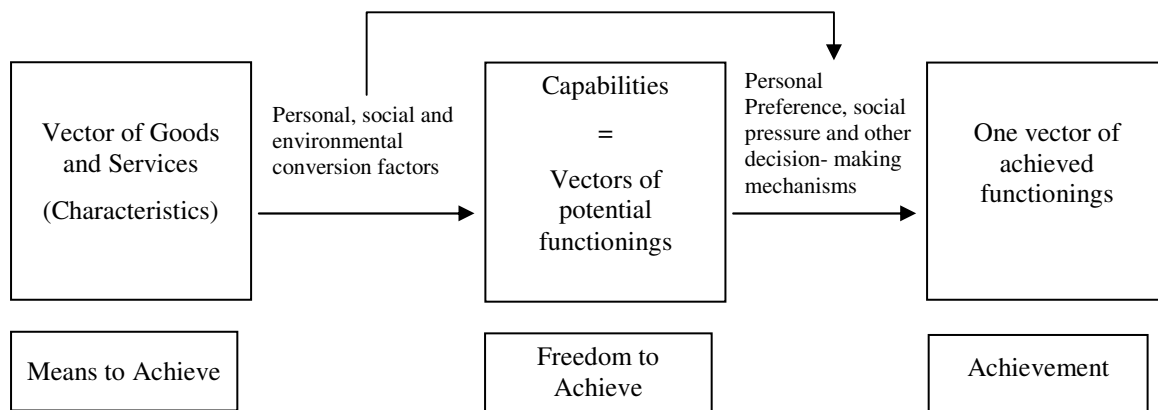
Figure 1 Adapted from a stylized non-dynamic representation of the core aspects of the capability approach (Robeyns, 2005)

Goods and services being the means to achieve (a life that one values), a person's freedom to achieve is defined by the capabilities, namely, potential functionings, that she is endowed with, including what her individual conversion factors allow her to generate from the available goods and services. It should be noted that not all capabilities have to be generated from goods or services. For example, being a respected member of a community only requires the respective behavior of other members rather than any specific goods or services. The actual achievement of functionings is a result of personal choice to select from the capabilities available, subject to personal preferences and other factors of decision-making mechanisms. This is again affected by the personal, social and environmental characteristics, such as personal history and social influences.

However, what is limited in Figure 1 is that it doesn't show the dynamic relationship between commodities and the conversion factors. In other words, the conversion factors are not static; they are constantly changing. The exploitation of commodities, such as technology, certainly contributes to not only social conditions but also personal characteristics which would feedback to the conversion factors and decision making mechanisms. Therefore, commodities are important for their contributions to both individual capabilities and conversion factors.

2.3.   Human Diversity

Human diversity is implicated in both aspects outlined above: the distinction between functionings and capabilities, and the explicit accommodation of personal and socio-environmental factors in the conversion of commodities into functionings. Indeed, one of the strengths of the capability approach is its ability to account for human diversity (Robeyns, 2005). The consideration of interpersonal variations among human beings differentiates the capability approach from other theories in that it explicitly distinguishes different spaces of equality. Equality in one space to lead a valuable life, e.g. income, does not necessarily mean equality in life opportunities to achieve it, e.g. access to quality healthcare. For instance, a computer will have different influence on the lives of a literate person and an illiterate. By the same token, two people with a similar set of functionings may have very different set of capabilities, and vice versa. Two literate, physically and mentally healthy young women in the UK and in Afghanistan may enjoy similar functionings, but they may have very different life chances to lead a life they want, say, to become a medical doctor. In other words, individual variations, as well as structural differences in society, are important factors to be taken into account in evaluating development initiatives.

2.4.   Well-being and Agency

Sen (1985) sees people from two different perspectives, the "well-being aspect" and the "agency aspect". He defines agency as the freedom to set and pursue one's own goals and interests. The

pursuit of one's own well-being may be one of the goals and interests. Other ends may include furthering the well-being of others, respecting social and moral norms, or acting upon personal commitments and the pursuit of a variety of values. A person is thus viewed as an "agent", as opposed to a "patient" whose well-being or the absence of well-being is the only concern (Robeyns, 2000). Most development approaches have concentrated on the well-being aspect, such as income, education, and healthcare. Even in the Human Development Reports which adopt the capability approach as a conceptual framework, the focus has been on the well-being aspect of human development. The agency aspect has been much less appreciated (Fukuda-Parr, 2003).

A person's capability set, which comprises of all the capabilities of a person, represents her freedom to achieve well-being and agency – and this is the dimension which Sen proposes as the informational basis for assessments of inequality, poverty, justice, and development (Robeyns, 2000). By putting agency as an explicit component of a person's capability set, any development policy or evaluation methods that are informed by the CA have to take into account the aspirations and needs of the people affected. Furthermore, taking agency seriously implies taking note of the motivations and constraints under which a person acts. When such elements as aims, objectives, allegiances, obligations, and norms are taken into account, it brings to the front the issue of "adaptive preferences" and "restricted agency" (Peter, 2003). In other words, what a person prefers or considers as valuable is closely linked to the social conditions to which the person is subject. For example, Sen argues that the fact that married women tend to value their contribution to the household as lower than their breadwinner husband is based on general social perceptions of market evaluations of work, and hence the gender contributions to social goods. Such a tendency is further compounded by their already low bargaining power in the family, thus resulting in their resignation to fate (Sen, 1990).

Therefore, the other side of *restricted agency* implies a caution against unconditional acceptance of whatever a person happens to perceive as valuable, or acceptance with as much intensity as valued by the person. As Sen (1984) comments, "the most blatant forms of inequalities and exploitations survive in the world through making allies out of the deprived and the exploited. … As people learn to adjust to the existing horrors by the sheer necessity of uneventful survival, the horrors look less terrible in the metric of utilities."

2.5. Critiques and Limits of the Capability Approach

Sen's ideas have invited certain critiques - some are general skepticism and some on specific aspects of his work. For example, the capability approach, while highly regarded, has been called "an unworkable idea" by some, and accused for being insufficiently specified by others (Robeyns, 2000). In fact, Sen has intended it to be used for a wide range of purposes, therefore the CA has been deliberately left "incomplete", rather than precise and prescriptive as most other development theories are (Robeyns, 2005). Sen has been reluctant, despite criticisms, to prescribe a list of functionings to be taken into account, or an aggregative principle, and for good reason. Such a formularized prescription, and the process of coming up with it, will be questionable given the vastly discrepant circumstances, conventions, and social pressures that people face. Therefore, the application of the capability approach, such as an evaluative exercise, should be carried out on under specific circumstances.

A frequently uttered critique on Sen, and one that is worth mentioning here, is the belief that the capability approach is too individualistic, and pays insufficient attention to groups and social structures (e.g. Corbridge, 2002; Devereux, 2001; Navarro, 2000). Interested readers are invited to refer to Robeyns (2005) for a more systematic review of critiques and defense of Sen. It suffices here to say that Sen explicitly takes into account social environment, societal structures, and culture, firstly by the distinction between functionings and capability, and secondly by recognizing the conversion factors from commodities to functionings (ibid.). Therefore, although one may comment

on the fact that the capability approach is "incomplete", which is intended to be by deliberation, the capability approach has provided an invaluable analytical and philosophical foundation to be built on (Evans, 2002). Nevertheless, Sen himself has pointed out that the approach is not equipped to account for the procedural aspect of freedom and justice, but focuses on the opportunity aspect (Robeyns, 2005).

3.   THE CAPABILITY APPROACH AND E-DEVELOPMENT

Having presented the main concepts from the capability approach, let us look at what implications can be derived to illuminate our understanding of e-development. The term e-development has often been used simplistically without explicit reflection on its meaning. Although there are certainly a number of studies that take a less categorical and more nuanced view (e.g. Avgerou, 2003; Walsham, 2001; Warschauer, 2003), insufficient efforts have been made to conceptualize e-development among decades of empirical studies of ICT for development.

It is proposed here that the capability approach offers a framework of thought to locate technological adoption in the bigger context of development, as means rather than ends. Drèze and Sen (2002) makes a comment on this point:

> "It should be clear that we have tended to judge development by the expansion of substantive human freedoms – not just by economic growth (for example, of the gross national product), or technical progress, or social modernization. This is not to deny, in any way, that advances in the latter fields can be very important, depending on circumstances, as "instruments" for the enhancement of human freedom. But they have to be appraised precisely in that light – in terms of their actual effectiveness in enriching the lives and liberties of people – rather than taking them to be valuable in themselves."

In this light, the capability approach could unveil some existing or potential "pitfalls" in e-development, in terms of assumptions and approaches. Clearly, e-development research is diverse and multidimensional, thus not unified in their assumptions and approaches (Walsham & Sahay, 2006). What is presented in Table 1 as "pitfalls" in the perception of e-development are extreme presentations of certain tendencies and underlying presumptions that are perhaps "poorly thought out" (Heeks, 2002b), traces of which one could perhaps recognize in the discourses of ICT for development. On the other hand, research that is more in line with the CA perspective certainly also exists.

The first pitfall is a latent focus on the well-being aspects of individuals, and a simplistic correlation between ICT acquisition and diffusion and the improvement of people's well-being. The word "capability", under such circumstances, usually refers to people's ability to use ICTs, such as computer skills. In comparison, the capability approach considers "capability" as the *freedom* to achieve *well-being* and *agency*. In other words, it would be concerned with life opportunities and the range of options for people to access and use ICTs to both improve the quality of life and to accomplish their goals. For example, to have access to the Internet does not necessarily mean that the person has the learning ability to benefit from the rich source of information; or that citizens are able to use information to pursue what they consider as important objectives.

A second pitfall is an implicit assumption that ICT is intrinsically good and beneficial for human development, namely, it embodies a set of ultimately desirable functionings that are achievable in developing countries. For example, it is not uncommon that e-development initiatives stop at the level of provision and uptake of digital technology. From a CA perspective, ICT is a type of commodity, or goods and services, thus mainly meaningful in the light of its contribution to the users' capability set. The characteristics of ICT - such as the functionalities for information collection, storage, processing, and dissemination, the facilities for instant communication across

	Pitfalls in e-Development	**Capability Approach Perspective**
Well-being & Capability	▪ Regarding improving well-being as the ends of development, thus focuses on the contribution of ICT to people's well-being. ▪ Only concerned with people's "capabilities" to adopt ICT.	▪ Considers substantive individual freedom as the ends of development. ▪ Essentially concerned with ICT's contributions to people's capabilities to achieve a valuable life. ▪ Concerned with effective opportunities for people to exploit ICT.
Goods and Services	▪ Considering ICT as embodying a set of ultimately desirable functionings that are achievable in developing countries.	▪ Views ICT as meaningful only in terms of relevant capabilities that can be generated from it. ▪ Questions what conversion factors are in place to generate potentials to achieve, and to allow people the freedom of choice to realize the achievement.
Human Diversity	▪ Tendency to apply universal criteria on using ICT as developmental instruments.	▪ Attention to diversity of and discrepancies in human conditions. ▪ Questions which space of equality does e-development address.
Situated Agency	▪ Only focusing on the well-being aspect of people. ▪ Regarding people as passive receivers of innovations. ▪ Viewing social arrangements and cultural values as the contexts of ICT adoptions.	▪ Concerned with not just have and have-nots, but can and can-nots. ▪ Emphasizes the agency of ICT users, therefore taking into account their aspirations and needs. ▪ Accommodates and critically evaluates the design of social arrangements and cultural values in relation to individual capabilities.

Table 1. The CA Perspective Against Pitfalls in e-Development

time and space, and the potentials for knowledge generation and diffusion - provide the "means to achieve" (desirable functionings), which can be converted into the capability set of the user.

A third pitfall in e-development is the unquestioning pursuit of ICT diffusion across contexts, and a tendency to apply universal criteria on using ICT as developmental instruments. Such tendency is particularly reflected in certain quantitative studies. A CA perception of ICT stresses human diversity, namely, interpersonal variations in conversion factors and decision-making mechanisms in e-development. For instance, a person living in an environment with a generally higher level of information literacy or information openness has a much wider set of capabilities to exploit information for the advancement of his or her goals in life. Interestingly, the achieved functionings are less of a concern to us, because it is (ideally) the result of an individual's personal choice according to his or her value system, as long as the person makes that decision with a free will. For example, some people may choose to live a largely ICT-free life because they prefer natural and face-to-face communication over digitized communication. Some people may avoid it simply for health reasons. Such choices should be well respected as long as people are given the options to do otherwise.

Finally, whereas a participative approach has been proposed in ICT for development (e.g. Puri & Sahay, 2003), there is a danger in e-development initiatives to perceive potential users as passive receivers of innovations, due to the fact that many technologies are transferred to the third world from contexts of more advanced economies. Even local e-government projects or e-health initiatives are often implemented without the consultation and involvement of citizens or healthcare workers. The capability approach emphasizes the agency of ICT users, and therefore taking into account the needs and aspirations of the people whose interests are affected by the innovations. This has two implications. First, it signifies the need for public discussions, participation, and social inclusion in the process of ICT adoption and diffusion. Further, the impact of ICT adoption is not to be evaluated merely in terms of the number of adopters, or how well it matches the intentions of the designers, or the economic benefit it generates. Rather, it should be evaluated in terms of the extent to which it meets the needs and expectations of the users. (See evaluation of e-governance in Madon, 2004).

On the other hand, social conditions and cultural values may be perceived as merely contexts of ICT adoption, or sometimes as barriers (Walsham, 2001). In contrast, the stress on agency from the capability approach creates the possibility to not only accommodate, but also to critically evaluate the design of social arrangement and the impositions of cultural values. Therefore, from the perspective of the CA, potential contradictions and tensions entailed by ICT adoption are not only to be recognized, but also possibly to be questioned and evaluated.

4.   TOWARDS A RESEARCH AGENDA

To recap, I have introduced key concepts of the capability approach and generate implications for applying the CA perspective on e-development. Many issues unveiled by applying the capability approach are not new to e-development research. But the capability approach entails a critique on the utilitarian assumptions of development. It is also able to surface a set of key concerns, systematically and coherently, on an explicit philosophical foundation. Table 1 has shown that the capability approach provides a conceptual basis upon which critical issues and embedded relationships are sensitized for investigation, thus directions and objectives of research can be guided and formulated, and theoretical perspectives can be selected to further explore those areas of enquiry. Table 2 in this section goes on to give selective examples of relevant theoretical perspectives in e-development which could be complementary to the capability approach. Finally, I suggest how the approach could guide our future research in e-development in Table 3.

Sen's ideas have been directly applied in information systems research. For example, Madon (2004) uses it as an evaluative framework for an e-governance initiative. Table 2 suggests that the capability approach, as a conceptual basis, could accommodate other theoretical perspectives in e-development. For example, although few research has taken up the perspective of the CA, some have shared the concern with the rationalities of development lying behind the discourses of e-development. Avgerou (2002; 2003) points out that ICT has become an institutional actor in developing countries, supported by the power alliance of the institution of "development". Thompson (2004) shows that the appropriation and discursive deployment of ICT has been associated with the mainstream discourse of progress and rationality, and has been used to further interests of "technocratic" and "mainstream" stakeholders.

In terms of effective opportunities for people to exploit ICT, issues of social inclusion (Trauth *et al.*, 2006; Warschauer, 2003) have been taken up, moving beyond the provision of technology and the resource-based view of digital divide. Reflecting on the role of ICT in development, Heeks (2002b) proposes that rather than focusing on e-development, we should be discussing *i-development*: "information-centered, integral to its environment, integrated with development objectives, intermediated, interconnected, and indigenized." Zheng (2005) argues that it is important to cultivate an information culture where people are able to effectively take advantage of information for meaningful purposes.

Cross-cultural studies (e.g. Walsham, 2002; Westrup et al., 2002) have given accounts to *human diversity* in the contexts in e-development. This group of research has highlighted the significance of national and organizational differences in the processes of ICT adoption, such as historical background and traditional norms. Research of specific cultures, such as the oral culture, (e.g. Metcalfe & Joham, 2003, Zheng, 2007) also provides examples of how unique local conditions encounter of a globalizing culture of information. A considerable proportion of research in e-development is concerned with the process of adopting and implementing ICT in various local contexts, and examines factors at play. Elements such as institutional structure and power processes (Silva & Backhouse, 2003), type of governance (Ciborra & Navarra, 2005), and information infrastructure (Rolland & Monteiro, 2002) are examples of social and environmental conversion

Capability Approach	Examples of Relevant Theoretical Perspectives
▪ Concerned with rationalities of development	▪ Escobar (e.g. Silva and Figueroa, 2002) ▪ Discourse analysis (e.g. Thompson 2004) ▪ Institutional theory (e.g. Avgerou, 2002, 2003) ▪ Neo-colonialism (Adam & Myers, 2003)
▪ Concerned with effective opportunities for people to exploit ICT.	▪ Digital divide (e.g. Norris, 2001; Van Dijk and Hacker, 2003) ▪ Social inclusion (e.g. Warschauer 2003, Trauth *et al.*, 2006)
▪ Views ICT as meaningful only in terms of relevant capabilities that can be generated from it.	▪ i-development (Heeks, 2002b) ▪ Information culture (e.g. Zheng, 2005)
▪ Attention to diversity of and discrepancies in human conditions.	▪ Cross-cultural issues (e.g. Walsham, 2002; Westrup et al., 2002; Gregory *et al.*, 2002) ▪ Oral culture (e.g. Metcalfe & Joham, 2003, Zheng, 2007)
▪ Questions what conversion factors are in place to generate potentials to achieve, and to allow people the freedom of choice to realize the achievement.	▪ Power (e.g. Silva & Backhouse, 2003) ▪ Governance (Ciborra & Navarra, 2005) ▪ Information infrastructure (e.g. Rolland & Monteiro, 2002)
▪ Emphasizes the agency of ICT users, therefore taking into account their aspirations and needs.	▪ Participative approach (e.g. Puri & Sahay 2003) ▪ Local adaptation (e.g. D'Mello, 2003) ▪ Improvisation (e.g. Heeks, 2002a)

Table 2 Examples of CA Accommodated Theoretical Perspectives

factors.

An essential emphasis on *situated agency* from the perspective of the capability approach also indicates the need of user participation and creative adaptation of technology on the one hand (e.g. Puri & Sahay, 2003; Heeks, 2002a), and on the other, to actively reflect, or even to challenge deep-seated power structure and rationalities (e.g. Thompson, 2004). Again, such efforts have been made in the ICT for development literature, although very uncommon.

The above are but a few examples of theoretical perspectives and approaches that can be used compatibly with the CA perspective of e-development (See Walsham & Sahay, 2006 for a more thorough review of theoretical perspectives). It should be noted that not all of these theories share the philosophical outlook of the capability approach. Yet they can be used to address aspects of what the approach is concerned with. This indicates that research can contribute to an agenda informed by the capability approach without actually committed to the normative stance that comes with it. Nevertheless, efforts are needed to further explore what and how other theories can supplement the capability approach to address the complexity of e-development. For example, the capability approach offers little about understanding details of technology and their relationship with social processes, while the information systems field has accumulated rich stocks of knowledge in these areas.

Finally, Table 3 provides a fuller set of research questions formulated from the perspective of the capability approach to investigate e-development initiatives. They serve only as preliminary and exploratory suggestions. What is particularly lacking in the literature, apart from more explicit reflections on the "meaning of development" (Walsham & Sahay, 2006), is research that explicitly identifies the *agency aspect* of local people, both *individual* and *collective agency*, examining whether or how ICT increases real opportunities for their active participation in the society, and facilitates their pursuit of life objectives that they have reasons to value. For example, while the Internet provides the platform for communication, it takes enforcement of legal measures to guarantee freedom of speech for people to engage in public debate, or to exercise citizens' rights of monitoring the government.

5.   CONCLUSION

Taking stock of e-development requires serious consideration on what kind of development ICT is supposed to serve, and how technological progress serves the ultimate and general purpose of human development. Taking a simplistic view that ICT diffusion automatically alleviates poverty and deprivation risks a possibly misguided devotion of resources and development strategy. This paper argues that the capability approach provides a conceptual lens which helps us avoid some of the pitfalls in e-development, such as too narrow a focus on ICT in relation to economic progress and technological utilities. In contrast, a CA perspective of e-development is able to embed ICT in the pursuit of "development as freedom", which is to achieve greater capabilities of individuals to lead a life as they value. Due to space limit, the discussions of the approach and e-development may not be as in-depth and comprehensive as what would be desirable. It is also not possible to include the analysis of an empirical study. For those who are interested, interdisciplinary applications of the capability approach are well exemplified by those in the feminist studies (Fukuda-Parr, 2003; Peter, 2003; Robeyns, 2003). This paper is also limited by not taking into account important research issues like methodologies and level of analysis in the application of the capability approach, which should be addressed in following-up papers. However, this paper constitutes an initial attempt to introduce the capability approach as a conceptual basis for e-development, and points out directions for future research.

Acknowledgements

Capability Approach	Research questions in e-Development
Functionings & Capabilities	- What are the ends and means of e-development?
	- How does ICT enable people to do which help them to achieve what they consider to be a valuable life?
Conversion Factors	- What capabilities can potentially be generated from a certain type of ICT?
	- Are they appropriate for local conditions at this stage?
	- What conversion factors (personal, social, environmental) need to be in place for capabilities to be generated from a certain type of ICT?
	- What decision mechanism affect the actual adoption of a certain type of ICT, or the selection of certain characteristics of a type of ICT over other characteristics?
	- How does ICT interact with these decision mechanisms (and their changes)?
Human Diversity	- Which space of equality or development are we trying to promote?
	- How do local conditions enable or constrain the implementation of an e-development initiative?
Situated Agency	- What are the needs and aspirations of the potential ICT adopters?
	- What are the rationales behind those needs and aspirations?
	- What conditions enable or restrict the "agency" of the ICT adopters?
	- How does ICT interact with these conditions?

Table 3. e-Development Research Questions Generated from the CA

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THE VALUE OF EXTENDED NETWORKS: INFORMATION AND COMMUNICATION TECHNOLOGY INTERVENTION IN RURAL PERU

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Abstract: This interpretive case study discusses the implications of the information and communication technology (ICT) intervention in a remote village located in the northern Peruvian Andes. An integrated perspective, bringing together the ICT and social capital theories, provides a sensitising framework for this exploratory research. Using grounded theory method for the analysis of the stories of two villagers, the paper illustrates how the ICT intervention enabled a few people to gain or reinforce ascendancy in their village. The paper then discusses implications from the actual and potential consequences of ICT intervention in rural areas in developing countries.

Keywords: Information and communication technology intervention, social capital, rural areas, developing countries.

THE VALUE OF EXTENDED NETWORKS: INFORMATION AND COMMUNICATION TECHNOLOGY INTERVENTION IN RURAL PERU

1. INTRODUCTION

The potential benefits of using ICT networks have attracted the attention of both academicians and practitioners as a useful way to overcome everlasting problems affecting less favoured regions in the world. Walsham (2001) stresses the relevance of ICT since it "can be regarded as a political actant in the production and reproduction of knowledge, truth and power" (op. cit., p. 59) and concludes that "no society can afford to ignore these technologies at this time in history" (op. cit., p. 203). However, evidence linking access to ICT and social development is increasing, but largely anecdotal (Bhatnagar, 2003).

This research is designed to discover, through the lens of social capital theory, the consequences of using ICT in a remote Peruvian village. We try to answer the question: How does ICT influence social relations among villagers in a developing country?

2. ICT AND SOCIAL CAPITAL

In this section we present a summary of the established literature relevant to this study. Figure 1 represents our preliminary theoretical framework, which takes previous knowledge into account and provides the guide for the fieldwork (Eisenhardt, 1989; Walsham, 1995b). By no means, does it constitute a definite model. It is a "sensitising device" (Klein & Myers, 1999) that represents the assumptions that guide this research and assisted us during the data collection process. The preliminary theoretical framework should not suppress new issues arising from fieldwork evidence (Miles & Huberman, 1994; Urquhart, 2001; Walsham, 1995b).
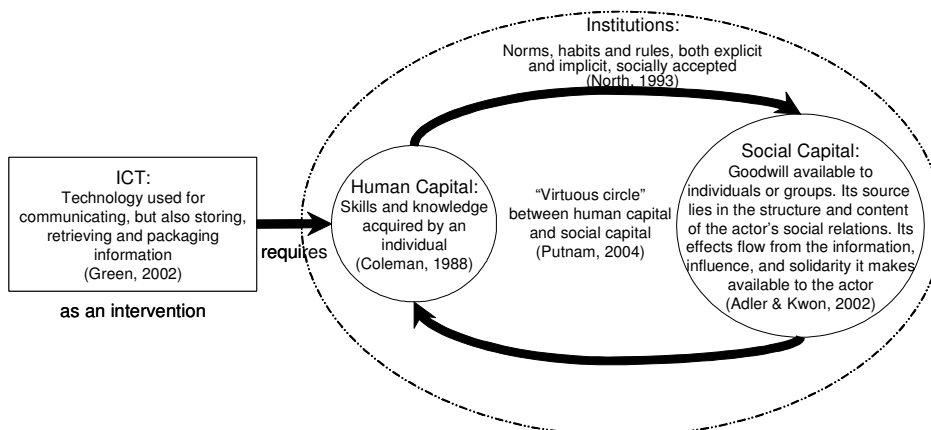

Figure 1: Preliminary theoretical framework

2.1. ICT and ICT intervention

In general, ICT is "the technology used for communicating, but also storing, retrieving and packaging information" (Green, 2002, p. xv); in particular, the technology that we are talking about is computers. An information system consists of not just the technology (hardware, software, data, networks) and/or the social setting (people, business processes, politics, economics, psychology, culture) but also the rich phenomena that emerge from the interactions between the two (A. Lee, 1999).

Technological intervention takes place when new ICT is inserted into a collective social space. Thus, the ICT intervention should be analysed through an examination of the interaction between technological innovation and social conditions (Avgerou, Ciborra, & Land, 2004).

2.2.   Human capital and social capital: micro-level and macro-level

An ICT intervention requires fertile conditions to be effective. They are represented by the notion of absorptive capacity – the individuals' ability to identify, incorporate and utilise new information, based on previous knowledge (Cohen & Levinthal, 1990). Absorptive capacity is embedded and underlies the concept of human capital – "the skills and knowledge acquired by an individual" (Coleman, 1988, p. 100). Human capital represents the micro-level perspective.

Achieving a successful technological intervention is not just a matter of access to computers, but people with the essential skills for interpreting contents are required (J.-W. Lee, 2001; Wade, 2004). However, individuals' abilities are not enough if they are not participating in a community. We need social structures, which represent the macro-level perspective, in order to exploit the technological potential (Avgerou, 1998; Main, 2001). Cornford (2003) states that social capital becomes the crucial determinant of the capacity of societies to utilise ICT.

Since Bourdieu's (1983) definition of social capital as "made up of social obligations", the concept has been evolving. It refers to norms of trust and reciprocity existing in networks (Putnam, Leonardi, & Nonetti, 1993). Adler and Kwon (2002) define social capital as "the goodwill available to individuals or groups. Its source lies in the structure and content of the actor's social relations. Its effects flow from the information, influence, and solidarity it makes available to the actor" (op. cit., p. 23).

We adopt this definition because it entails both internal (bonding) ties – the structure of relations among actors within a group – and external (bridging) ties – the relations an actor maintains with other actors. Coleman (1988) proposes that social capital fosters individuals' human capital, and Putnam (2004) declares the existence of a virtuous circle between both human and social capital. Yet social capital has its "dark side" (Field, 2003), where strong networks can be used for negative purposes such as drug cartels and corrupt practices. The World Bank's enthusiastic promotion of social capital has also been criticised (Schuurman, 2003) as a vehicle for promoting neo-liberal values and ignoring those communities that do not have the 'right kind' of social capital.

Huysman (2004) builds on Nahapiet's and Ghoshal's (1998) dimensions of social capital – structural, cognitive, and relational embeddedness – and Adler's and Kwon's (2002) sources of social capital – opportunity, ability and motivation to propose three domains of social capital. 1) Structural opportunity, 'who' transacts and 'how' social capital is transacted; 2) Cognitive ability, 'what' resources of social capital are transacted; and 3) Relation-based motivation, 'why' and 'when' the transaction takes place. These domains and components are shown in Table 1.

Social capital domains	Components of the transaction
Structural opportunity to share	'Who' and 'how'
Cognitive ability to share	'What'
Relation-based motivation to share	'Why' and 'when'

Table 1: Social capital domains (Huysman, 2004)

2.3. Institutions

The aforementioned transactions do not take place in a vacuum. They are performed within established frameworks socially accepted and instantiated by norms, habits, and rules both explicit and implicit (North, 1990). A social constructivist approach supports the thesis that technology's consequence is ultimately a matter of interpretation by human actors according to their social circumstances (Madon, 2003).

"Our opportunities and prospects depend crucially on what institutions exist and how they function", declares Sen (1999, p. 142). Analysing the consequences of any ICT intervention ought to include a portrayal of the particular context because "without an institutional lens, information technology research might focus more narrowly on technological designs, economic imperatives, or psychological impacts, thus missing important social, cultural, and political aspects" (Orlikowski & Barley, 2001, p. 154).

3. BACKGROUND OF THE ICT INTERVENTION

Given the nature of this research, there is a need for a rich description of the context where the ICT intervention took place (Avgerou & Walsham, 2000; Klein & Myers, 1999), and this section provides that description.

It began with the conception of the *Infodes Project* by Intermediate Technology Development Group (ITDG) a British NGO. In 2001 the *Infodes Project* provided library services through local information centres, 'infocentros', in six villages (Guillén Marroquín, 2004). Because they lacked Internet and even telephone services, ITDG deployed two additional projects: a broadcasting station for the region (Villafuerte Quiroga, 2003) and a rural telephony pilot project (Guillén Marroquín, 2004).

The particular ICT intervention discussed in this paper was initiated by the Rural-Urban Information System Project (Sistema de Información Rural-Urbano – SIRU) in the village of Chanta Alta in the Cajamarca region, in 2003. It was funded by a number of European NGOs, including ITDG, and seeks to "provide timely and useful information to local farmers, businessmen and government agencies to build up capabilities for local development" (our translation, Pereyra Romo, 2002, p. 5). An information system was implemented connecting the infocentros and the Coordination Information Centre in Cajamarca City, the chief city of the region, by satellite communications. Infocentros services include Internet access, phone calls and messaging, computer training courses and local broadcasting programmes.

3.1. ICT in Peru and rural Cajamarca

Since the mid 90's, the swift pace of ICT adoption in the Peruvian cities is chiefly explained by the burgeoning number of cabinas públicas[1] run on a profit-seeking basis by small entrepreneurs (Holmes, 2001). Rural towns, however, neither provide the market potential nor enjoy the infrastructure that the cities do. Almost 7.5 million, out of the over 27 million Peruvians, live in rural areas[2] (INEI, 2006). Nearly 80% of Peruvian rural inhabitants are below the line of poverty, while more than 50% of them live in extreme poverty (INEI, 2006).

Among all the Peruvian regions, Cajamarca encompasses the largest rural proportion: 75.3% of the cajamarquinos live in the countryside (INEI, 2005). Cajamarca region is one of the largest producers of dairy products and also contains Minera Yanacocha, one of the world's top five gold mines (Newmont, 2006). Paradoxically, Cajamarca lacks adequate

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[1] As the Internet cafés are known in Peru.
[2] Rural areas are those with 100 or less contiguous dwellings or having more than 100, these ones are dispersed (INEI, 1999).

roads infrastructure, only 36.3% of its population enjoys electricity (Reyes, 2005), ranks 21st among the 24 Peruvian regions on human development index, and its population is regarded among the five poorest in the nation (PNUD, 2002).

3.2. Chanta Alta

Chanta Alta (3,800 metres above sea level) is a 2.5-hour drive from (68 kilometres north of) Cajamarca City. It has 539 inhabitants (MAQS, 2005), largely devoted to subsistence farming and stockbreeding. Its Saturday open-air market, where individuals trade and barter their products, attracts not only people from the nearby hamlets, but also traders from Cajamarca City. Chanta Alta lacks electricity, and the only telephone available is a satellite one at the infocentro; drinking water is provided with major restrictions and public sewage was made available in February 2005.

An identifiable informal association in Chanta Alta is the Peasant Organisation. Beyond its mission to combat cattle rustling, it provides strong social glue that unites the villagers around common goals, while creating strong links of reciprocity. Within the organisation, villagers organise the voluntary and unpaid communal work, which is a long established tradition. A handful of non-governmental organisations are present in the village. Two large private companies have major influence: a Nestlé Corporation subsidiary, which collects milk from local producers, and Minera Yanacocha, the gold mine corporation. The latter engenders mixed feelings in the village population; one folk muttered bitterly, "We cannot make them go out; so, they have to contribute to us because they extract our resources".

4. METHODOLOGY

This study is located on the "analytical borderlands" (Sassen, 2004), where cultural values and specific practices define the way of using computers. Our ontological assumption is that social reality is locally and specifically constructed (Guba & Lincoln, 1994) "by humans through their action and interaction" (Orlikowski & Baroudi, 1991, p. 14). Our epistemological assumption is that "findings are literally created as the investigation proceeds" (Guba & Lincoln, 1994, p. 111). Thus, an interpretive perspective was brought into play, where the researcher becomes the vehicle by which the reality is revealed (Cavana, Delahaye, & Sekaran, 2001; Guba & Lincoln, 1994; Neuman, 1997; Walsham, 1995a, 1995b). On pursuing this, we applied the case study research methodology (Yin, 2003) from an interpretive perspective (Walsham, 1995a, 1995b) to get a deep understanding of the anticipated consequences of the ICT intervention.

4.1. Data collection

The data collection process aimed to obtain information that shed light on the phenomenon's hidden dimensions. One of the authors was directly involved in the data collection process between 4th and 13th September 2005, as part of a four-and-half month stint in the field. This allowed the first author to live with the participants and to some extent enter their world, which confers an ethnographic approach to this study. A self-imposed condition for the fieldwork was to be flexible (Eisenhardt, 1989; Trauth, 1997; Yin, 2003) and adaptive (Yin, 2003). Sometimes, the current conditions took control of the data collection process. Sampling, which proved to be a major challenge in rural and remote Peru, was designed towards theory construction (Charmaz, 2006). Both enthusiastic users of and strong opponents to the infocentro were sought; none of the latter could be identified.

We used multiple sources of evidence, which were recorded, organised and analysed to corroborate our findings (Creswell, 1998; Yin, 2003). Focused in-depth interviews, field

notes and photographs were our primary sources. The interviews, conducted in Spanish and audio-taped, were key elements to uncover participants' understandings, experiences, feelings and motivations (Collis & Hussey, 2003; Tacchi, Slater, & Hearn, 2003; Walsham, 1995b; Yin, 2003) when using computers. Nearly 40 hand-written pages of field notes contain not only factual accounts but also researcher's interpretations of the observed phenomenon. We reviewed secondary sources too: ICT media content and documentary material.

4.2. Data analysis

Since the output of this research is to explain how social relations are affected in the presence of ICT based on data directly obtained from the fieldwork, we followed grounded theory technique as the method of analysis. That is "the discovery of theory from data" (Glaser & Strauss, 1967, p. 1) by coding textual data. Once again, the preliminary theoretical framework, depicted in Figure 1, helped avoid getting overloaded with data, but it may be revised and modified according to the actual facts observed during the fieldwork and should not be regarded as a rigid set of premises (Miles & Huberman, 1994; Walsham, 1995b).

We assigned labels to the units of meaning according to the codification procedure, which was assisted by NVivo® software, starting with initial codes (Charmaz, 2006). When naming them, we privileged in vivo words – "the terms used by actors" (Strauss, 1987; p. 33) – over sociological constructs, in order to hold firmly to what the data were saying (Glaser, 1992). We always kept in mind not to develop too many substantive codes that might dilute the core categories analysis (Glaser, 1992).

Then, we moved towards focused codes, those with higher inference power, to differentiate and combine the gathered data (Charmaz, 2006). Since we allowed "the data [to] speak to us… rather than imposing preconceived categories" (Urquhart, 2001, p. 129), we adopted the Glaserian version of grounded theory as opposed to the Straussian one[3].

Through an iterative process, we discovered our emergent categories, the conceptual elements that explain the process under study (Charmaz, 2006; Glaser, 1992). They emerged from the application of the concept-indicator model (Glaser, 1978), contrasting pieces of data against other pieces of data through a "constant comparison" (Charmaz, 2006; Glaser, 1978, 1992; Glaser & Strauss, 1967; Strauss, 1987). We often had to compare, again, raw data to the new categories since some category boundaries are fuzzy. We also wrote analytic memos to build theoretical ideas around the identified codes (Charmaz, 2006; Dey, 1999; Glaser, 1978, 1992; Strauss, 1987; Strauss & Corbin, 1990; Urquhart, 2001).

Finally, from the categories, a major theme explaining the phenomenon emerged. Figure 2 represents the inductive thinking path.

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[3] Kendall (1999) presents a detailed discussion on the divergence between the authors of grounded theory.
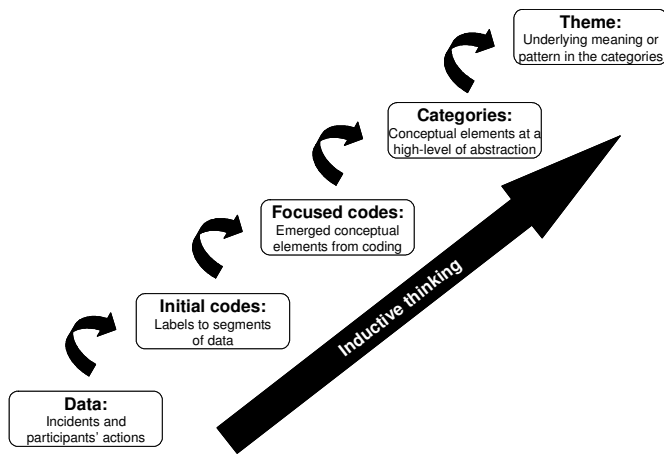
Figure 2: Inductive thinking path (adapted from Glaser (1992) and Charmaz (2006))

Strauss (1987) stresses that one of the requirements of grounded theory analysis is to engage the emergent theory with current theories. In this paper, one of the emergent themes of the grounded theory – ICT as a vehicle for ascendancy – is then viewed through the lens of social capital theory – one aspect of the sensitising framework.

5. THE FINDINGS

This paper examines two personal accounts about using computers. Arturo[4] (28), the infocentro manager, and Alejandro (33), a farmer, who raises cattle, runs a small dairy shop and looks after other people's livestock as part of his duties as a local livestock technician. In the following sub-sections we present a synopsis of the chain of evidence along the bottom-up inductive thinking process that led to the discovery of the two emergent categories as shown in Table 2 and Table 3.

Category	Focused codes	Initial codes
Individual capacities	Value of education	*Family expectations, seeing long-term benefit, comparing quality of education, demonstrating commitment, not seeing long-term benefit*
	Reading habits	*School demands, general interest, specialised interest, indifference towards reading, functional illiteracy*
	Learning computers	*Manifesting eagerness, formal setting, informal setting, implying the existence of other priorities, excitement on the novelty*

Table 2: Construction of Individual capacities category

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[4] Participants' names are disguised.

Category	Focused codes	Initial codes
Individuals' attitudes	Recognisable characters	*Being famous, increasing recognition for computer abilities, being respected*
	Community leadership	*Organising activities, guiding role, representing fellow countrymen, setting goals*
	Urban exposure	*Personal purposes, acting as a delegate, professional purposes, business purposes*
	Degree of initiative	*Bringing initiatives, looking for better opportunities, can-do-attitude*
	Accepting modernity	*Not perceiving the benefits, daring to try with new ideas, acting as change agents*

Table 3: Construction of Individuals' attitudes category

5.1. From data to focused codes through initial codes

We start by presenting the data, i.e. participants' quotations, and the discovered initial codes, which are distinctively marked in italics. Retrospectively, we present the focused codes, constructed from the initial codes, as the headings of the next sub-sections.

5.1.1. Value of education

We need to comprehend people's expectations and interests in the process of knowledge acquisition to understand more about the social consequences of the technological intervention. For example, it is not an unusual situation in Chanta Alta and its surrounding hamlets that school students walk long distances, normally more than one hour, to attend classes (*demonstrating commitment*).

However, villagers recognise their disadvantage when they talk about education opportunities. Indeed, Arturo and Alejandro completed high school in Cajamarca City (*comparing quality of education*, *family expectations*). Alejandro moans, "Education became worse because teachers do whatever they want… they come to classes whenever they want and nobody cares" (*comparing quality of education*).

Alejandro declares, "Education is essential for development" (*seeing long-term benefit*). However, we observed a high rate of drop-out at the school; not a few villagers prefer their children working at their land instead of spending their time at school (*not-seeing long-term benefit*). And girls seem to drop-out more readily than boys (*not-seeing long-term benefit*).

5.1.2. Reading habits

Another emerging aspect was people's inclination, or not, for reading. In a village where there is no public library, newspapers are not available at all and the few books at the infocentro are untouched and dust-covered (*indifference towards reading*), Alejandro's eagerness in reading information about stockbreeding is remarkable. He periodically receives information about animal research from a website he has subscribed to (*specialised interest*). In addition, he seizes the opportunity to read newspapers on his weekly travels to Cajamarca City (*general interest*). Students only read for completing assignments (*school demands*).

Many women hardly read and write. For instance, the lady managing the local restaurant barely writes her name and is not able to prepare a receipt (*functional illiteracy*). When a movie was screened – using solar panel energy – most of the female spectators could hardly make sense of the quick-running sub-titles scripts (*functional illiteracy*). In general, women are devoted to chores (see Figure 3).

Figure 3: Chanta Alta woman weaving on a traditional loom

5.1.3. Learning computers

The previous findings lead us to explore the process of learning computers. Alejandro asked a forestry researcher to teach him how to use computers (*informal setting*); he learned in Cajamarca City even before the infocentro was launched (*manifesting eagerness*). Later on, he encouraged his livestock technician colleagues to ask ITDG for a training workshop (*manifesting eagerness*). He asserts, "We all three were trained in computers and Internet" (*formal setting*).

Arturo recalls, "I thought it was too late for me, that I would never be able to use a computer [...] I could use neither the mouse nor the keyboard". When he was appointed as infocentro manager, he received training and overcame this deficiency (*manifesting eagerness*, *formal setting*). Afterwards, he offered basic computer training to the villagers (*formal setting*), "They liked computers very much. They never had access to one… they looked very happy… they learnt, they went a step further" (*excitement on the novelty*).

Nevertheless, Arturo admits, "The most important thing for them was to use the computer at a basic level" (*implying the existence of other priorities*). Probably, learning computers was an attractive experience, but it was beyond their real interests. Alejandro concurs that only a few people are able to use computers and adds, "I think I am the most interested among my colleagues in learning computers and the one who uses it the most" (*implying the existence of other priorities*).

5.1.4. Recognisable characters

It was easy to find the most renowned persons in the village; people spontaneously coincide in mentioning a few names. Arturo makes explicit his satisfaction in his recognition, "I am very famous; not only in Chanta Alta but also in the surrounding hamlets" (*being famous*). He proudly affirms, "People have always had high respect for me" (*being respected*).

Alejandro acknowledges that his involvement in planning for running a small farming business in 2001 prompted his subsequent nomination as a livestock technician promoter.

He recalls, "When ITDG had to decide for someone to be trained, that person should be acknowledged by the community with a relative degree of recognition and acceptance" (*being respected*).

But that is not the complete story. Alejandro says that he brings to the villagers the information he obtains from computers (*increasing reputation for computer abilities*). Arturo's role as infocentro manager makes apparent this benefit, "I enjoy being recognised as the infocentro manager… I want to learn more how to interact with people because it helped me to increase my contacts; it made me even more famous…" (*increasing reputation for computer abilities*). He reflects on new attractive opportunities, "Thanks to the infocentro I could meet other people and high-profile persons" (*increasing reputation for computer abilities*).

5.1.5. Community leadership

The fact that the non-governmental organisations working in the zone avoid appointing anyone as a representative without villagers' approval constitutes an unambiguous indication of the community's ability to recognise its leaders. Alejandro was elected president of the school's parents' association (*representing fellow countrymen and women*). Once in charge, he "exerted pressure on Minera Yanacocha to build four classrooms" (*setting goals*). He recalls, "We had a meeting, where I raised the scheme for each parent to work for four days" (*organising activities*). He concludes, "Everybody agreed" (*guiding role*).

During the interview, Alejandro illustrates other instances of his leadership in Chanta Alta; i.e. "I encourage my colleagues to visit a specific website" (*guiding role*). Although not so remarkable as Alejandro's, Arturo shows some leadership traits. He is proud of his contribution in reorganising the Peasant Organisation, "We have reorganised it. Today we are working very well; the infocentro was the venue for the initial coordination" (*organising activities*).

5.1.6. Urban exposure

Everyone in Chanta Alta has visited the surrounding hamlets and Cajamarca City at least once during their lives. However, not many people have been exposed as many different environments as the interviewees. Arturo, besides his regular meetings for SIRU Project at Cajamarca City (*professional purposes*), has visited other Peruvian cities for various reasons. He declares, "I participated in regional and national tournaments in Lima, Huancayo and Trujillo" (*acting as a delegate*). And his qualities both as a painter (*professional purposes*) and musician (*business purposes*) brought him to different places in the Cajamarca region.

Alejandro travels to Cajamarca City almost every week to bring goods for his dairy shop (*business purposes*). He takes advantage of his time in there to visit cabinas públicas to get some information related to stockbreeding and be in touch with some contacts in both Peru and overseas. He has visited Lima only once when he got his passport for a failed trip – due to budgetary constraints at ITDG – to Italy, where he was supposed to attend an international conference about organic food (*professional purposes*, *acting as a delegate*).

5.1.7. Degree of initiative

The participants instinctively expressed their commitment in pursuing certain objectives. Since they are distinguished persons in Chanta Alta, their efforts in achieving their goals drag other people along. For instance, Alejandro pushed himself and other people, "We were incorporating a small business… we were around 15 people" (*bringing initiatives*). He declares he wants to use his knowledge and will to get better opportunities for the village (*looking for better opportunities*).

Arturo reveals his determination when he had to deliver a computer workshop for 28 people having only one computer. He declares, "It was not difficult for me, I did manage to deliver it". He was very creative, "I asked them to bring typewriters… So, the one who did the best typewriting exercise was ready [to sit in front of the computer]" (*can-do-attitude*).

5.1.8. Accepting modernity

The above-explained participants' dynamism, however, is not the common denominator in the village; it seems that almost everybody takes for granted the hard life they experience. Villagers need to see concrete results before adopting new ideas; Alejandro reflects, "It is difficult to make people change" (*not perceiving the benefits*). But he acknowledges any change takes time and is part of a process, "There are people who are changing… They want to improve their work and to increase their production. You have to accept risks" (*daring to try with new ideas*).

It is in that process where Alejandro and Arturo – the former more than the latter – instinctively turn into models for the rest of the villagers (*acting as change agents*). Alejandro, through everyday face-to-face contacts, shares with the villagers his knowledge on stockbreeding. Arturo, through the information he gathers, from SIRU Project, to be disseminated both at the infocentro and his weekly radio programme, is also a change agent.

5.2. From focused codes to emergent categories

Now it is time to put together the heretofore-unconnected ideas. We put together the most relevant and conceptually-linked focused codes "in terms of how well-founded they are in prior experience [and at the same time recognising] the value of holistic understandings" (Dey, 1999, p. 147). Two categories emerged from this process.

The evidence leads us to conjecture that only a few individuals made an effort in building special abilities, mainly regarding computers. Therefore, when we group together the discovered focused codes value of education, reading habits and learning computers, the **individual capacities** category emerges. It represents the way people strive for nurturing themselves or nurturing by others.

Similarly, the following focused codes make up the **individuals' attitudes** category: recognisable characters, community leadership, urban exposure, degree of initiative and accepting modernity. This category stands for the way of thinking and approach of our interviewees when dealing with other people and when facing both challenging and new circumstances.

5.3. Shaping the theme

So far, we have discovered two categories. An holistic analysis in the presence of the ICT intervention shapes the core theme. The evidence indicates that those individuals who enjoy a prestigious position, both by their knowledge and by their attitudes towards the villagers when accessing information through computers, consciously or unconsciously, strengthen their guidance role in the community.

Indeed, we discover that ICT is a useful vehicle the participants use for gaining ascendancy. It became a catalyser that reinforced or generated appreciation for individuals before their peers. We do not affirm that using ICT by itself enlarges individual status, but those who enjoy a prominent position in the village can increase this feature by using it. We reconstruct the whole story and put in context the role of the technological intervention.

Alejandro elucidates the benefit he obtained from a virtual friend, who provided an effective solution to the villagers' problem:

"My level of knowledge has increased. For instance, in the past I had a problem with the cows in this area; they had sores in their udders. So, I brought this problem [online] to a Mexican doctor; he asked me some questions and suggested possible solutions. He told me, 'Do this. We always do in this way; try with your cows'. What can I say! He looked very interested. The next time [we met online] he asked me, 'How did it go?' I told him, 'Yes, it is working'. It makes it easier to have different alternatives".

In turn, Arturo recognises the benefits from his computer abilities and how he uses them for the community:

"I received computer training in Lima... I took advantage from it and did it well […] My motivation, overall, is that I have always liked sharing with the community. Sharing what I have learnt and giving it to them. That is what I like the most; teaching to the community".

6. DISCUSSION

Before discussing the emergent theme, it is important to note that the findings indicate that the majority of the villagers have not embraced the technological intervention. There are a number of possible reasons. A slow speed access to the Internet (9.6 kbps), an hourly-fee for computer use (S/. 1.50) greater than the water monthly bill (S/. 1.00), the limited features of the computer (i.e., no text processor), the restricted computer availability (only one computer for two hours a day) and even quarrels with the infocentro manager's family prevent most villagers using the computer at the infocentro. For instance, Alejandro only accesses computers from cabinas públicas in Cajamarca City.

Alejandro and Arturo recognise the computer's value not only for their everyday activities but also for the village as a whole. They reinforce their ascendancy and observable position before the villagers through the information they get from computers. But they do not replace their face-to-face contacts at all; rather the contrary, they enjoy interacting personally with people. They are keen on transmitting the recently obtained information to their fellow countrymen and women. By no means, using computers has left them aside from communal life. Instead, it has opened new sources of information to them; as Alejandro points out, "It makes things much easier".

We can only speculate about the participants' personal motivations in using computers, but what emerged from the analysis is that the information they obtain from computers strengthens their leadership position. The key point from a social capital perspective is that they are in a dual, and privileged, position. On the one hand, they feel strongly attached to current issues within the village, i.e., participation in communal organisations and activities; instantiating the bonding form of social capital, which gives cohesiveness to the collectivity (Adler & Kwon, 2002). On the other hand, they are the village's agents who interact with the external world, mainly by using computers; representing the bridging form of social capital that links them to actors in other networks (Adler & Kwon, 2002). Both bonding and bridging forms of social capital are interacting on each other, making evident the "strength of the weak ties" (Granovetter, 1973).

In order to address our research problem, we engage the emergent theme with Huysman's (2004) domains of social capital summarised in Table 4. First, as regards the structural opportunity domain, we observe that our participants (the 'who') act as brokers of information over the technological network (the 'how'). They are agents bringing information from external groups to the community. They become a node linked to several other networks; the information they get from external ties is immediately transferred to the village through internal ties. As a result, our participants become what we name 'activators of information' and set in motion collective action (cf. Krishna's (2002) Active Social Capital).

Second, the cognitive ability domain demands the parties involved in the transaction to understand one another. Both participants exchange information (the 'what') with other

nodes in the extended network. Arturo receives produce market price information from SIRU Project to be shared with the villagers. Alejandro's ability to interact with veterinarian specialists and translate the received information to local people exemplifies the exchange of knowledge.

Third, the relation-based motivation domain in these transactions is based on norms of trust and reciprocity (the 'why'). For instance, when Alejandro solved the problem of the villagers' cows' udder sores, he not only trusted the Mexican doctor but local people trusted him too; consequently, reciprocity between Alejandro and villagers, and between him and his contact, is reinforced. Moreover, this initial exchange of information built a relationship beyond the casual and self-interested interaction. Because of the restrictions to infocentro opening hours, described above, the 'when' of the transactions is potentially affected, but it should be noted and individuals such as Alejandro seek alternatives to the infocentro.

Social capital domains	Illustrative components of the transactions
Structural opportunity to share: 'who' and 'how'	Alejandro and Arturo brokering the information they receive from their outside contacts to the villagers in Chanta Alta.
Cognitive ability to share: 'what'	Personal capacities allow them to process the information they receive before sharing it with the villagers.
Relation-based motivation to share: 'why' and 'when'	The relationship is based on, stimulated by and subsequently reinforced by trust and reciprocity among the parties.

Table 4: Social capital domains and their components observed in Chanta Alta (adapted from Huysman (2004))

The concept of social capital has demonstrated to have both theoretical and practical implications for ICT intervention initiatives. The findings suggest social capital provides the fertile conditions that produce a multiplier effect for any developmental initiative. Thus, promoters of ICT deployment initiatives should take into account the local expressions of social capital when deciding the implementation of this kind of projects. Launching such initiatives in communities where expressions of social capital are weak might have no beneficial results.

7. CONCLUSION

The ICT intervention in Chanta Alta has not altered common practices and not replaced face-to-face encounters; they are still very part of local culture. However, some individuals, who already participated in active networks outside the town, were able to envisage the potential benefits of the ICT intervention.

When these computer enthusiasts started either interacting with other people or simply obtaining new information they gained a larger degree of exposure compared to their fellow countrymen and women. When they connect Chanta Alta to the external world, they activate weak ties. When they bring the acquired information and knowledge to the town, they not only reinforce the strong ties within the community but also reinforce their leadership and guiding position before their peers.

It seems that the technological intervention is unlikely to be adopted and exploited by the majority of rural inhabitants. Nevertheless, the evidence suggests that some individuals, generally the leaders, the more respected, and the more exposed to different environments,

will be enabled to convey the acquired information and link their external contacts to their strong local network.

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9. ACKNOWLEDGMENT

TEXT-FREE UI: PROSPECTS AND CHALLENGES FOR ICT ACCESS

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Abstract: This paper examines the constraints that mediate the ability of individuals in developing country contexts to benefit from Information and Communication Technologies (ICTs). We identify social constraints, such as low levels of education and literacy rates, as making it difficult to access ICTs. We outline an innovative approach to address these constraints with a text free user interface (UI) design of an application for the illiterate population. We apply this text free UI to the case of a problem that ICTs hold the potential to influence—informal domestic labor markets in Bangalore, India. We examine the potential of the text free UI application and present preliminary results from user testing. These tests examine whether individuals without prior computer skills and low literacy levels could successfully navigate and access employment information. We flag challenges in promoting access to ICTs with this application, given the multiplicity of ways in which people derive benefits from technologies, the difficulties in formalizing labor relations and informal dissemination of information.

Keywords: Information and Communication Technologies, Access, Illiterate populations, User Interface, Design

TEXT-FREE UI: PROSPECTS AND CHALLENGES FOR ICT ACCESS

1. INTRODUCTION

Increasingly, multilateral organizations, NGOs, governments and private companies are trying to address the 'digital divide' by using Information and Communication technologies (ICTs) as a tool for economic development and poverty alleviation in developing countries (Keniston 2002; WorldBank 2003). For example, ICTs have been used in targeted interventions to address problems in agriculture, education, and health (Brewer et al. 2005). However, physical, capital and social constraints can mediate the ability of individuals to benefit from ICTs. Given these constraints, access to ICTs can be highly differentiated, particularly when these constraints occur within a developing country context. Despite these efforts to target rural areas and other groups through the application of ICTs, research shows that social constraints, such as education and literacy levels, can mediate the ability of illiterate populations to benefit from technologies (Best and Maclay 2002). Marginalized groups tend not to benefit from these technologies due to low literacy rates, income and/or fear of technologies. Few computing applications because of the heavy use of text are accessible to illiterate people.

This paper examines the constraints that mediate the ability of individuals in developing country contexts, particularly India, to benefit from ICTs. We identify social constraints, such as low levels of education and literacy rates, as making it difficult to access ICTs. We outline an innovative way to address this constraint with a text free user interface (UI) design of an application for the illiterate population. We apply and test this text free UI in the case of one problem that ICTs hold the potential to influence—informal domestic labor markets in Bangalore, India. There is a large surplus of labor of domestic workers, since women from slum communities in Bangalore find it difficult to identify and approach potential employers. Within this situation, there is no formal system by which employers can identify domestic workers for employment. The application aims to address the inefficiencies of the informal domestic labor market given the lack of formal information exchange.

In this paper, we describe this application within the context of accessing ICTs and the target community it tries to address. We present preliminary results from user testing and highlight the potential use of such a text free UI application. These tests examine whether individuals without prior computer skills and low literacy levels could successfully navigate and access employment information. We also flag challenges in promoting access to ICTs with this application, given the multiplicity of ways in which people derive benefits from technologies, the difficulties in formalizing labor relations and informal dissemination of information. Despite the fact that the provision of market information through ICTs is often hyped as a solution to labor market inefficiencies, actual implementation proves difficult given the different incentives for employers and employees to adopt such a system. We recognize that this technological application is one aspect of a much larger challenge to address the informal domestic labor market.

2. ICTD INITIATIVES AND ACCESS

2.1 Access and Technologies

The 'digital divide' is broadly defined as the difference between information 'haves' and 'have nots (Castells 2000).' The OECD defines it as the "the gap between individuals,

households, businesses and geographic areas at different socio-economic levels with regard both to their opportunities to access information technologies and to their use of the Internet for a wide variety of activities"(OECD 2001). Norris (2001) examines this idea of the Digital Divide, particularly in trying to understand whether the Internet will serve to reinforce or erode the gap between information rich and poor groups. The debate over the digital divide is often seen as binaries: as a debate between cyber optimists who hope the internet can reduce traditional inequalities between information rich and cyber pessimists who think that technologies just adapt to the social and political status quo and leads to further stratification (Norris 2001).Eventually, the discourse moved beyond a problematic divide between skeptics and optimists and whether or not to use ICTs or focus on development to a focus on 'access.' This debate focused on the divergence between technological drivers and potential beneficiaries.

'Access' in the context of ICTs and development is often discussed in relation to access to markets, business services, public services, and information (Sun and Wang 2005). Specifically, access to markets refers to the potential that ICTs can connect individuals to formerly inaccessible markets. This can be assisting rural populations to access urban markets, farmers accessing commodity information, or laborers participating in markets that were previously not formalized. For example, the provision of market information has been acclaimed to be a valuable benefit of ICTs in rural areas to farmers because it is supposed to create better functioning markets, get rid of intermediaries and allow for increased participation in global markets (Eggleston 2002). ICT kiosks for farmers in rural India have been lauded for organizing farmers and "providing them with a two-way means of selling and buying that both opens markets and empowers the poor" (Prahalad 2001; EIDParry 2004). According to economists' definitions, markets are a set of transactions over a range of goods and services, which allow for mutually beneficial exchange (Ibid). Information plays a great role in the coordination of markets and allocating resources efficiently. In such rural settings, there are virtually no sources of information about production or market prices (Eggleston 2002). Second, access to business services refers to how rural enterprises can gain access to higher quality lower cost business services through electronic delivery. Third, access to public services means that citizens can get improved access to public services such as health and education services because of the Internet. Fourth, access to information means that with improved information sources individuals gain valuable knowledge that they did not have before (Sun and Wang 2005).

2.2 Constraints to Access

We will now examine issues of access to ICTs by focusing on understanding the multiplicity of constraints, which influence how people derive benefits from technologies. Scholars often approach issues of access to ICTs by looking at three types of constraints: physical constraints, capital constraints, and social identity constraints. We do not presume that any of these categories are mutually exclusive. In fact, there are multiple ways in which these issues are inextricably linked.

By focusing on physical constraints to understand access to technologies, scholars link access to a physical ICT infrastructure and availability to rural populations (Brewer et al. 2005). In this case, access depends on availability of technologies and infrastructure. Studies indicate that ICT infrastructure access is not geographically or spatially even (Sun and Wang 2005). In this case access to high-speed networks and broadband penetration differ by location. However, only using physical constraints such as penetration and technological availability as ways to approach access limits one's understanding of how there may be social or economic differentiation among the rural populations who access technologies. It can neglect how

particular processes, such as accessing technology, are influenced by larger political issues such as attaining credit or capital or one's social identity.

Material inequalities of access, particularly in terms of capital, are important to consider because they highlight some of the causes of poverty and wealth inequalities. Access to capital is a constraint, which mediates the ways people, benefit from ICTs since households cannot always afford to pay for ICT services or purchase ICT equipment. Having access to capital determines who is able to benefit from ICTs by controlling or maintaining access to them. With limited access to capital, this can limit acquisition of ICT services as well as opportunities for households to improve their own situations (Ribot and Peluso 2003; Brewer et al. 2005). The distribution of benefits of ICTs is dependent on access to capital for payment of services or initial investment in purchasing computers and ongoing maintenance of PCs. This often limits access to PCs and ICTs to high and middle-income groups (Menon, Kiri, and Toyama 2006).

Another way to analyze access to ICTs is through a lens of social identity constraints, equity and social differentiation, while focusing on power dynamics among rural households. Social identity constraints can mediate equitable access to ICT technologies and facilities particularly when there is a highly stratified society based on caste or religion and wide social differences. Although we split material and social constraints of access into different categories, there are numerous ways in which they overlap. Inequality in access can result when the population is differentiated along ethnic, religious, linguistic/cultural, caste and class lines (Ribot and Peluso 2003). This is particularly salient when these sectors are considered to have differential rights, involving domination of one by the other (Pearse 1980). Accessing ICTs can depend on the particular social identity of the individual or group. For example, certain castes may be prohibited from using ICT rural kiosks that are operated by other castes (Kumar unpublished). Furthermore, levels of education and literacy levels act as a constraint that determines who is able to benefit from ICTs. It is often assumed that users of ICTs are literate or semi-literate given prevailing user interface requirements.

Finally, another way this concept of access has been described is incorporating notions of bundles of power as nodes in larger webs of power that can be separated into their constituent strands (Ribot and Peluso 2003). These strands within the webs and bundles of power can be viewed as the means of processes and relations by which actors can gain, control and maintain access to technologies. This definition of access, in terms of relations of power, can be a useful way to understand the terms by which households are able to attain the benefits of ICTs.

In sum, by examining physical, capital and social constraints when understanding access to technologies, it becomes possible to understand some of the material and social inequalities related to benefiting from ICTs. Physical constraints in terms of availability of a network, connectivity, and actual numbers of PCs available in a village can influence whether individuals benefit from ICTs. Material inequalities such as variations in levels of income, one's ability to gain credit, or purchase PCs are important in determining one's access to ICTs. Furthermore, social identity, in particular caste, social networks, status in society, and levels of literacy can determine the ways in which households access ICTs. Some of these studies reveal that particular outcomes, such as equity, whether it is differential attainment of capital, credit, proxy for access. Relations of power are undoubtedly linked to these constraints and unpacking these relations can provide further insights into how households and individuals mediate the ability to benefit from ICTs.

For the purposes of this paper, we focus on social constraints (particularly in terms of education levels and literacy) to access to ICTs and propose one possible way to address these constraints. We recognize that this application may not address the multiplicity of constraints that individuals face when trying to access ICTs. However, we will outline this application that aims to address access to ICTs as well as the challenges we see in terms of actual implementation.

3. CONTEXT

In Bangalore, there is a surplus labor of domestic workers, since women from slum communities find it difficult to identify and approach potential employers. The nature of labor is impersonal in that there is no formalized process by which women can talk to employers. The process is usually based on word of mouth, and these women rarely have formalized contracts with their employers. They may work for years and months without benefits, holidays, or guaranteed salaries. Presently, many employers take advantage of this situation and women are made to do more work than was agreed upon when joining, and do not receive extra wages for this additional work. Employers, however, are also at risk in this relationship and insecure in terms of losing workers at any moment, since there are no guaranteed contracts and employment is based on honorary service. Many part-time domestic helpers do not maintain regular work hours or they may show up to work sporadically. Few of these women have access to information regarding employment opportunities and available employees. Additionally, as an increasing number of employers are recent migrants to Bangalore (often working as part of the emerging IT sector), traditional systems of using social networks to identify employees becomes more difficult. Thus the informal labor market is fraught with problems for both employers and employees rooting in information scarcity and lack of formalized contractual agreements.

4. TEXT-FREE UI

4.1. The application

Specifically we explore how the use of ICTs through a text-free user interface (UI) holds the potential to partially address these labor problems by connecting women from urban slums in India with information about employers who are in need of their services. Because many of the women from the slums are illiterate, we designed a text free UI application prototype for employment search. The aim is to make information about employment opportunities accessible to illiterate domestic laborers. The application gives the user group a wider range of choices to meet their specific needs, unlike in the present situation where the process is informal, inefficient, and mediated by self-appointed agents.

We envision the final application to be a web-based application with a backend database. Through the web-based application, employers will specify their requirements from their PCs. This information will get stored in a database and domestic helpers will be able to see the same information at community kiosks in a Text-Free form of UI. The helpers will be able to use this information to apply for jobs which match their specific needs. The plan is to have a trusted intermediary organization like an NGO, host this service, set up agreements, establish fair practices, and resolve and negotiate employee-employer interactions. Currently a manual system for this service has been set-up as a pilot project to understand feasibility and interest where the NGO is hosting this service. We will describe this in further detail below (See section 6). Presently, the technological application has not yet been introduced. Before

introducing the Text-Free UI application we are trying to understand if formalization of the labor market is possible.

The application is designed so that first-time, illiterate users can successfully navigate through a computer application on their own with minimal assistance. It consists of UI components which, together, can lower the barriers to computer use for this user group by providing them with semi-abstracted cartoons for graphics, audio output, a consistent help icon and movie dramatizing the purpose of the application. Through this application domestic helpers can look for a variety of information about employment opportunities including: specific tasks requested by the employer, hours to be worked, total wages to be paid (and break-up of wages by task), geographic locations of the employer, and numbers of rooms and people in the residence.

The application contains the following pages: a context setting page, an introduction page, a page allowing users to select jobs by location, a job overview page, and a job description page.

1) **Context-setting page:** This page consisted of a video, which included dramatizations of how a user might use the application and how relevant information comes to be contained in the computer, in addition to a tutorial of the UI. The video had dramatizations of the scenario in which the application would be useful and how the relevant data was ultimately input into the computer. It would run in a loop at the beginning of the application. By clicking over this movie, the user would be able to go to the introduction page.

2) **Introduction page:** The first page consists of an icon, which represents job information for employees. This page is intentionally simple to avoid overloading first-time users. Even "decorative" text was removed so as not to intimidate illiterate users. On clicking this icon, one arrives at the Location page.

3) **Location page:** The user can retrieve information about how many jobs are available in a particular location. By clicking the mouse over a landmark, such as a hospital, restaurant or government office, the name of the location is called out, and the rectangular icons animate into an enlarged image of the landmark. By clicking on one of these rectangles on the map, users can navigate the Job Listing page.

4) **Job Listing pages:** In these pages, the jobs available in a neighborhood are listed by icons along with the basic picture information about each job. In order to proceed to detailed job descriptions, the user must click anywhere within a particular row of information.

5) **Job Description page:** This page compiles all of the relevant details about a particular job without using text. This includes information about addresses of the potential employer, wage break-ups, chores to be performed, number of rooms in the employer's house and the work timings with voice descriptions on mouseover. On every page, there is a "back" button to return to the previous page.
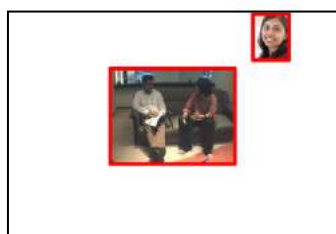
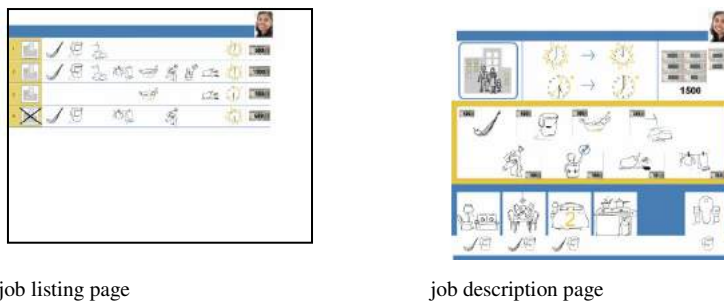Context-setting page   introduction page   location page

job listing page   job description page

Figure 1. Screenshots from a text-free job-search application.

4.2 Methods

In designing the UI, we drew from guidelines of *contextual design* and *goal-driven design,* in which techniques of ethnography were used to gain a deep understanding of the subjects, within the context of their specific goals (Cooper and Reimann 2003). It is a process which focuses on observing and understanding users in specific contexts, analyzing and synthesizing information gathered, and incorporating these insights into a design. The goal of ethnographic design is to make the most of user experience. For this purpose, it becomes important to check the design innovation with the user group at each step to understand the problems in design and accommodate changes in the next iteration (Parikh, Ghosh, and Chavan 2003a; Parikh, Ghosh, and Chavan 2003b). We held open-ended interviews and conducted subject trials with our target communities, both with literate employers and illiterate and semi-literate domestic helpers. The ethnographic study of illiterate helpers involved over 250 hours of open ended interviews with 115 women in three urban Bangalore slum communities.

We visited individual households in the slums in order to talk to women in focus groups about their daily activities and to observe their living environments. Through open-ended interviews and participant observation techniques, we explored women's economic relationships, and their communications and interactions with people within and outside the slums. We also explored their information needs. This gave us a broader understanding of the local context and needs. While choosing the participants for the interviews, we selected women from a range of low income groups and varying levels of technological familiarity with productions and applications.

Subsequently, we used an interactive design process to develop the UI, which required constant feedback from the employees with each iteration. We used this information to evaluate our designs and incorporated the necessary changes into each following prototype we designed. Being accepted and trusted by the community, making the subjects feel comfortable to voice their opinions and feedback about the UI, helping them overcome their fears and reluctance while using technology were a few of the challenges we faced during the process of design.

We had to take various actions to accommodate subjects and make them feel at ease. We spent considerable time in the community, attending weekend meetings to understand the context, culture and practices of the users. We visited the communities on an average of two to three times a week, for three-four hours each session, for 15 months.

We also conducted 35 usability tests with 35 illiterate subjects. We defined a task for each of the users and embedded tasks into a story[1] like in the "Bollywood method" (Shaffer 2004). In

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[1] We told them the following story: A friend of theirs who lived in their neighborhood was in trouble and desperately looking for a job. Their objective was to find the best paying job in a nearby neighborhood and to be able to report the address of the potential employer. (We initially started by asking them to find a job for

this method, tasks are embedded in dramatized stories involving the subject, which has been found to be better at motivating subjects toward the desired tasks, even for computer novices. Particularly in a context with asymmetric power relations, and where subjects tend to be reserved about giving feedback to people they perceive to be in authority (as test administrators were perceived to be), this became an invaluable tool for encouraging honest feedback.

4.2. Target population

The target community this project aimed to address is any first-time, illiterate user. For the purpose of our study, we chose a group of employees or domestic helpers[2] who closely matched the criteria we had for our target population.

All of the subjects we worked with had the three characteristics we sought to address in our work: (1) functional illiteracy or semi-literacy; (2) low levels of formal education (highest education attained being schooling up to the sixth grade); and (3) no experience whatsoever using a computer.

We based our project in three urban slum communities in Bangalore, India. To gain access into these communities we worked with an NGO called Stree Jagruti Samiti, which has an established presence in these three slums for 15 years. The NGO has been involved in working for the rights of women in the unorganized sector, at their workplaces and in their homes. It has 7 full-time members currently working towards formalizing and establishing minimum wages for the unorganized sector of domestic labor workforce. The NGO has a two room office and is located within 3 kilometers radius of all the slums with which they work. The NGO office has one computer with Internet connection and a landline phone. Weekend meetings are held at the NGO office and these are attended by the both NGO workers and women from the slums who are NGO members.

Most of the women in the slums work as domestic helpers, either illiterate or semi-literate (highest education attained being schooling up to the sixth grade). The male members of the house are generally hold jobs such as daily wage laborers like plumbers, carpenters, construction workers, mechanics, and metal bar benders, fruits and vegetable vendors. Their primary language of communication is Kannada, their native language. Apart from this, a few people also spoke Hindi and Tamil. The average household income was INR 800 - INR 3000 (approximately USD 18 – USD 67) per month. A few of them also had television sets, music players, and liquid-petroleum gas burners. Some of them have seen computers in the houses of their employers, but due to class and caste-based discrimination were prohibited from touching the computer even for the purposes of cleaning. None of them had previous experience using a computer.

The women in these communities worked at one to five employers' households and also did most of their own household chores. At present, they indicated that they get job information through word of mouth or through agents within the slum who informally connected employers with employees. Most of the women had limited options and often continued working at the same place for low wages because they were not aware of better opportunities elsewhere. We also found that many helpers would be happy to take up an additional job that involved small workloads because it would help them earn more additional income.

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themselves, but switched to this scenario after one woman in one of our earlier trials, seemed agitated by the idea that she would need to find herself a job and if she was losing her current job.)

[2] From here on we will refer to employees as helpers.

Focus-groups with employers show that there is definite interest among employers for a more formalized system. Employers we interviewed expressed that if there were an intermediary organization to take responsibility of the labor market connections, issues of accountability could be better addressed than in the current informal social network system. They felt that if necessary prior information (where the helper lived, where she worked earlier, and recommendations from previous employers) were available about the prospective helper then this system would be a more convenient method of connecting to helpers. Illiterate domestic helpers with whom we tested this application were able to successfully navigate the application with minimal assistance and found value in such a service.

The employers interviewed were all literate. The average household income per month was INR 100,000- INR 150,000 (approximately USD 2200- USD 3300) which is classified as the upper middle class household income bracket in India (Bery, 2004). 40% of the households interviewed were double income families. Most of the families had home PCs and the women in the family also used these PCs. Most of them lived in their own two-three bedroom apartments.

These employers currently found domestic helpers through informal social networks. For example, security guards of apartment complexes often arrange for someone from a nearby slum to work for the employers through a point of contact in the slum. Most employers paid an average of Rs. 1000 (USD 20) per month to their domestic helpers for the chores of sweeping, swabbing and washing dishes. They felt that there was a lack of accountability among their current helpers and a definite need for sense of responsibility and commitment. They said that most of their helpers were irregular at coming to work and would do so without prior notice. From our interviews, they indicated that they were welcome to the idea of a system that would address the issue of accountability, instill a sense of responsibility among helpers and regularize attendance.

5. PRELIMINARY TESTS AND RESULTS

We conducted a comparative test of the employment-search application with three configurations: one that was text-based, one that was text-free with video and one that was text-free without video. The goal of the tests was to understand whether first-time illiterate users could successfully use a computer application to extract relevant information without assistance. We performed the testing in a physical setting which was routine for the participants. In some instances, we visited subjects in their own homes (in slum neighborhoods of Bangalore); in a few cases, we conducted tests in the homes of their employers.

Throughout our design iterations and formal subject studies, we made a number of observations. We saw that overall there was a lot of excitement and enthusiasm among our subjects about the application. Furthermore, the application generated remarkable interest with the overall slum communities where we had based our project. Slum residents who had not had a chance to take the formal usability test heard about the project from their neighbors who had taken the test, and were eager to try out the application. Most subjects felt that the application would be very beneficial when deployed because they would be able to choose from more employment options and would be better aware of paying jobs. Some subjects who were not allowed to touch computers at their employers' houses were proud that they had finally used a computer. They expressed that they would inform their employers about how successfully they had navigated through the application. Results suggested that illiterate subjects could successfully interact meaningfully and independently with a computer

application on their first contact with a computer, providing that the user interface and interaction design are appropriately designed.

5.1. Quantitative results

All 100% (35 participants) successfully completed the task in the text-free version with full-context video. The average number of prompts required was 5.2 and the average time taken drastically reduced to 7.5 minutes.

5.2. Qualitative results

Collaborative use: At one point when we were conducting subject studies, a group of women began playing with the application between our formal test sessions. As they seemed more animated, we allowed them to continue for some time. In our individual tests, subjects appeared nervous and uncomfortable, probably because they were being video-taped and scrutinized in isolation in front of researchers. The group, on the other hand, seemed more confident, suggesting ideas to one another, discussing the purpose of the application, advising each other, and interacting more boldly with the computer. There was more excitement among respondents, compared with single-subject tests. This suggested the potential for a future design with a collaborative user model.

Immediate comprehension of voice feedback: With almost no exception, we found the same reaction to those who were exposed for the first time to voice feedback in their own language: Most expressed a positive response to hearing a computer speak in their native language, and went as far as to call others in the vicinity to hear for themselves. In fact, voice feedback appeared to make the applications *enjoyable* for subjects, who seemed more engaged and eager to explore the application.

The value of help: In addition a "help" feature shortened the time that tasks were completed in the employment search application and also acted as a source of reassurance to users. There were occasions when before performing a task on a particular page they referred to help three or four times. Similar to the voice feedback, the "help" feature encouraged users to explore the text-free UI, without assistance from researchers. In one of the sessions, we observed that subjects went to the help icon themselves without any prompting and performed the actions exactly as told by the help. The same pattern continued for forthcoming screens and before taking any further action, they referred to help. Throughout the study, we found that we needed to prompt and encourage subjects to try out things on screen. It is possible that a few encouraging voice instructions telling users how to operate the tool would be helpful.

Navigation metaphor: In our employment-search application, we felt that subjects were more likely to understand hypertext navigation when they were told to think of the pages as pages in a book. Although no quantitative studies were performed, the most recent version of the help recordings that made this analogy seemed to be more helpful than earlier versions.

Subject involvement among test subjects: One thing we found repeatedly among subjects who were most comfortable with the application was that they were eager to give us advice about design and potential features. Some subjects suggested that there should be a way to contact the employer with questions or salary negotiations.

We saw that both our illiterate and semi-literate subjects got very anxious when we showed them the text-based UI. Even subjects who could read isolated words needed significant prompting.

The value of the movie: We saw that using a video in addition to the UI instilled a great amount of confidence among the test participants. They seemed to feel that if the domestic helper shown in the video could successfully get a job through a computing application, they would be able to as well. Our subjects got a much better sense of the purpose of the application and its use after watching the video. They also understood where the information came from and how the jobs were created, which they had not understood earlier. The dramatized video helped to put the story in a context to which they could relate. Our subjects were so excited about the video that even after the tests, they continued discussing that the wages suggested by the employers in the video were inadequate. Some subjects even began to offer recommendations, suggesting that there should be a way to contact the employers through the application so that they can negotiate their wages.

6. CURRENT SYSTEM SET-UP

We have started a pilot project to test the feasibility and challenges of how the text free UI for employment purposes may work in practice. Before applying a technical solution with the text free UI to address these labor market issues, we are initially using a low-tech solution in order to see whether the formalization of the labor market is even possible. The low-tech solution consists of a manual system of connecting employees and employers and formalizing contractual labor relations using an intermediary such as an NGO.

Currently, the NGO previously mentioned is hosting this service and the pilot project has been running for three months. In the current low-tech solution, 10 small and medium size apartment complexes have been chosen as the pilot test bed for this system. On the helper side, the NGO has collated a pool of domestic helpers from the slums with which they work.

Pamphlets containing information about the employment service were distributed to individual households in these apartment complexes. Interested employers can telephone the point of contact at the NGO mentioned in the pamphlet and provide specifications about the kind of domestic help which they desire. This information is entered into a paper register manually by the contact person. The specifications provided by the employers are matched with the helper profiles and their needs from the pool of helpers. Once the best match is decided, the recruitment process begins.

The formalized recruitment process is done under a contract that is established between the employer and the NGO. There are two schemes that are currently available to the employers to participate in the contract. In scheme I, the NGO finds a helper for the employer and thereafter does not intervene in the relationship between them. In this scheme, the NGO does not bear responsibility of the helper provided. The NGO charges a helper finding fee. The wage for the helper is negotiated between the employer and the helper.

In scheme II, the NGO first finds a helper and then enters into an agreement with the employer. Both the employer and the employee have to abide by the clauses of the agreement and the NGO bears the accountability of the employer-helper relationship. There are standard wages for domestic chores under this scheme. A higher fee is charged by the NGO for this scheme and additional benefits are provided such as finding a substitute helper when helper is on leave, verification on account of suspected theft by helper etc.

Since this process is still in the fledgling phase, we are still observing the weaknesses and challenges in the system. But similar to the design process, the system will be refined based on feedback from both employers and helpers. Eventually, if the low-tech system becomes

established and functional for both groups, we will introduce a PC into which the coordinator can input the employer and helper information. Based on the success of establishing a formal database, our hope is to eventually launch an "employment" kiosk in the slum using text free UI, where women can access information. On the employer side, we hope to ultimately establish an online database which can be accessed remotely. We recognize that this process will be slow given the realities of working in the current social, cultural and technical environment of informal labor relations and with illiterate populations. But we plan to observe each phase of the process in order to best inform the resulting system.

7. SUCCESSES, CHALLENGES AND OPPORTUNITIES

Based on our qualitative research and usability tests and given the complexities of formalizing informal labor relations we will now highlight the challenges involved in promoting access to employer information,. We will also point to a few examples of opportunities in which access to labor market information may prove to improve market efficiencies. We will look at incentives and challenges of such a system from both the perspectives of employees and employers.

For employees to engage:
There are several incentives for employees to engage in a more formalized labor process. This could help ensure them a fair wage, contract, and some basic rights. However, employees also face some challenges in engaging in this system. The system could create competition for helpers and initially helpers currently employed through informal social networks, might lose their existing jobs to their *better* counterparts, once the system is deployed. Currently because of the small scale of the pilot project, such situations have not yet arisen. Till date 5 out of the 45 people in the worker pool have been placed with employers through the pilot project.

For employers to engage:
There are several challenges for employers to engage in this system. First, for employers, as compared to employees there are fewer incentives to participate in this system. There are some incentives to use the application to find a helper if you do not have an extensive social network and have just moved to a city. Also, depending on the occupation of the employer, this application can result in time savings in terms of finding an employee. There are fewer incentives, however, if the individual employer already has an existing social network, prior contacts and wants to maintain a suppressed wage because the labor relationship is informal. With formalization, employers may feel more accountable, forced to pay higher wages, and may find it more difficult to exploit workers.

The responses to engage in the pilot project from employers have been slow but steady. Most employers who have called to participate said that the service seems useful. There have been calls not just from the apartment complexes where the pamphlets were distributed but also from friends and relatives of these people living elsewhere in the city. The reactions to the two schemes have been mixed. Recent interviews with employers revealed that some employers were not willing to enter into an agreement that could make them liable to questions regarding their labor practices from the intermediary organization. They were worried that in the new system, if a helper launched a complaint against an employer, it was likely that the intermediary organization would support the helper and question the employer. These employers expressed that in such a situation they would prefer their informal social network to find a helper. Employers with such sentiments tended to choose Scheme I or did not use this service. However at the same time, a number of employers have participated in scheme 2. There have been a total of 30 calls from employers so far in the pilot project.

Other challenges:

One of the challenges for the project is to standardize wages under scheme 2. Again setting standard clauses and at the same time catering to various employer requirements remains a challenge. Most employers felt that the intermediary organization should in addition to making helpers aware of their own rights, also instill in them a sense of responsibility and commitment. Employers we interviewed indicated that in an unforeseen case of theft by the helper at the employee's house, the intermediary organization within the new system is likely to face the repercussions. The employers would also want the intermediary organization to find a helper located close to their residence. The reason was so that employers could contact and find the helper if she missed a day's work without prior arrangements with the employer. In a localized system that would be possible, but when the system is scaled up this issue of finding helpers close to employers' homes will have to be dealt with by the intermediary organization. This may prove difficult if the intermediary is a small NGO with limited capacity.

Since the beginning of the pilot project, there have been calls from different parts of the city requesting the service. Currently the NGO hosting the service is not equipped to provide helpers to all neighborhoods in Bangalore. Not many helpers are willing to travel big distances for work without getting travel allowance, since many employers are not willing to pay travel allowance. Gradually the NGO will collaborate with other NGOs working in other slums in the city to increase the size of the worker pool and to be able to connect helpers to employers living in other parts of the city.

In all the placements that have been done, the employers have paid a fee for the service. The cash flow is low currently, but as the scale of the project increases, the hope is to increase this cash flow.

As has been mentioned earlier, we envision the final application to be a web-based application with a database backend. Through the web-based application, employers will specify their requirements from their PCs. This information will get stored in a database and domestic helpers will be able to see the same information at community kiosks in a Text-Free form of UI.
Transitioning from a low-tech service into a technical service appears to be a challenging task. More than the technical set-up, the difficult part would be deciding physical locations for setting up the text-free UI at community kiosks. The plan is to set-up the kiosks at the NGO office where the physical infrastructure such as electricity and connectivity is conducive for setting up the system.

8. CONCLUSIONS

This paper has shown that social constraints, such as low levels of education and literacy rates, can make it difficult for certain populations to access the benefits of ICTs. We proposed an application to address this constraint with a text UI design for the illiterate population to access labor market information. The preliminary results from user testing indicated that semi-literate and illiterate individuals without prior computer skills could successfully navigate and access employment information through this UI.

Evidently there are social and economic challenges for both employers and employees to engage in this new system. We recognize that this technological application is one aspect of a much larger challenge to address the informal domestic labor market and that the technological solution is not necessarily the first step in this process. As the low-tech pilot project is implemented we hope to better understand whether and where this technological application may add value to a more formalized system.

However, despite these challenges, results of usability tests show that the application generated positive interest among the illiterate communities. The current low-tech service also demonstrates there are several benefits that employers could gain from using such a system. The design principles behind this text free UI holds broader relevance to a number of other domain (such as agriculture and health) and applications in the field of ICT and development.

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NO MAN IS AN ISLAND: ISOLATION, COOPERATION AND IT CAPACITY BUILDING IN THE MALDIVES

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Abstract: In many developing countries, lack of IT skills and human capital impede the potential of IT investments in organisations in developing countries (Lee, 2001). This paper draws upon theories of human and social capital, and knowledge to explain enablers/obstacles for knowledge creation and transfer for IT capacity building in a tourism organisation in a developing country – the Maldives. IT capacity building is intimately linked to knowledge and skills at the level of human resource development. Using Nahapiet and Ghoshal's (1998) framework for the role of social capital in knowledge creation and transfer, we examine the major issues of IT capacity building for that organisation. We conclude that the role of cognitive capital is the most important for the tourism sector of the Maldives.

IT CAPACITY BUILDING IN THE TOURISM SECTOR IN THE MALDIVES: A SOCIAL CAPITAL AND KNOWLEDGE PERSPECTIVE

1. INTRODUCTION

While the literature shows some success stories of IT in developing countries, we often hear about IT initiatives that aim to bring positive outcomes but fail in some way (Silva & Figueroa, 2002; Avgerou & Walsham, 2000; Bhatnagar & Bjorn-Andersen (1990); Bhatnagar & Odedra, (1992); Odedra-Straub (1996); and Odedra-Straub, Okot-Uma & Cyranek, 1995).

One overriding factor that contributes to the unsuccessful adoption and implementation of IT in developing countries is the lack of IT awareness, skills (Sahay, 2001; Waema, 2002), and human capital (Lee, 2001) to adapt new technologies that restricts the technology absorption capability of a country (Lee, 2001). Lee argues that even when all the countries have equal access to technology, the mismatch between skills and technology would lead to disparity in productivity. It follows then that IT capacity building – creating and enhancing the ability to use IT – is a vital, if under researched, issue for developing countries.

The purpose of this paper is to provide insights from a single case study of the Maldivian tourism sector, into the major issues of knowledge creation and transfer processes, and the role that social capital plays in facilitating those processes for IT capacity building in that industry. More specifically, the two research questions addressed in this paper are:

- What are the major issues of knowledge creation and transfer in the tourism sector in the Maldives?
- What role does social capital play in facilitating the creation and transfer of knowledge in the Maldivian tourism sector?

The primary contribution of this paper is to analyse IT capacity building in private sector organisations in developing countries using the theoretical perspectives of social capital and knowledge. A secondary contribution is to provide one example of the role that social capital plays in facilitating knowledge creation and transfer for IT capacity building in a specific tourism organisation in the Maldives, a nation facing major skills shortages in all sectors of the economy. This analysis can provide insights into a range of organisations in developing countries.

The paper is structured as follows. The next section discusses the role of human and social capital in knowledge creation and transfer for IT capacity building. Section 3 provides details of research setting and the methodology, followed by the details of the case study in Section 4. The case findings and discussion of knowledge issues and the role of social capital in facilitating those issues for IT capacity building are laid out in Section 5. Finally, some conclusions are presented in Section 6.

2. THEORETICAL PERSPECTIVES: SOCIAL CAPITAL IN THE CREATION AND TRANSFER OF KNOWLEDGE FOR IT CAPACITY BUILDING

2.1. Human and Social Capital

For the purposes of this paper, human capital is defined as "the collective knowledge, skills, abilities and characteristics (that is, all of the capabilities combined) of an organisation's employees and managers that create a capacity (potential that can be realised) for competitive advantage" (Lengnick-Hall & Lengnick-Hall, 2003, p. 45). Whereas human capital resides in individuals, social capital resides in relationships (Côté, 2001). Social capital is defined as "the sum of the actual and potential resources embedded within, available through, and derived from the network of relationships possessed by an individual or social unit." (Nahapiet & Ghoshal, 1998, p. 243). Unlike other forms of capital, social capital inheres in the social structure itself (Coleman, 1988), and hence, it is invisible, ubiquitous, and hard to pin down (Snell, 1999).   Recent research has highlighted the importance of social relationships, norms of behaviour and reciprocated trust in various social and economic activities (OECD, 2001). As such, social capital is increasingly seen as an important concept in the development literature because it is important for the efficient functioning of modern economies, for having a stable liberal democracy (Fukuyama, 2001), and for understanding the part of relations and networks in social and economic development (Côté, 2001).

There is a strong relationship between human capital and social capital (Côté, 2001). Coleman (1988) emphasised the role of social relations among parents, educators, and pupils in fostering learning, and the facilitation of skills and knowledge creation in individuals. Coleman (1988) demonstrated that both the social capital within the family and that within the community facilitate creation of human capital. Further, Schuller (2000) argues social capital to be both the 'material and by-product' of socio-economic progress because it could be seen as an enabler of the productive use of human capital.

No paper would be complete without an acknowledgement of criticisms of the social capital concept, and in particular its enthusiastic endorsement by the World Bank. Schuurman (2003) maintains that the use of the social capital concept allows development organisations such as the World Bank to advance neo-liberal economics that exclude the consideration of the role of the state and substitute it with the role of the civil society. There is also the negative side of social capital – Harriss (2002, in Cummings, Heeks & Huysman, 2003) notes that strong networks can also engage in negative activities – mafias, gangs and cartels. Corruption can also be said to be a negative manifestation of social capital.

2.2. The Relationship of Human and Social Capital to Knowledge Creation and Transfer in Organisations

Nahapiet & Ghoshal (1998) put forward a framework for exploring the role of social capital in the creation and transfer of knowledge in organisations, and this is very relevant for our examination of ICT capacity building in developing country organisations. They argue that organisations that support two generic processes of knowledge – combination and exchange – to occur, help to create and transfer of knowledge. Rastogi (2003) argues that successful performance of an organisation depends on its ability to create valuable products and services to its customers, and this in turn, depends on the joint efforts of its highly motivated, skilled, capable, and knowledgeable employees (human capital).

The presence of social capital, in three forms or dimensions – *cognitive* capital; *structural* capital; and *relational* capital – is a prerequisite for combination and exchange to come about in the creation of knowledge (Nahapiet & Ghoshal, 1998; 2002). Central to the three dimensions is that social capital influences the knowledge available for the organisational

actor through his/her network of relationships. The kind of relationship existed between actors involved in the network determines the knowledge actually disclosed to, or retrieved by, the actor; and the efficiency of the resulting knowledge transfers (Yli-Renko, Autio & Sapienza, 2001). The properties within these forms of social capital, in different combinations, have been studied by many researchers (e.g., Yli-Renko, Autio & Sapienza, 2001; Droege & Hoobler, 2003).

2.3. IT Capacity Building

Capacity building is usually defined in terms of people, institutions, and practices that help developing nations to achieve their goals (Vreede, Jones & Mgaya, 1998/1999). Three conditions are said to be necessary for effective capacity building (A1-Jayyousi, 2001; Vreede, Jones & Mgaya, 1998/1999). They are (1) an enabling environment with appropriate methods, tools, policy and legal framework, (2) an institutional development that supports community participative development efforts, and (3) human resources development through training and education (A1-Jayyousi, 2001; Vreede, Jones & Mgaya, 1998/1999).

For the purposes of this paper, IT capacity building is defined, based on the concept of human capital, as the *process of creating or enhancing local human and organisational abilities to use IT to perform specific tasks in organisations in order to attain organisational objectives*.

Although capacity building is a widely used term in the development literature, 'IT' capacity building is seldom discussed. The studies that discuss the latter either (i) concentrate on the problem of weak human resource capacity in developing countries at a regional and national level, rather than the industrial organisational level or (ii) focus on how IT could be used as a *supportive* tool for regional, institutional or organisational capacity building efforts, rather than building IT capacity per se of regions, institutions or organisations (See for examples, Vreede, Jones & Mgaya, 1998/1999; A1-Jayyousi, 2001; Snoussi & Awosika, 1998; Masalu, 2005; Gregson & Upadhaya, 2000; Zawdie & Langford, 2002; Goulden, 2005). The research problem addressed in this paper, IT capacity building in an industrial organisation in a developing country, addresses a gap in the IT capacity building literature with respect to the organisation level.

From our perspective, the Nahapiet & Ghoshal (1998) rendering of social capital concepts as deeply connected to knowledge creation and transfer of knowledge in organisations is a very useful framework to understand IT capacity building issues. Firstly, it addresses the aspects of enabling environments and community participation required for capacity building, through its consideration of social capital. Secondly, its focus on knowledge creation and transfer allows consideration of human resources development. For these reasons, our analysis uses this framework to understand IT capacity building issues in the case study in this paper.

3. RESEARCH SETTING AND APPROACH

The case study is based in the Maldives, located in the Southwest of the southern tip of India, as shown in Figure 1.
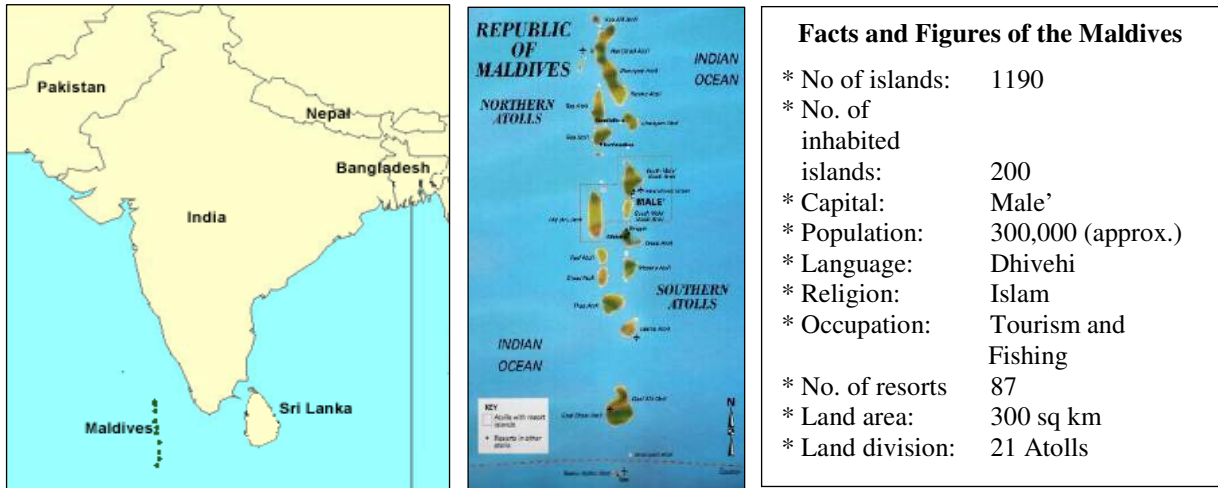
		Facts and Figures of the Maldives
		* No of islands: 1190

Figure 1. The Map, Facts and Figures of the Maldives.

(Sources: www.tiscali.co.uk; www.acmetravels.com/maldives/about_maldives.html)

Tourism, which began around three decades ago with two resorts and some thousand tourists, is one of the key industries in the Maldives, consisting 87 resort islands and contributing 33 percent of the Gross Domestic Product in 2004 (Ministry of Planning and National Development (MPND), 2005).

Due to the lack of trained locals, a high percentage of the workforce in the tourism organisations are expatriates. The most recent census (MPDP, 2005) reports that out of 17,117 employed in the tourism sector in 2004, 7451 (44%) were foreigners. Although the statistics for the IT workforce are not available, a review of the IT status and experience of several organisations in the Maldives suggests that there is a major shortage of IT-trained personnel in organisations (Ministry of Communication, Science and Technology (MCST), 2001).

The interpretive case study reported here is one of 12 tourism organisations and firms researched in a multiple case study of the tourism sector of the Maldives. The study used an inductive grounded theory building approach (Eisenhardt 1989, Urquhart 2001) to identify and examine major knowledge creation and transfer issues for IT capacity building in tourism organisations and firms in the Maldives. In order to gain a picture of the sector, an embedded design where multiple levels of analysis was used. That includes owners/managers, training/human resource managers, and potential IT trainees from small, medium, large and international resorts/hotels as multiple sub-units, together with government officials from Ministries, executives from industry promotion boards and the top management from the post-secondary training institutes in the Maldives. Although such an embedded design is complex, it allows for induction of richer models (Graebner & Eisenhardt, 2004).

The case study research was conducted by one of the authors over a period of three months, from February to May 2005. Over this period, the main method for collecting data was through semi-structured interviews that were of open-ended nature. 46 interviews were conducted in total, out of which 6 interviews were carried out in the case organisation presented in this paper, the details of which are shown in Table 1.

Type of Employee	Duration and Date
Owner/Manager	12 Apr 05 / 85
Training HR Manager	14 Mar 05 / 60
Training HR Manager	12 Apr 05 / 80

Training HR Manager	24 Apr 05 / 140
Potential IT Trainee	12 Apr 05 / 35
Potential IT Trainee	14 Apr 05 / 30

Table 1. Summary of the Interviews Conducted at Organisation X

This was followed by semi-structured open-ended questionnaires of qualitative nature. In addition, other sources of documentary evidence were used. Further, a logbook was kept to record the key observations made during interviews and site visits for interviews. The selection of these data sources followed the recommendations, as put forward by Glaser & Strauss (1967), of using diverse data to obtain multiple vantage points into the phenomena of interest.

The data was analysed using the grounded theory method steps of open coding, selective coding, and theoretical coding (Glaser 1992). One important aspect of grounded theory method (GTM) that is frequently neglected is the obligation to engage the emergent theory with pre-existing theories (Strauss 1987). This helps relate lower level substantive theories produced by GTM to larger, higher level theories and helps the theory building effort as a whole. One aspect of the emergent theory was then engaged with theories of social capital and knowledge management, and these findings are reported on in Section 5.

4. THE CASE STUDY

4.1. Background of Organisation X

Organisation X originated as a shipping and trading company which later diversified its business to include tourism in the late 80s with one small resort island where the business later expanded to five resort islands. Starting from scratch, with limited tourism knowledge and skills, the owner himself was involved in all the aspects of the business. A commitment to local community involvement, job creation for the local community, and safeguarding the local environment and habitat are key characteristics of this organisation. The owner has emerged as a well-recognised, respected, and influential personality in the business arena, government circles, and among the ordinary citizens of the country. He had either occupied or was serving in most senior positions of the national tourism organisation, and government boards and agencies in 2004.

All the resorts of Organisation X have the capacity of providing all the modern facilities for over 2000 guests at any given time. Like the other resorts in the Maldives, the individual resorts of this organisation have one-island, one-resort concept. Hence, the individual resorts were operated independently of the other, each having systems for power generation, desalination of water, sewerage and waste elimination, sea transportation and day-to-day supplies for resort operation.

However, in spite of high quality modern facilities, a lack of skilled and qualified people, from the top management through to the grass-roots level, hampered the organisation from providing quality services to its guests. In 2004, Organisation X faced a chronic shortage of skilled staff. National shortages combined disastrously with appalling living and working conditions for the employees. Employees lived in isolation, away from family and friends, with no hope of self-development. Consequently, the multi-million dollar business had a very high staff turnover of 22.4 among the 2330 employees in 2004, as shown in Table 2.

Resorts	No. of Employees	Employee Turnover
Resort #1	836	21.53
Resort #2	624	19.71
Resort #3	383	22.45
Resort #4	290	27.98
Resort #5	198	26.33
	Total no. of employees: 2330	Average turnover: 22.40

Table 2. Number of Employees and the Turnover Figures in 2004

While the management was not concerned about employee well-being, it was recognised that, in the face of increasing competition from internationally owned resorts, such things needed to change. The Hilton, Taj and the Four Seasons hotel chains, are synonymous with training in the international hospitality industry, and Organisation X realised that dedicated and well trained staff were behind their success. Therefore, the organisation recognised the need to raise standards, increase its performance and react to the emergent trends of the industry in order to survive in growing industry competition.

In 2003, a corporate human resource department was established and gradual changes were made. Under the leadership of the human resource director a complete restructuring of the organisation was initiated. Organisation X embarked on a massive project of training for skills development of all levels of employees for building capacity at the corporate level. Although training was a new concept for the organisation, employees' keenness to learn and develop themselves resulted in a positive attitude towards training from their end. At the initial level of training, the focus was on building a learning culture within the resorts. As early as the third month of the training project implementation, the effects of skills development were noticed. Guest complaints had been reduced, guest satisfaction survey forms showed positive comments about service quality, and employee morale was boosted. However, turnover still remained a problem in 2004, though the organisation was hopeful that this would ease.

Organisation X makes provisions for the staff to access training at local public and private institutions, particularly the only hotel school in the country. The strong relationship with the hotel school helps fill the void caused by the lack of qualified trainers and facilities within the organisation. Organisation X hires local trainers and training facilities from the school to give in-house training for the staff. It also enables students of the hotel school to do industry training (internship) in its resorts. Organisation X also sponsors students to study at the school, and they later recruit them when they graduate from the institute. However, their demand for staff exceeds graduates available, and those graduates who are recruited show a poor fit between their skills and organisational requirements.

4.2. IT at Organisation X

The importance of IT to Organisation X was realised in the mid to late 1990s. Organisation X was one of the first local tourism organisations to have adopted advanced IT systems. By 2004 it had a range of IT resources, which are shown in Table 3. Expatriates were employed in the most senior IT positions of the organisation as locally trained IT people were extremely rare and difficult to find.

IT Resources	IT Human Resources		
• An international property management systems (PMS) called FIDELIO • Computer-based sewerage and power generation systems • Internet Connection • Email • Cyber Cafés in 4 resorts with machines ranging from 2-10 • Microsoft Office-type Software packages • PCs	Locals	Expatriates	Location
	2	5	Head Office
	7	2	Resorts

Table 3. Types of IT Resources in Organisation X

In spite of increased IT resources, the organisation was concerned that the effective use of IT did not generally occur: many PCs were used as simple word processors. The PMS software was under-utilised - telephone, fax and paper-based memos were more commonly used as sources of communication instead of email, and there was limited internet use for learning purposes. Further, there was no organisational policy on giving training to employees in IT areas, even though administrative staff needed training in all aspects of IT, as:

> *"some people don't know how to manage the basic things in computer other than the basic operations of the applications. That is an area where we have to give some training." (IT Systems Engineer)*

In the absence of training, employees usually acquired knowledge through 'asking others' or casual talking, as explained by the Accounts Assistant:

> *"when I don't know something I call and ask someone who knows or whom I think would know, and he will share his knowledge with me. Very often people from other departments call me and ask for my help, and if I know I tell them how to do it on the phone or sometimes I go to their work site and tell them how to do it or we try to solve the problem together."*

Apart from training, limited mechanisms for knowledge creation, transfer and sharing in the form of daily departmental briefings and weekly management meetings were established within individual resorts, but were absent across the organisation as a whole. There was lack of coordination between head office and individual resorts. However, a deep-rooted culture of unintentional knowledge sharing among employees was substantial within resorts.

5. ANALYSIS AND DISCUSSION: IT CAPACITY BUILDING

This section is based on our grounded theory analysis[1] of the data that examined the knowledge and training issues in the organisation, and engages that analysis through the three forms of social capital (cognitive, structural and relational) outlined by Nahapiet & Ghoshal (1998). This is our theoretical lens with which we engage our emergent theory of knowledge and creation issues in IT capacity building in Organisation X.

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[1] For reasons of space, the codes are not included but they are the basis for the issues identified in Table 4

5.1. Structural Capital

The structural dimension of social capital comprises network ties, network configuration, and the degree of social capital that can be transferred from between contexts (Nahapiet & Ghoshal, 1998). In this section, we examine the different aspects of structural capital in order to shed some light on knowledge creation and transfer, both inside the organisation and in the sector generally.

5.1.1 Network Configuration

The geographic isolation of the resorts in Organisation X formed a major barrier to sharing knowledge within the organisation, and also in the industry. Collaboration, outsourcing and networking are concepts hardly in existence within the tourism industry, and 'sharing' as explained by the corporate training manager:

> *"To share something between the resorts in this industry is good in my opinion. But that [sharing] concept is not there among us.....people in one resort don't know what is going on in the other unless otherwise they visit that resort."*

On the positive side, the island setting compels employees to live together and share the same accommodation, allowing plenty of interaction even after work, as explained by the corporate training manager:

> *"these are little islands so we get to interact with each other all the time, 10-12 times a day, [besides] everybody eats, drinks and sleeps together."*

Therefore it was not surprising to find out that the main knowledge creation and transfer mechanism, including that for IT, within the resorts of Organisation X is through informal means such as 'casual chatting' rather than formal mechanisms such as training. A possible disadvantage of knowledge acquired through informal knowledge sharing as a result of these strong ties may be that the circulated information is often repetitive and stale and may not add to the knowledge base of individual employees. On a positive note, sharing of repetitive skills-based knowledge, such as IT, should be effective for new employees.

Informal knowledge sharing could potentially have a significant positive impact on the capacity building of resorts. On the other hand, the centralised network configuration of the Organisation X creates barriers for knowledge creation and sharing among employees. This may impact negatively on capacity building in the organisation. Such network structures are identified to minimise the interactions between technologies, techniques and people, and hence reduce the knowledge transfer (Healy & Iles, 2003; Bhatt, 2001)

5.1.2 Network Ties

The owner of Organisation X was a founder and a board member of the tourism association and had a great influence on the activities carried out by the association. The association's activities and resources were slanted toward the interests and benefits of Organisation X.

Interestingly, there was hardly any relationship, in terms of sharing knowledge, between the association and individual resorts of the Organisation X. This is possibly because there are no formal business arrangements for knowledge creation and sharing between the two parties. Density alone, without collaboration, does not facilitate for knowledge diffusion (Powell, 1998 in Droege & Hoobler, 2003).

Organisation X also has good connections with the only hotel school in the country, most of the employees in high ranking positions in Organisation X are graduates of this. A training manager explained:

> *"We have a very good relationship with the Hotel School – from GM to many of the other senior level positions are filled by hotel school graduates….we share and discuss information and other things at a very personal level"*

In the light of a sparse network configuration of few redundant contacts (Burt, 1992), it is not difficult to understand the reciprocal knowledge creation and sharing between the Organisation X and the school.

The strong social tie between the two parties is further substantiated when (i) it was realised that the organisation recruited graduates of the school despite the fact that the graduates do not attain the skill requirements of the Organisation X, and (ii) in spite of resource limitations the school provided trainers and training facilities for conducting in-house training at, and made provisions for mobile training for Organisation X.

5.1.3 Degree of Social Capital

A close personal relationship, rather than a business relationship, exists between the owner of the Organisation X and the government officials. This can be seen as an instance of negative social capital, as corruption is a major problem in the Maldives. As the mainstay of the economy, tourism is the backbone of Maldives politics and corruption is an issue (Himal South Asian (2003). The government buys political support by expending the country's most important assets (Himal South Asian, 2003). For example, uninhabited islands were granted for government supporters, who in turn rent out to western hotel investors (Himal South Asian, 2003). Hence, the bulk of the revenue generated from the tourism industry was being bagged by few families of government supporters and their foreign cronies (Himal South Asian, 2003).

This issue of negative social capital goes some way to explain why Organisation X, along with smaller players in the industry, was enabled to bypass many legislative matters related to resort operations. Powell & Smith-Doerr (1994. in Côté, 2001) state, "the ties that bind may also turn into ties that blind." (p. 31).

The personalised relationship between the government and a large number of resort owners, entailing a dense network configuration, would potentially explain why the Organisation X's connection with the government does not facilitate for the government's sharing of IT, training and human resource knowledge with them.

5.2. Relational Capital

The relational dimension is the aspect social capital that describes the nodes in a network when they have a strong sense of identification, trust each other, have a felt obligation to others in the network, and abide by the norms of the network (Wasko & Faraj, 2005). In the case study we see many of these features of relational capital which affect the knowledge creation and transfer of the Organisation X.

5.2.1 Identification and Norms

As far as industry norms of identification, or a sense of belonging in the network of industry stakeholders is concerned, there are some issues that are significant in the case. Firstly, the Maldives is 100 percent Muslim. Religious and associated cultural and family values support

stereotypical views of the industry as "bad" and that resorts are where "bad things happen" (MCST, 2001). While the impact of this image goes beyond both genders, it is more strongly felt when women are considered for employment in resorts (MCST, 2001). Thus, such beliefs held in the society control actions of individuals (Coleman, 1988). This explains to some extent why the Maldivian community in general is reluctant to participate in resort activities, and this restricts the opportunities for knowledge transfer via trained local workforce.

As each resort has been built on an individual island, the industry norm is to build capacity in individual resorts in all respects, including obtaining machinery and developing skills. Hence, the impression of the industry is that all resorts are similar in terms of physical settings, the level of knowledge and skills among workers, and operational activities.

5.2.2 Trust

The independent industry norm tends to foster distrust and focuses resorts on their own operations rather than joint efforts to build industry capacity. In fact, sharing of resources, such as knowledge, with other organisations is perceived as a competitive threat to the organisation.

5.2.3 Felt Obligations

Although industry norms restrict the organisation from sharing resources with other organisations, we noted that Organisation X makes scholarship and employment opportunities available for locals. So there is a felt obligation of serving the community, and this may also have reciprocal benefits.

Prior research indicates that economic exchange is positively correlated with knowledge acquisition in that out of a mutual indebtedness, individuals usually reciprocate the benefits they receive from others (Yli-Renko, Autio & Sapienza, 2001). Organisation X's provision of scholarships is returned in the sense that the scholars consider themselves obliged to work for the organisation after completion of studies. However, a commitment of providing job opportunities for locals may not benefit the organisation in the long term due to the low level of knowledge and skills of the majority of locals employed in the organisation.

5.3. Cognitive Capital

There is a major issue of cognitive capital for Organisation X. Before the international hotel chains were established in the Maldives in the 1990s, workplace training was unknown to the tourism industry. Organisation X's implementation of a massive training program around that time, with neither qualified trainers nor adequate facilities, may be seen as seeking a place in the collective that proved to be a major step for formalising knowledge creation and transfer.

The adoption of expensive resort management software, can be attributed to the influence of international resorts that recognise IT as an important tool for efficiency and productivity. Even though the software was ill-fitted to the local situation, the transfer of international knowledge embedded in the software provided some standards for the chaotic situation in the resorts, impacting IT capacity building of resorts.

Cognitive capital entails resources that facilitate shared interpretations and meanings within a collective (Wasko & Faraj, 2005). The case provides adequate evidence to suggest that cognitive capital plays a crucial role in understanding knowledge creation and transfer issues in Organisation X. Like any other tourism organisation, Organisation X had employees with a lack of education and training. Workers were directly recruited into the resorts from their home island and it was said that:

> *"most of the people whom we get from the job market, their education level is very low." (Human Resource Director)*

Even though informal knowledge sharing is high within the resort, lack of basic education among the employees may prevent the drive for knowledge acquisition, unless arrangements are made for persuading employees to trigger this process. Further, in the absence of a sound knowledge base in management, qualified people may be seen as a threat to management. As the HR Manager said, it was

> *"very difficult for [managers] to accept [graduates]who join here and start working here" (Human Resource Director)*

Lack of IT knowledge and skills of employees due to lack of IT training in the organisation does not give them the ability to share the language and codes rooted in the technology (Nahapiet & Goshal, 1998). At the same time, owing to the mismatch between the design and configuration of the international software discussed in the case and the local situation, there seems to be disparities between the knowledge required for technology utilisation and the contextual knowledge employees acquire from the environment.

Table 4 is a summary of the three forms of social capital in relation to the issues associated with knowledge creation and transfer in Organisation X.

Forms of Social Capital	Knowledge Creation and Transfer Issues
Structural Capital	*Inter-Organisational Knowledge Creation/Transfer* - Dispersion of islands and competition in the industry create barriers for relationship building and knowledge sharing. *Intra-Organisational Knowledge Creation/Transfer* - Informal knowledge sharing is high within the resorts. - The main mechanism for knowledge creation and sharing within resorts is by informal means such as close personal relationship with each other rather than formal ways of training. - Centralised management structure of the organisation and the geographic nature of islands create barriers for knowledge sharing across the organisation. - The primary method of IT knowledge sharing within the resorts is through informal ways such as asking IT skilled people in the resort, rather than training. - IT managers located in the resorts get the needed support from the head office IT team. - Internet is widely used but limited use for learning purposes. - Individual resorts are fully networked but there is no connection between the resorts that inhibits knowledge sharing across the organisation. - Telephone, fax and paper-based memos are more trusted and therefore are commonly used as sources of communication instead of email. *Extra-Organisational Knowledge Creation/Transfer* - Personal relationship with the tourism promoters is high but no business arrangements for knowledge creation/transfer between the two parties. - Personal relationship with the government is high but no

	business arrangements for knowledge creation/transfer between the two parties. - Reciprocal personal and business relationship with the training institutes is high.
Relational Capital	- Religious norms and values caused to have negative perceptions about the industry that restricts the transfer of knowledge via the skilled and qualified local workforce. - To keep up with the norms of international resorts, and the industry for that matter, the organisation implemented training and IT that resulted in formalized mechanisms for knowledge creation and transfer. - The industry's belief of all the resorts being similar in terms of physical settings, the level of knowledge and skills among workers, and operational activities, does not rationalize the organisation for knowledge sharing with other organizations. - Restriction of inter-organisational knowledge sharing: one-island one-resort concept of the industry shapes a mind-set that influenced the organisation not to trust others and do everything on their own. - Scholarships are provided to the local community by the organisation that enables knowledge creation in the society and in the industry. - The scholars are later recruited by the organisation when their studies are completed that enables knowledge transfer to the organization. - A commitment of providing job opportunities for locals does not benefit the organisation due to the low level of knowledge and skills of the majority of locals employed in the organisation because of the national skill shortages.
Cognitive Capital	- Lack of organisational policies and procedures for human resources, training and IT due to lack of knowledge and skills among employees. - The low level of education among the majority of employees prevents the drive for knowledge acquisition, and therefore relationship building with other resorts for the purpose of obtaining knowledge. - International resorts transferred knowledge about workplace training and advanced IT systems that enabled the organisation to make rational decision for adopting and implementing them. - IT resources are under-utilised due to lack of knowledge and skills to use them.

Table 4. Summary of Three Forms of Social Capital in Relation to the Issues Associated with Knowledge Creation and Transfer in Organisation X

6. CONCLUSIONS

In this paper we have identified the major issues of knowledge creation and transfer in a tourism resort in the Maldives, and considered the role that social capital might play in facilitating the creation and transfer of knowledge in that sector. This case study is typical of others in a larger study, and our preliminary results from those other cases indicate that the situation in Organisation X is representative of the sector. We discussed how three forms of social capital – structural, relational and cognitive – play a role in influencing knowledge creation and transfer in the resort for IT capacity building.

The issue of the lack of cognitive capital in the case study underlines the importance of IT education and training for both the successful use of IT, and effective creation and transfer of IT knowledge. This confirms the need for human resource development in ICT capacity

building for the sector. We further suggest that this capital may be vital for accumulating the other two types of social capital.

While the geographic dispersion of the island resorts impede structural capital building, it is possible that an internet based network could facilitate knowledge creation and transfer across the industry. Another advantage of such a network would be that education and training could be delivered on line to a national standard. This would benefit many tourism organisations that lack in-house training and have to travel to Male', where almost all the training institutes are located, to participate in training for skills development.

The centralised organisation of this resort and others were seen to impede knowledge flow. Electronic mails, organisation-wide intranets and interlinking of integrated information systems are all means for enhancing a flatter management structure which would increase knowledge flow across the organisation. Also, the structural dimension of social capital suggests that it is imperative for organisations to realise that instead of a mere personal relationship, formal collaborative arrangements with the actors in a network are necessary for knowledge creation and sharing to occur. The current negative social capital in the network, based purely on personal relationships and influence, impede the enablement of ICT capacity building in the sector.

The case also suggests the importance of government policies and long term plans to national and workplace training and skills development, increasing IT awareness, and changing the negative societal perceptions about the tourism industry – government has a role to play in enabling the sector.

We believe our findings may be relevant to the study of IT capacity building in organisations of the same or different industries in other developing countries, but obviously national context needs to be taken into account. We see a need for more research in the area of IT capacity building in industrial organisations in other developing countries, looking at how knowledge creation and transfer issues influence IT capacity building in those organisations.

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AN E-COLLABORATION APPROACH TO BUY-IN OF DEVELOPMENT INNOVATIONS IN RURAL COMMUNITIES: A SOUTH AFRICAN EXPERIENCE

Hossana Twinomurinzi

Abstract: South Africa is attempting to rewrite its history as a national heritage of empowered citizens working in close collaboration with the government. Recognising the inherent capabilities in fast-tracking development, ICT is regarded as a critical success factor in delivering development innovations in rural communities. However, the ICT innovations do not include the collaboration element. This paper reports on the effect of an e-collaboration approach in a simulated environment to raise awareness of an act of government within rural communities. The research followed an interpretive paradigm with the researchers as participant observers. The collected data was analysed using elements of the diffusion of innovations theory as a theoretical lens to reveal that e-collaboration can lead to the buy in of government development innovations.

Keywords: Diffusion of Innovations, E-Collaboration, Collaboration Engineering, ThinkLets, Promotion of the Administrative Justice Act, Batho Pele, Multi-Purpose Community Centres, South Africa, Rural Development

AN E-COLLABORATION APPROACH TO BUY-IN OF DEVELOPMENT INNOVATIONS IN RURAL COMMUNITIES: A SOUTH AFRICAN EXPERIENCE

1. INTRODUCTION

South Africa has come out strongly in its development initiatives in a bid to rewrite its recent history reminiscent of institutionalised oppression and forced separation to a national heritage of empowered citizens working in close collaboration with the government. Recognising the mammoth task of changing the deeply seated suspicious attitudes towards government (Twinomurinzi & Phahlamohlaka, 2005), one of the primary government policies is to make public service delivery "people-centered" and "people-driven" (South Africa, 2006). The policy, which is called Batho Pele, is aimed at instigating a collaborative approach to public service delivery which places "people at the centre of planning and delivering services" (ibid) using among others, strategies which are driven by Information and Communication Technology (ICT). One such ambitious government initiative powered by ICT-enabled gateways is the Multi-Purpose Community Centres (MPCC) programme. The MPCC programme is earmarked as a key enabler for implementing development initiatives and to introduce government services in rural communities. The goal of the MPCC programme is to "provide every South African citizen with access to information and services within five minutes of their place of residence within 10 years" (South Africa, 2001). Notwithstanding, the noble task is not without its challenges, the greatest being in adopting the programme within the communities and the community failure to adopt MPCCs (South Africa, 2006). Moreover, whereas ICT is regarded as an MPCC critical success factor, it is one of the other serious challenges facing the implementation of MPCCs in the rural areas (Legoabe, 2004).

These challenges to technological and development innovations should not come as a surprise. The discourse on the role of ICT in development efforts is criticised for being sold by international donor agencies such as the World Bank to developing countries as the silver bullet in sidetracking development hindrances and institutional inertia to leap frog development efforts. Further, the recommendations by the influential bodies to link aid to good governance and good governance to ICT enabled public sectors are misleading (Avgerou, 2003) and on the contrary lead to a new form of dependency on the donor countries (Wade, 2002). Wade (2002) argues that ICT can only be beneficial if it is used as a tool which can be adjusted to combine external knowledge and experiences and adapted within a local context. Much as the role of ICT for development is under critical scrutiny, we cannot ignore the inherent capabilities that ICT has to offer. The hardships and frequently unfulfilled and broken promises from governments and NGOs usually results in negative mindsets for which the process of socialization can be used effectively to sustain investments in rural ICT (Avgerou, 2003; Kanungo, 2004). Development efforts should show a clear relationship between the project and the community not in a "donor-recipient" type relationship but in "partnership in progress" relationship (Kanungo, 2004). The qualities of the ICT for ICT enabled rural development initiatives should be similar to the qualities for rural development goals; local relevance to the community, repeatability, sustainability and predictability (Steinberg, 2003). These qualities can be delivered through a novel e-collaboration approach, collaboration engineering using thinkLets. Collaboration Engineering using thinkLets is an approach where facilitators develop transferable, repeatable and predictable collaborative processes which can easily be adopted and used by practitioners in their local context (Briggs, Vreede, & Nunamaker, 2003).

This paper draws on results from two years of an ongoing six year longitudinal interpretive research into identifying and harnessing opportunities for sustained collaboration and interaction by communities through the use of web-based Group Support System tools within e-government contexts in South Africa. The results to date suggest that the e-collaboration approach when used as an enabler in a role playing scenario which builds on practical examples, can lead to the buy in of government development innovations in rural communities. The research can contribute to proposing a new government approach in collaborative service delivery and also for research in investigating the qualities of ICT for development in rural communities.

The remainder of this paper of this paper is structured as follows. The next section gives the theoretical background of the research from a government development perspective particularly in terms of Batho Pele and the MPCCs towards rural communities. The e-collaboration concept of Collaboration Engineering and thinkLets is introduced and the relationship with the ideals in development goals is elaborated. This is followed by the research approach, design and methodology to collect data. The data is analysed with corresponding discussions through the theoretical lens from elements of the diffusion of innovations theory. The paper concludes with a summary of the key findings, practical implications, limitations, recommendations and areas for further research.

2. BACKGROUND

2.1. Batho Pele and Multi-Purpose Community Centres

Batho Pele is a Government white paper which sets out a belief set and a functional approach to transforming public service delivery to make it service oriented. Batho Pele, a Se-Sotho term meaning "People First", is based on eight citizen-focused principles (South Africa, 2006). It is grounded in three important policy and legislative themes; those that are directed at placing citizens at the centre of public service delivery, those that deal with access to information utilising techniques such as those provided by ICT and those that deal with the transformation of service delivery for efficient administration and good governance (*ibid*). Regardless, for the vast majority of South Africans who live in rural communities, access to government services can be as many as two days away on foot (H. Twinomurinzi & Phahlamohlaka, 2005). Ironically, it is these people who have the greatest need for government services. The government therefore decided to go to the people in the rural communities through the Multi-Purpose Community Centres (MPCC) programme.

Multi-Purpose Community Centres are community service centres which will be based in each district and metropolitan council. The MPCC vision is to have these centres provide at least six key government services which are relevant to the particular community such as social grants, social security pensions, health, education, passports and identity documents (South Africa, 2001). The MPCC programme was initially started in 1998 but slowly fell silent as the years progressed and by 2000 there was almost no mention of it. It is important to note that at the first launch of the MPCC programme, ICT was not considered as a strategic driver. However, by April 2004 the government had renewed its commitment to implementing the MPCC concept adopting ICT as a critical success factor and strategic driver. ICT at the MPCC is integrated in two ways; firstly through a Batho Pele Gateway Portal office where individuals coming to the MPCC must first report; and secondly through a cyber café like extension where computing facilities are commercially made available to the community for training and personal purposes (Twinomurinzi & Phahlamohlaka, 2005).

The Batho Pele collaborative intentions combined with the MPCC are important enablers in changing the deeply seated suspicious attitudes towards government. The intention is for the programmes to reduce government complexity, disseminate information, achieve community consensus and create an air of social acceptance (South Africa, 2006). According to Vreede

(2006) there are three modes of collaborative efforts; collective type efforts where each group member works separately and the results are combined; coordinated efforts where each group member works separately but handover is a critical element and; concerted efforts where all the group members must contribute simultaneously. Basing on the above, the Batho Pele collaborative efforts can be considered as an attempt at a concerted effort. Nonetheless, there is a tendency within communities to avoid such government innovations (Rogers & Scott, 1997). People prefer not to work collaboratively for many reasons such as losses in time and coordination, social conformity, groupthink, fear of being judged, dominance from some group members and due to the information overload that usually occurs (Vreede, 2006).

Batho Pele and the MPCC programme are a good indication of the commitment of the government to engage in collaborative efforts with the public even within the rural communities and to deliver appropriate and better service delivery. But despite the good policy and rural development intentions, the corresponding government efforts are not collaborative; at most they are a one way communication channel from the Government to the public. Anyhow, even if the communications were to be collaborative as intentioned, a concerted collaborative effort between the few government administrators and the vast majority of the South African public is clearly an insurmountable task. There exists a collaboration gap between people in rural communities and the government. Recognising the demonstration by government to harness the capabilities of ICT in the Batho Pele and MPCC initiatives offers good opportunities to investigate other potentially helpful ICT options for the benefit of rural communities. The answer appears to lie in adopting an ICT strategy that facilitates collaborative work; e-collaboration.

2.2.   E-Collaboration: Collaboration Engineering using ThinkLets

E-collaboration as a field of research on its own is relatively new though as a concept, it has been around the public media for a while in an unfocused manner with different groups assigning different meanings based on the audience (Kock, 2005). A fundamental aspect of e-collaboration is the electronic exchange of information with the goal of the participants playing a role in the outcome of the collaborative process (ibid). This paper adopts a definition of e-collaboration from Kock (2005) as "collaboration using electronic technologies among different individuals to accomplish a common task" (pg. i). Although Kock (*ibid*) provides an ingenious framework for e-collaboration, he does not prescribe a method on how to go about it. Historically, most methods of e-collaboration tended to focus too much on the technology and much less on the human interaction (Gopal & Prasad, 2000). Gopal and Prasad (2000) attribute the inconsistent results from e-collaboration studies mainly to the technology-centred focus. Regardless of the results, research on e-collaboration has not abandoned the technology fad predominantly because of the inherent potential capabilities that it promises. Thus, to investigate the opportunities for sustained collaboration and interaction by communities, the research group adopted an e-collaboration approach that takes into account the human and development aspects; Collaboration Engineering using thinkLets (Briggs et al., 2003).

Collaboration Engineering is an approach where facilitators develop transferable, repeatable and predictable collaborative processes which can easily be adopted and used by practitioners (Briggs et al., 2003). Briggs et al (2003) reckon that the fundamental role of Collaboration Engineering (CE) is in training practitioners in the relevant facilitation skills on e-collaboration technology and group dynamics necessary for them to use the e-collaboration technology to create a repeatable collaborative process. They define CE as "an approach for the design and deployment of collaborative technologies and collaborative processes to support mission-critical tasks" (p. 45). For successful CE efforts, there are three critical requirements; a low e-collaboration technology related skills conceptual load (easy computer steps to follow); the e-collaboration technology related facilitation skills need to be packaged such that different practitioners using the same packaging will get similar predictable results

from their groups; the e-collaboration technology facilitation skills blocks must be packaged such that they can be reused easily to create a new collaborative process by re-organising the package blocks. These building blocks called thinkLets are "the smallest unit of intellectual capital required to create one repeatable, predictable pattern of collaborAtion among people working toward a goal" (pg. 46). The thinkLet consists of a collaboration tool, the tool configuration and a script with step by step instructions on how to run it. In order to achieve a goal collaboratively, the participants must follow a reasoning process towards a collaboration pattern. Briggs et al. (2003) adopt and define five general patterns of collaboration; diverge - the group moves from fewer to more concepts; converge – from many concepts to focusing on a few worthy of further attention; organise – from less understanding to more understanding of the relationships among the concepts; evaluate – from less to more understanding of the possible consequences of each concept; build consensus – from having less to having more agreement on courses of action.

Gopal and Prasad (2000) also attribute the inconsistent results in e-collaboration research to the use of positivistic epistemological approaches. A strong criticism of positivistic research is its attempt to transcribe socio-cognitive phenomena into quantitative constructs that can be measured objectively. The positivist stance therefore does not appear to inform this research. Considering the strong social context of the research, the research group adopted an interpretive approach to investigate the opportunities for sustained collaboration and interaction by communities.

3. RESEARCH APPROACH, SETTING & DESIGN

3.1. Research Approach

Unlike positivism, the central ontological focus in interpretivism is the relationship between the researcher and the phenomenon being studied (Nandhakumar & Jones, 1997). Reality is a result of individual subjective interpretations and/or of inter-subjective constructions shared between individuals. Epistemologically, facts and values cannot be separated and knowledge is viewed as ideological serving the interests of particular social groups (Burrell & Morgan, 1979).

Given the dual social and technology focus of the research in understanding social processes and trying to improve them using technology, we followed an action research method. Although the meaning of action research has been used in many different ways depending on the theoretical tradition (Reason & Bradbury, 2001) we adopt the meaning portrayed by Reason and Bradbury (2001, p. xxiv) that action research describes the "approaches in inquiry which are participative, grounded in experience and are action oriented." Through action research the researchers are able to infer new insights into a social system while at the same time attempting to improve it in a quasi-experimental fashion (Kock, 2003, p. 105). The nature of the research as is described in the next section illustrates such an attempt.

Data was collected in different forms; the electronic logs from the e-collaboration technology, observations, video taping, discussions, questionnaires, written feedback and we took minutes and reports and registers for keeping of accurate records. The process is auditable because of the nature of the design through following the notion of a thinkLet. Owing to the space and time limitations imposed on conference paper research reports, the bulk of the research design and setting will not be elaborated on in detail; it will only be briefly described in as sufficient detail to enable a good understanding. The details of the research design and setting are fully described in Twinomurinzi and Phahlamohlaka (2006).

3.2. Research Design and Setting

The research followed the CE approach as a basis for conducting simulation exercises using an e-collaboration technology, GroupSystems®, as the e-collaboration technology tool in a

workshop setting. The aim of the workshops was to raise awareness about the process involved in the implementation of one of the acts of government, the Promotion of the Administrative Justice Act 3 of 2000 (PAJA). The PAJA stipulates the right to procedurally fair, just and reasonable just administrative action to anyone in South Africa and that everyone who has been affected by it has a right to request written reasons. Administrative action is any decision or the lack of a decision which could have a negatively impact on an individual or a group of individuals. There is a stipulated process that must be followed by an affected individual or a group of individuals when requesting the written reasons. There is also a process that an administrator who receives the request for written reasons must follow. The PAJA advocates a concerted collaborative effort between government and the public.

In the simulation exercises, we facilitated the collaborative process between participants using GroupSystems® basing on a real case scenario. The simulation exercises are designed following a uniform set of procedures, support material, case scenario, instructions, duration and facilitation with the goal of being able to create possible repeatable patterns of interaction. We followed the notion of a thinkLet in designing the simulation exercises based on the design illustrated in Figure 1. While maintaining the same process in the simulation exercises, in Workshop 1 to Workshop 3 one real case scenario was used and in Workshop 4 and Workshop 6, a second real case scenario was adopted (Twinomurinzi & Phahlamohlaka, 2006).
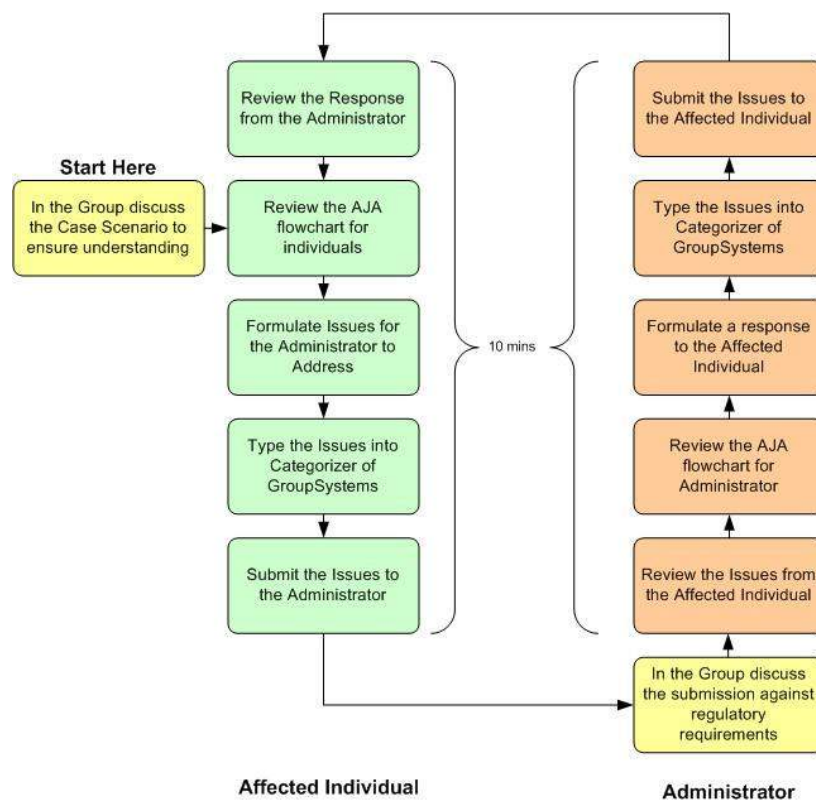

Figure 1. The Simulation Model for the TurnStormer thinkLet (Twinomurinzi & Phahlamohlaka, 2006)

At each workshop, the computer simulations are followed by three research feedback sessions. In the first session, there is a group discussion where the participants, facilitated by the research members, record their experiences of the PAJA while using ICT. For the second session the participants record their experiences individually. At the final discussion, the participants openly offer their personal opinions and observations within the context of the day on anything they wish to comment on. At the close of the workshops a follow on

workshop is requested and planned for with the participants. All participants expressed their willingness to participate as research participants.

Three field locations were chosen which covered four of the nine provinces of South Africa; North West, Limpopo, Mpumalanga and Gauteng. Each of these locations presented a unique social environment. A great deal of consultation and preparation with the community leaders went into selecting twenty participants from within the provincial localities. The leaders from the institutions played a significant role in deciding who the most appropriate participants from within those communities would be based on the criteria we requested. The research sought to have a cross-section of participants ranging from government officials, community leaders, students, pensioners, social workers and those who were likely to attend. Most, but not all participants came as representatives of their organizations. Written invitations that were signed by the research project leader and by the community leaders from within these institutions were sent out to each participant two weeks prior to the workshop. A substantial effort also went into preparing the actual locations for the workshops.

As is consistent with action research, our role in the research was as both participants and as observers (Whyte, 1991).

3.3.   Data Interpretation & Analysis through elements of the Diffusion of Innovations

Theory in interpretive case studies such as this can play a role in providing some insight into the thinking of the researcher about a social phenomena, as a guide to the research approach and as a theoretical lens to interpret and analyse data (Walsham, 2001, p. 8). Walsham (2001) alludes to the fact that there is no theory that can perfectly describe a situation and recommends that elements of a theory which are appropriate to the situation can be borrowed in order to make sense of it. In this report, elements of the diffusion of innovation theory are adopted as the theoretical lens to interpret and analyse the data that was collected. The choice of the Diffusion of Innovation theory suggested by Rogers (1995) was predominantly because of its historical roots in rural sociology research which focuses on the social problems of rural life. Rogers & Scott (1997) describe diffusion as a four stage linear process of communication of new ideas in which ; (1) an innovation (2) is communicated through certain channels (3) over time (4) among the members of a social system.

However, Rogers' linear suggestion of how the four variables come together towards the adoption and implementation of an innovation does not apply to the complex societal mix and collaborative approach that this research is investigating. This report is only able to identify with the characteristics of the four elements as identified by Rogers for the similarities with the thinkLet notion in repeatability, transferability and predictability. The four elements from the diffusion of innovations theory have been shown to be critical for collaborative interactions (Briggs et al., 2003; Twinomurinzi & Phahlamohlaka, 2006) but are lacking in the thinkLet approach. By borrowing these four elements from Rogers, this report defers the criticisms that are targeted at the theory on its prescribed linear adoption and implementation of an innovation without taking into account the social aspects.

4. RESULTS AND DISCUSSION

4.1.   Innovation

Roger and Scott (1997) define an innovation as "an idea, practice, or object that is perceived as new by an individual." In this instance, the innovation is the use of e-collaboration technology in a simulation environment to assist in raising awareness about the PAJA. An innovation has characteristics which determine the rate at which it is adopted. These characteristics are relative advantage, complexity, trialability and observability.

4.1.1. Relative advantage

Relative advantage is the degree to which an innovation is perceived as better than the idea it supersedes. The measure of this can be using economic terms and other social indicators. The greater the perception of relative advantage, the higher the rate of innovation. Against both economic and social indicators, the use of the e-collaboration technology was perceived to have the potential to offer greater benefits. The participants noted that it would make more economic sense to use adopt such an e-collaboration technology to interact with government than the alternative which is to travel to the next government service delivery point, wait in line and hope that the request will be accepted. The participants commented that the e-collaboration if adopted by government could "*save me time and money (travelling expenses)*" and "*I will not used more money for transport, faxing etc*". The social benefit was the most cited with the predominant comment being "*It is a simple way to answer me for my application, because answers comes fast, rather than going there (physically)*", "*Because computer make thing easy and fast, the administrator help people because of the living conditions*". In summary, the e-collaboration experience was perceived to be better than the traditional means of communicating with government.

4.1.2. Compatibility

Compatibility is the degree with which an innovation is socially relevant to potential adopters. Firstly, it is important to note that the research participants were carefully selected to be a good representation of the communities in which we carried out the research. Most importantly though, the entire workshops are built around the PAJA and its implementation which is relevant to the rural social contexts. E-collaboration technology is appropriate for the PAJA as the PAJA entails a constant back and forth movement from people who have requested a government service. For people in rural communities, we introduced the act to them and then allowed to experiment with the technology to communicate with government better basing on a real case scenario. "*I can communicate with the administrator by means of an email, internet because it is the most simplest form of communication especially with people from far places, to get the information easily and fast.*" In summary, CE was socially relevant for PAJA in the rural communities.

4.1.3. Complexity

Complexity is the degree with which an innovation may be regarded as difficult to understand and use. The easier it is, the greater the potential to be adopted. The simulation exercises on the computers were carefully facilitated by the researchers and research group members assisted groups which did not have anyone with typing skills. This was acceptable to all the groups. The groups would then get together and discuss the case, and give a response. For example, we take note of a group which used a research group member to type, "*Computer can speed up the information or details. And is simple way that message can received faster.*" In summary, this approach to assist those who could not type reduced the complexity of using the technology.

4.1.4. Trialability

Trialability refers to the degree to which an innovation may be experimented with on a limited basis. An innovation should be able to have been trial run before it is adopted. If it cannot be trial run, then it is harder to have it adopted. At each of the workshops, it was emphasised that we are conducting research and requested the participants to be as open about there experiences as is possible. We noted that it is their feedback that would enable us to improve the process. The process of building a thinkLet is an iterative one which is dependent on the context. Time is an important factor in developing a thinkLet. In summary, it is possible to do a trial run using another real case scenario.

4.1.5. Observability

Observability is the degree to which the results are visible to others. The easier it is for individuals to see the results of an innovation, the more likely they are to adopt it. Such visibility stimulates peer discussion of a new idea. The simulation was well captured by the participants, several commented at the second workshop that had received opportunities to share about their experience and to leverage their new knowledge of the PAJA as a result of the workshops. Some of the response to whether the members had an opportunity to exercise the PAJA include:

"Yes. One of the members involved in the workshop helped another member also at the workshop, this was in concern of a transfer of a child grant that was transferred to the bank but was paid to a wrong person. The one member went to the another and they reapplied and stop the wrong transaction."

"Yes, one of the participants was personally affected by the AJA and used the principles of the AJA to formulate a program to assist with the implementation of the AJA. Another one of the participants was involved in helping people who were HIV positive to get grants from the government."

In summary, the degree of observability of the e-collaboration experience was high.

Rogers and Scott (1997) reckon that an innovation which is perceived by individuals to have a greater relative advantage, compatibility, trialability and observability and a less degree of complexity, the greater the potential that the innovation will be adopted. The potential that e-collaboration as an innovative tool to lead to buy in of the PAJA is great.

4.2.   Communication Channel

This is the process in which participants create and share information with one another in order to reach a mutual understanding. The communication channel is the means by which messages get from one individual to another. Mass media is good for creating the knowledge about the innovation while interpersonal channels are effective in forming and changing attitudes. The research design in terms of the social setup was such that groups could interact with one another. We used the Categoriser tool of GroupSystems® which is ideal for enabling people communicating with each other to come to a mutual understanding. The groups also allowed interpersonal communication between the participants and from the comments on observability, certainly led to new and changed attitudes. For example, *"The workshop helped one participant by giving her the knowledge of the AJA as well as helping her to transfer the knowledge to her citizens/clients (in this case it was a group of PWAs). It also helped her realise the potential use of technology for implmenting the AJA. Another particiapnt used the knowledge from the workshop to tackle an issue of corruption in her local community.*

4.3.   Time

There are three sub-elements in time; innovation-decision process is an information seeking process where an individual passes from first knowledge of an innovation to forming at attitude toward the innovation, to a decision to adopt or reject, to implementation of the new idea and to confirmation of the decision; innovativeness which refers to the degree to which an individual is relatively earlier in adopting new ideas than other members of a social system; the rate of adoption which refers to the relative speed with which an innovation is adopted by members of a system. This is usually measured by the number of people who adopt the innovation. While "sustainability is a desired goal, rural IS initiatives should not pressure themselves or be pressured into unreasonable timeframes to demonstrate sustainability" and "nurturing collaborative relationships takes time" the same would apply to e-collaboration (Kanungo, 2004). We recognise that this is research in progress.

4.4.   The social system

This is a set of interrelated units that are engaged in joint problem-solving to accomplish a common goal. The social structure and norms affect how an innovation will be accepted. The norms refer to the culture. Opinion leadership is also an important aspect of this element; the extent to which an individual is able to influence informally other individuals' perceptions with relative frequency. As noted earlier, the representative groups consisted of community leaders, ordinary citizens, government workers, NGO organisations. A change agent, who in this case are the researchers, seek to influence other individuals towards what the change agency believes is better, towards PAJA and the potential use of e-collaboration technology to address PAJA related issues. A final critical mass of the social system is the critical mass where enough individuals have adopted an innovation that further adoption becomes self-sustaining; the basis of the thinkLets is designed to create a repeatable and predictable pattern of action which is self-run and self-sustaining within unique contexts.

Figure 2. In Gauteng Province

Figure 3. In North West Province

Figure 4. In Mpumalanga Province (participants from Mpumalanga & Limpopo)

5. CONCLUSION

South Africa is emphatic on its development goals in terms of creating a national heritage of empowered citizens working in close collaboration with the government. It is because of such intentions that the constitution of South Africa is regarded as one of the best in the world (Weinberg, 2004). The use of ICT to fast-track development initiatives at the national level has some challenges most notably the community failure to adopt the initiatives and the inability to correctly harness the ICT being used.

From the results, it comes out that government efforts are still a one way communication channel, from the Government *to* citizens. According to Belanger and Hiller (2006) the collaborative intentions would group South Africa under the e-government category of Government with Individuals (G*w*IS) where a government seeks to establish and maintain a

direct relationship with citizens to deliver a service or benefit through a two way communication.

The results also illustrate that Collaboration Engineering through the use of thinkLets has the qualities which are fundamental to rural development initiatives; sustainability, relevance to local context, predictability and repeatability. Moreover, within a simulated environment in rural communities, the results have shown that a CE approach leads to the buy in of rural development initiatives. .

Based on the field experiences, CE can add value to government development initiatives which are intended for public service delivery. For research, CE could act as a blueprint on how to change attitudes to technology innovations prior to adopting new technologies in rural communities. CE appears to offer an approach to aligning incongruent technological frames (Orlikowski & Gash, 1994).

The limitations of this paper include the rejection of the suggestion in the Diffusion of Innovations theory by Rogers (1995) to prevent users from changing an innovation to better suit their circumstances (Siebeling, 2004) as it does not align with the inherent nature of CE in which adapting a technology for the specific local context carries great significance. It may also be questionable whether this approach is suitable in rural communities in terms of the resources that would be required to run the communication when citizens do not have basic computing skills. For this, we argue that according to the government commitment in terms of the MPCCs and community development workers, there are sufficient resources to operate such technological innovations within rural communities. Additionally, it is not perfectly clear whether the acceptance of the development innovation was a result of the CE experience or the PAJA awareness raising. We make the assumption that since the CE experience formed a crucial part of the workshops, it similarly had a significant impact.

For further research, we note that the process of creating and refining a thinkLet for every social context is a daunting task requiring multiple iterations over an extended period of time. Also, assuming that e-collaboration worked very well in rural communities and was adopted, the next hurdle would be whether the government is ready for the new way of doing work.

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A RURAL-URBAN DIGITAL DIVIDE?
REGIONAL ASPECTS OF INTERNET USE IN TANZANIA.

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Abstract: The digital divide is the gap between those with regular, effective access to digital technologies, in particular the Internet, and those without. The global digital divide is a term often used to describe the gap between more and less economically developed nations, while at the national level, there is often an urban-rural divide. In developing countries, most Internet users gain access through public access points like Internet cafés. In this article, we take a closer look at the digital divide within Tanzania. Based on a survey among Internet café users in rural, semi-urban and central regions of the country, we find that the divide is mainly a question of finding venues with technology to access the Internet. The Internet users and usage at the different sites are surprisingly uniform, with, however, a few significant differences.

Keywords: Digital divide, Internet access, Internet use, Internet cafés, urban, rural, Africa

A RURAL-URBAN DIGITAL DIVIDE?
REGIONAL ASPECTS OF INTERNET USE IN TANZANIA.

1. INTRODUCTION

The global disparities in access to the Internet and other information and communication technologies have led to a "digital divide" between technological haves and have-nots. (United Nations, 2006). The digital divide results from the socio-economic differences between communities, which in turn affects their access to digital information, mainly but not exclusively through the Internet (Wikipedia, 2006).

The digital divide can be categorised as global, regional or national. At the national level, there is an urban-rural digital divide (Rao, 2005). In developing countries in particular, we see clear tendencies of increased concentration of information flows to urban and central areas (Wong, 2002; Mwesige, 2004). Economically disadvantaged countries and rural and peripheral districts within these nations tend to fall further behind in human resource development as well as in economic progress and political participation.

Even if the above presented access oriented definition is commonly used in literature and everyday discussions, the digital divide will not be understood if it is viewed purely as a technological phenomenon. A broader interpretation of the digital divide is necessary. Van Dijk (2006) claims that the term cannot be understood without addressing issues such as digital skills and cultural analyses of lifestyles and daily usage patterns. On the other hand, the great merit of the sudden rise of the term digital divide is that it has put the important issue of inequality in the information society on the scholarly and political agenda.

Expansion of Internet access in poor areas is facilitated by arrangements for public use, such as Internet kiosks, cybercafés, or multipurpose community telecentres (Rogers & Shukla, 2001). The Internet café (or cybercafé) concept has been successfully spread to poor countries mainly because it combines a reasonably priced access to the Internet with the comfortable environment of a coffee house or a bar and the chance to socialise with fellow users and to pick up new knowledge and ideas in computer usage.

Ideally, Internet cafés in developing countries represent reasonably priced access points to sources of information for personal development, business start-up and growth, or political participation and the progress of civil society. Information has become one of the primary inputs in economic processes, and information and information and communication technologies (ICT) gradually become more crucial for the ability of enterprises, communities and individuals to participate successfully in the global economy (Hollifield & Donnermeyer, 2003).

In this article, we take a closer look at the digital divide within Tanzania, a poor developing country in sub-Saharan Africa. Based on a survey performed in rural, semi-urban and central regions of the country, we investigate if there are any differences in quantity or quality of public Internet access points and their use and users. When studying the users, we concentrate on infrastructural, socio-economic, and demographic aspects.

The article is organised as follows. After this introduction, we present an overview of the socio-economic context and the spread of the Internet and Internet cafés in Tanzania. Section 3 presents the theoretical basis and relevant literature, and is followed by an outline of the methodology and data collection in section 4. Our empirical findings are depicted in section 5, and in section 6 we present the conclusions, limitations, and prospects for further research.

2. THE STUDY CONTEXT

Tanzania, a merger of Tanganyika and Zanzibar, is now a multiparty democratic republic. It was firstly formed and became independent from the UK in 1964.

With 37 million people and an area of 945,000 square km, Tanzania remains one of the least urbanised African countries; only 23 percent of the total population live in urban areas. Looking at the Tanzanian administrative regions, Dar es Salaam Region has the highest urban proportion (94 percent), followed by Zanzibar (40 percent) and Arusha Region (31 percent) (Tanzania national website, 2006). There has been a moderate increase in the share of the urban population between 1988 (18 percent) and 2002 (23 percent).

Dar es Salaam, with a population of 2.5 million, is the largest city, the cultural and economic centre, and the former capital of Tanzania. The relocation of the capital to Dodoma has not yet been completed. In addition to Dodoma, six other towns (regional centres) have more than 200,000 people (Tanzania national website, 2006).

According to the national website, 2.3 million people are unemployed, but the majority of people are self-employed and most of the work is seasonal in the agricultural and informal sectors. About 82 percent of the employed working age population is engaged in agriculture. Some national statistics describing Tanzania is depicted in table 1 below.

The population of Tanzania is young and poor. More than 43% of Tanzanians are younger than 15 years, with an average age calculated to 17.7. People in Tanzania can expect to reach 45.6 years, statistically, and one-third of the population is defined as poor. Compared to its neighbouring countries, Tanzania has a relatively high literacy rate. It is worth noticing, however, that the difference in literacy between men and women is large.

Area (sq. km.)	945,087
Population (mill.)	37.4
Labour force (mill.)	19.2
Age structure (%) *0-14 years:* *15--64 years:* *65 -> years*	43,7 53.6 2.6
Life expectancy at birth (years)	45,6
Literacy (%) *(Age 15 and over can read and write)* *Total* *Male* *Female*	78.2 85.9 70.7
GDP; purchasing power parity (PPP) (Billion $)	27.1
GDP (PPP) per capita ($)	700
Population below poverty line (%)	36
Unemployment rate (%)	12.9

Sources: CIA (2006) and Tanzania national website (2006)

Table 1. Country statistics

In Tanzania most people have their own local language; many of them are very different from each other. Kiswahili has become the lingua franca of eastern Africa and is the official

language, spoken by all Tanzanians. From secondary school level, all teaching is in English, the second official language of Tanzania.

The penetration of the Internet in Africa differs from one country to another, depending on each country's government policy, legal and regulatory frameworks, competition among Internet service providers (ISPs), and pricing of telecommunications services. Internet connectivity in each of the world's continents far exceeds that of Africa (Mutula, 2003). Africa with currently 850 million people, about 13% of the world population, had, in 2005, about 2 PCs per 100 inhabitants and an Internet penetration of less than 4% (table 2, below). The global average Internet penetration rate was more than 15% (ITU, 2006). The situation in Sub-Saharan Africa is even worse, and in Tanzania the ITU (2006) estimates the number of Internet users to be less than 1%.

From table 2 we see that the number of Internet users in Tanzania increased from 60 000 to 333 000, or by 455%, in the period 2000-2005. The number of Internet hosts meanwhile increased by 300%. The Tanzania Communications Commission (TCC) has licensed only nine companies to provide data communication services including Internet bandwidth. As a result of their policy, Tanzania lacks cheap and high-capacity connections to the global Internet, while there is a large and increasing demand for Internet access (Tanzania Ministry of Communications and Transport, 2003).

	Year	Internet				PCs	
		Hosts	Hosts per 10,000 inhab.	Users (000s)	Users per 100 inhab	Total (1000)	Per 100 inhab.
Tanzania	2001	1,478	0.44	60.0	0.18	120	0.36
	2005	5,908	1.57	333.0	0.89	278	0.74
Africa	2005		4.92		3.72		2.24
World	2005		421.63		15.17		13.38

Source: ITU (2006).

Table 2. Internet use and PCs

Privately owned Internet cafés increasingly represent opportunities for ordinary people in economically poor areas to access the Internet. In such venues, computers are made available at various rates and connection speed, enabling regular or occasional customers to search for information and make electronic connections with others via e-mail and chatting. Internet café employees normally provide valuable guidance in Internet use and information access to inexperienced users. The fact that mainly operational costs are incurred in the payment for Internet use represents a huge advantage in economically poor contexts. Fixed costs from the purchase of equipment and leased lines are left to the business owners and only charged to the users according to the time spent on-line. In other developing countries, like Indonesia, India and Peru, more than two thirds of Internet users gain access through Internet cafés (Kristiansen et. al., 2003; Boase et al. 2002; Haseloff, 2005). Policy documents indicate that Internet cafés are the main means of Internet access in Tanzania as well (Tanzania Ministry of Communications and Transport, 2003).

Other sources of Internet access in developing countries are telecentres or multiple purpose community telecentres. The differences between telecentres and Internet cafés are mainly related to ownership, financing, and variety of services. Telecentres operate mostly as 'not-for-profit organisations', relying on various sources of external funding. In Tanzania there are only a few telecentres and we have chosen not to include them in this study.

There are no reliable statistics on the number of Internet cafés in Tanzania. Tanzania Ministry of Communications and Transport (2003) stated that the number was above 1000, while other sources estimated 300-400 some years ago (SIDA, 2001). Chachage (2001) estimated the number to be about 100, and other sources (e.g. web-directories and our own experience) indicate that 300 is an upper limit today, with the majority of them located in the commercial centre of Dar es Salaam. Due to high infrastructure prices and tough competition among them, it seems that the number of Internet cafés has decreased over the last 3-4 years.

The Internet café fee is more or less standardised over the country. Except for the most central and business oriented areas in Dar es Salaam, and special tourist sites, like the Kilimanjaro area and Zanzibar, the price is Tsh 500, or USD 0.5 per hour.

3. LITERATURE REVIEW

The digital divide is essentially a geographical division, and can be categorised as global, regional or national (Rao, 2005). The global digital divide is a term often used to describe disparities in opportunity to access the Internet between wealthy and poor nations, or between developed and developing countries. The extension of infrastructure for the use of the Internet in developing countries has generally been much slower than in economically rich parts of the world. This is mostly due to low demand and thereby low profitability of ICT businesses. The disparity in the intensity of ICT adoption among countries is wider than the disparities in their GDP per capita, indicating that the digital divide is also increasing and likely to become even more severe in the future (Wong, 2002).

At the regional level, Africa is in a particularly bad condition. According to the UN ICT Task Force (2002), the digital divide is at its most extreme in Africa, where the use of ICT is still at a very early stage of development compared to other regions of the world. Sub-Saharan Africa remains at the bottom of the list of developing regions in Internet usage surveys around the world and we will, for instance, see that Sub-Saharan Africa have only one-third of the Internet penetration compared to North Africa or one-thirtieth of the European penetration (ITU, 2006).

In developing countries, in particular, we see clear tendencies of increased concentration of information flows to urban and central areas (Wong, 2002; Mwesige, 2004). Economically disadvantaged countries and rural and peripheral districts within these nations tend to fall further behind in human resource development as well as in economic progress and political participation and thus widening the intra-country or national digital divide.

In academic literature, we find many articles covering the global and regional digital divide, in particular describing the gap between more and less industrially developed nations (e.g. James, 2005; Wade, 2004; Warschauer, 2003; Lucas & Sylla, 2003; Norris, 2001). Some authors, like Gyamfi, (2005) cover the regional aspect of the digital divide in Sub-Saharan Africa, while there are very few papers dealing with the intra-country digital divide, in particular in Africa.

Even if the above presented access oriented definition is commonly used in literature and everyday discussions, the digital divide will not be understood if it is viewed purely as a technological phenomenon. A broader interpretation of the digital divide is necessary (Joseph, 2001; De Haan, 2004; Rao, 2005). In line with this, Van Dijk and Hacker (2003) claim that the extent and the nature of the digital divide and information inequality depend on a multifaceted concept of access, where they distinguish between four kinds: "mental access", "material access", "skills access", and "usage access". While the public opinion and public policy, so far, have been strongly preoccupied with the second kind of access, lack of computers and network connections, they have observed that access problems of digital technology gradually shift from the first two kinds of access to the last two kinds.

Kling (1999) argued that Internet use is a question of social as well as technological access. Technological access refers to infrastructure and the physical availability of computer hardware and software, while social access refers to the mix of professional knowledge, economic resources, and technical skills required for the use of ICT. Chen & Wellman (2004) were looking at Internet use in eight countries: UK, US, Germany, Italy, Japan, Korea, China and Mexico. Across these eight countries, socioeconomic status, gender, life stage, and geographic location significantly affected people's access to and use of the Internet. The study reveals that Internet users are more likely to be well-off and better educated than non-users and, that men are more likely than women both to access and to use the Internet regularly. In both developed and developing countries, the Internet penetration rate among younger people is substantially higher than that among older people. Students who can get online via school connections make up a big share of Internet users in developing countries, and geographic location also affects access to and use of the Internet, with more affluent regions having higher Internet penetration rates than poorer ones. Moreover, the intersection of socioeconomic status, gender, age, language and geographic location tend to increase the digital divide in mutually reinforcing ways within and between countries. The largest gap is between better-educated, affluent, younger, English speaking men in developed cities and less-educated, poor, older, non-English speaking women in underdeveloped rural areas.

Rao (2005) highlights India in the context of digital divide by discussing its infrastructural bottleneck that includes electricity, IT penetration, teledensity, and Internet industry. Within India, some states are more digital than others and within a state, there is an urban–rural digital divide. Within urban areas, there is educated–uneducated digital divide and amongst educated there is a rich–poor digital divide.

This broader interpretation of the digital divide also contains a cultural dimension. Mosse and Sahay (2003) tell that attempts to deploy ICT in Mozambique face critical problems due to a variety of constraints ranging from inadequate infrastructure to manpower shortages, to a culture that does not yet value the "efficient use of information". Van Dijk (2006) claims that the digital divide cannot be understood without addressing issues such as attitudes toward technology, the channels used in new media diffusion, educational views of digital skills, and cultural analyses of lifestyles and daily usage patterns. He has studied the digital divide research during a period of time and states that the deeper social, cultural, and psychological causes behind the inequality of access have not been addressed so far.

According to UN ICT Task Force (2002), in Sub-Saharan African countries, the divide between urban and rural areas is even greater than in the rest of the world. Most of the services and users are concentrated in the towns, while the majority of Africans are scattered in small communities spread-out across vast rural areas. Very limited diffusion of the telecommunications networks into rural areas (often over 75 percent of the country's telephone lines are concentrated in the capital city) and irregular or non-existent electricity supplies are a common feature and a major barrier to the use of ICT, especially outside the major towns.

Kasusse (2005) has investigated the strategies of bridging the digital divide in Tanzania's neighbouring country, Uganda. Even as communication barriers fell, he found that new divides had emerged and Internet access, though certainly affordable to the middle class in the urban area of Kampala, is still mostly non-existent for the 90% of Ugandans who live away from Kampala. This shows that the digital divide is not only a hardware divide regarding telephone lines and computers. It is also a mental divide, defined by illiteracy, command of English, and feelings of ease and familiarity with these technologies.

Even if we agree in a broad definition of the digital divide concept, the first step in the direction of bridging the digital divide in a country is to provide access to the Internet in rural areas. In developing countries, most Internet users gain access through public access points

like Internet cafés (Kristiansen et. al, 2003). In China, Liang & Ning (2004) predicts that Internet adoption in smaller cities will continue to grow with the popularization of Internet cafés. Mathur & Ambani (2005) claim that private profit-making institutions, like cybercafés, can develop solutions to capture the hitherto unrecognized markets, make profits, and at the same time provide aid to the rural societies in India. From Malaysia, Alhabshi (2004) reports that in an area, which is politically marginalized and physically ignored, the digital divide is bridged by way of structurally poor and financially weak cybercafés. In a study of cybercafé industry in Africa, Mutula (2003) states that they have become important access points for a majority of Internet users.

This basis of theoretical and empirical studies will be used in the upcoming analysis of Tanzanian data to investigate if there are any differences in quantity or quality of public Internet access points and their use and users. When studying the users, we have concentrated on infrastructural, socio-economic, and demographic aspects.

4. DATA COLLECTION AND METHODOLOGY.

This paper is based on recent surveys of users of Internet cafés in five towns in Tanzania (see map, figure 1 below). Previous in-depth interviews with business owners as well as with users prepared the ground for developing a questionnaire in the Kiswahili language. Draft versions of the questionnaire were tested on a number of respondents before the final version was decided. The questionnaire has formed the main research instrument for this study.
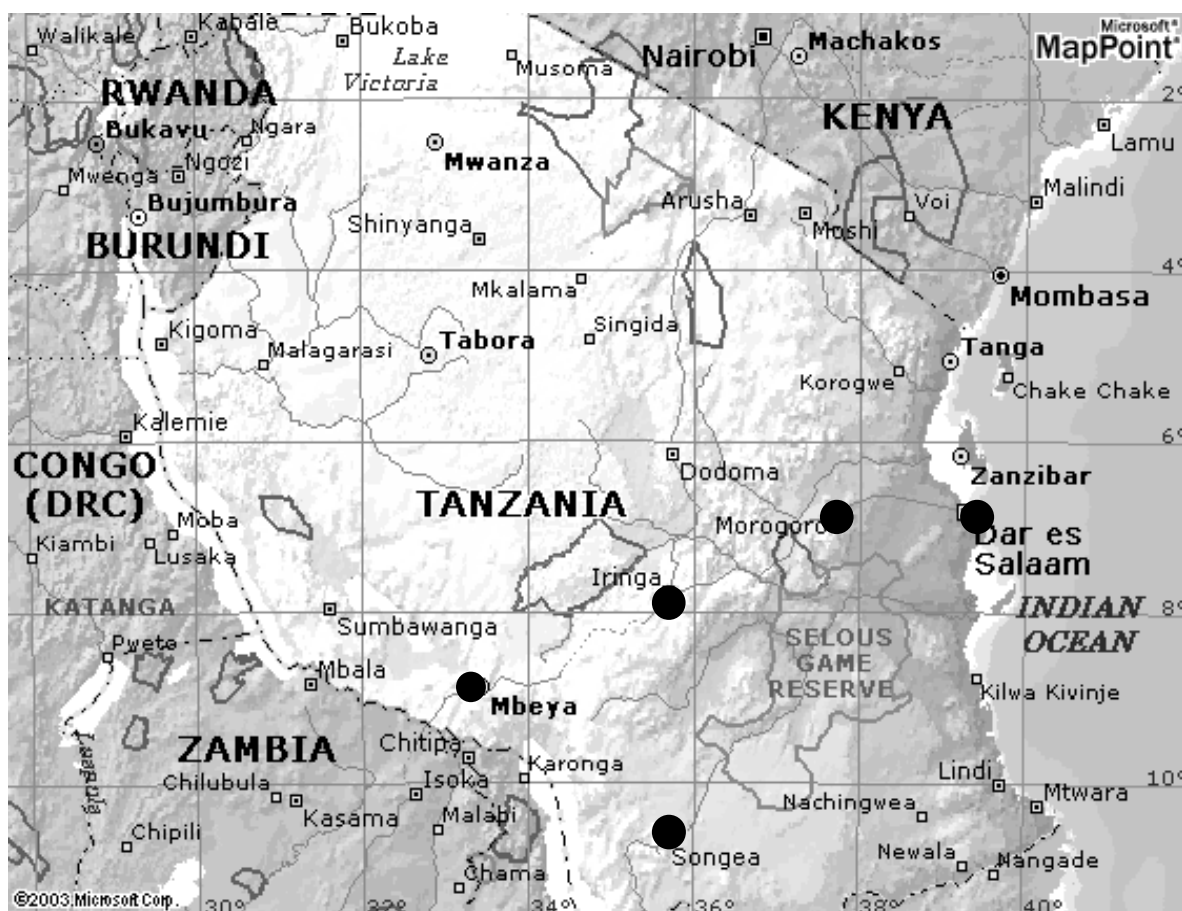

Figure 1. Tanzania – research sites

The survey was executed during two periods in 2004. In January/February, the survey took place in three rural regions, Iringa, Mbeya, and Songea in the south-western part of the country, along the main road from Dar es Salaam towards Malawi and Zambia. The three regions have between one and two million inhabitants (see table 3, below). The distance from Dar es Salaam is between 500 and 1000 kilometres. All the seven Internet cafés we visited

were found in the regional centres (towns), three in Mbeya, three in Iringa, and one in Songea. This resulted in a sample of 63 respondents. In September 2004 we carried out the second phase of the survey in Morogoro and Dar es Salaam. Morogoro region, about 200 km east of Dar, between Dar and Dodoma, has a population of 1.7 million and 260,000 people in the regional centre. The town has some industry and a number of educational institutions, including two small universities. We collected 41 questionnaires in four of the six cafés in town (no selection criteria) from all customers, at different time (morning and afternoon) on two days. Dar es Salaam is the biggest city in Tanzania, with 2.5 million people. Through our own mapping, combined with various other sources, we have registered 61 Internet cafés, mainly in the Kinondoni and Ilala areas. From this list, we selected 12 of the cafés, based on an even distribution across the two areas. In some cases, we did not get permission to distribute questionnaires to the customers from the managers, and then we went to the next, nearby café. Half of the cafés were visited in the morning, half in the afternoon. All customers present were asked to fill in the questionnaire and all together 161 valid answers were collected in Dar. The total number of respondents is 265.

Region	Population	% urban pop	# ICs	People per IC
Dar es Salaam	2 497 940	94.00	61	40 950
Morogoro	1 759 809	13.00	6	293 302
Iringa-Mbeya-Songea	4 682 545	10.78	7	668 935

Table 3 - Tanzania regions, population and number of inhabitants per Internet café.

Dar es Salaam is a typical urban and geographically central region, while Iringa, Mbeya and Songea are rural and geographically distant. Based on the geographical position, the infrastructure and the public services, we have classified Morogoro as semi-urban in this regard.

In examination of survey data, we have used simple statistical analysis. A number of additional in-depth interviews with customers in Morogoro and Dar es Salaam have helped us in interpreting statistical findings. In our statistical analyses, we investigate a number (ten) of variables across the three levels of rurality, namely age, gender, education, employment, financial capacity, Internet café expenses, personal capability (skills and knowledge), Internet café use frequency, Internet experience, and access flexibility. The variables are identified on the basis of the literature review and previous empirical findings and they are operationalised as follows.

The operationalisation of variables like *age* and *gender* is obvious. For the *education* variable, we make the distinction between three levels, namely elementary, high school, and university. In the analyses, we count the number of years in schooling. For the *employment* variable, we make a distinction between the following categories: student, self employed, government employee, private company employee, and unemployed. *Financial capacity* and *Internet café expenses* are measured by respondents' reported monthly expenditures (in Tanzanian shillings, Tsh). *Skills and knowledge* is measured by the respondents' perception of their own skills and knowledge in computer and Internet usage and English language proficiency (1=beginner, 5=advanced) and *personal capability* is the sum of the three numbers. *Internet café use frequency* is measured as the number of days per month the user reports to visit an Internet café and the hours spent per visit. *Internet experience* is measured as the number of years since the respondents started using the Internet, and, at last, the *access flexibility* is measured by the number of various venues through which the respondents report that they can access the Internet. A number that is higher than 1 means that a respondent has access to the Internet in other venues than Internet cafés.

5. EMPIRICAL FINDINGS AND DISCUSSION

Based on the literature review, we find it suitable to group the digital divide into 4 categories: Infrastructural, socio-economic, demographic, and cultural. The infrastructural digital divide is the basic one, dealing with physical access to ICT resources and to the Internet. The socio-economic category is about financial, educational and geographical conditions, while ordinary demographic dimensions, like age, gender, marital status, and ethnicity constitute the third group. The cultural category is difficult to define exactly, but it consists of elements like motivation, attitudes (for example to information and technology), and religion. In this paper, we have looked at the first three categories, when studying the Internet café users.

There is a very clear geographical digital divide between urban and rural areas in terms of public internet access points, and access to the Internet. Table 3, above, shows that there are 16 times more people per Internet café in the rural regions of Iringa, Mbeya and Songea compared to urban Dar es Salaam, and in the semi-urban region, Morogoro, there are 7 times more people per café.

On the other hand, we found that the use and users of the cafés in the three different areas are remarkably uniform, which, to some degree, question the described socio-economic or demographic aspects of the digital divide between urban and rural parts of a developing country. Out of ten investigated variables, only three (gender, age and total monthly expenditure) significantly differ across levels of centrality. There are, however a few other, smaller, differences, worthy of commenting.

The descriptive statistics in table 4 show that the semi-urban users are youngest, and also the rural users are younger than the urban users in Dar es Salaam. This combined with the lower share of students in Dar es Salaam, shows that young people, and in particular students represent a main user group in rural areas. This is in accordance with a study from Indonesia which states that the early Internet café market in developing countries is characterised by students and "youngsters" (Wahid et. al., 2004). It also supports the "life stage divide", pointed to by Chen & Wellman (2004).

Looking closer to the combination of the users' profession and the number of alternatives for Internet access, we see that there is a high portion of governmental employees among the rural users, while very few of those users have alternative Internet access at their work place. This confirms the SIDA (2001) assertion, that the level of automation (in the governmental sector) is low and is exacerbated by shortage of skills, equipment and money.

While the female share of the Internet café users is close to 40% in the urban areas, it is only 25% in Iringa, Mbeya and Songea. These numbers illustrate the difference in public participation between the two genders in developing countries in general, and in rural areas in particular, indicating that there is a "gender digital divide" within Tanzania.

The users' financial status, represented by their own stated monthly expenditure, shows a significant and interesting difference between the rural and the urban/semi-urban regions. The rural users have only one third of the purchasing power compared to the two other groups. At the same time, they spend almost the same amount of money on Internet café fees. One probable explanation is the informal economy in the rural, agriculture based areas. Due to an extensive barter economy, people neither have, nor need cash to the same degree as in the urban regions. This is, of course, a serious limitation to the spread of commercial Internet café business to these areas.

	Dar es Salaam	*Morogoro*	*Iringa, Mbeya, Songea*
Number of respondents	161	41	63
Gender distribution (%, male/female)	61.0/39.0	62.2/37.8	74.6/25.4
Age (average, years)	27.6	24.1	25.7
Education (%)			
Elementary	10.8	0.0	3.2
High school	56.4	69.7	65.1
University (diploma/Bachelor/Master)	32.8	30.3	31.7
Education (average, years)	11.55	11.73	11.68
Employment (%)			
Students	32.1	50.0	6.0
Self employed	20.1	2.8	11.1
Governmental	8.8	2.8	15.9
Private company	28.3	38.9	14.3
Unemployed	10.7	5.6	12.7
Monthly total expenditure (average, Tsh)	247,515	248,170	85,454
Monthly spending in Internet cafés (average, Tsh)	12,016	13,980	11,642
Skills and knowledge			
Computer knowledge	2.7	2.4	2.7
Internet knowledge	2.8	2.9	2.9
English proficiency	3.3	3.5	3.9
Personal capability	8.80	8.76	9.39
Internet experience (average, years)	4.84	4.44	4.00
Internet café use frequency (hours per month)	22.9	27.6	20.7
Number of visits (days/month)	12.7	13.8	13.8
Time spent per visit (hours)	1.8	2.0	1.5
Alternative places to access the Internet (%)			
home	5.0	9.8	6.3
at work place	17.4	22.0	6.3
at school/university	11.8	14.6	15.9
Access flexibility	1.18	1.34	1.19

Notes: 1 USD = 1,050 Tanzanian Shillings (Tsh).

Table 4 Descriptive statistics – the IC users

As presented in table 4, the users' educational level is remarkably similar. The average number of years in school varies by less than two percent over the three regions. Around one-third of the users, with marginal difference between rural and urban areas, have got some university education. The main impression is that the Internet café users are well-educated, which is also well documented in the literature (e.g. Chachage, 2001; Mwesige, 2004; Haseloff, 2005).

The personal capability value is a little higher for the rural users, mainly due to their perception of their own English language competence. The difference is, however, not statistically significant and has no obvious explanation other than random variations.

The semi-urban users from Morogoro are more frequent users of Internet cafés than rural or urban users. The difference is marginal, however, and is in accordance with the monthly spending on Internet café fees. The use frequency has a remarkably minimal variation across the three sites, even if the rural users have considerably less money to use.

We are a little surprised by the lack of variation in access flexibility. It is generally low. On average, the number of alternative places to access the Internet is very similar over the three sites, even if there are some differences between the access possibilities at work. This indicates that, except for the Internet café density, there is no difference in people's chance of finding places to use the Internet.

Next in our analyses, we investigate if there are any differences in type of use between the three research sites. The popularity index (table 5) is based on questions in the survey regarding the importance of various forms of use during respondents' current visit in the Internet café. The users ranked the 13 alternatives by number 1 to 13 (1=most important), and the table is the result of the average values from the users' rankings. The correspondence between the three rankings is more striking than the differences, showing that the use of Internet cafés seems rather uniform across the levels of centrality. It is worth noticing, however, that communication (e-mail and chatting) are ranked higher in the urban and semi-urban regions, while information searching activities (information seeking, research, and reading news) are all together the most popular rural activities. The reason for the lower communication ranking in the rural regions might be the low number of Internet users in that area. People in Iringa, Mbeya and Songea have fewer people to communicate with, on the net, than people in urban parts of the country.

Internet service	*Dar es Salaam*	*Morogoro*	*Iringa, Mbeya, Songea*
Email	1	1	5
Information seeking	2	2	1
Chatting	3	3	4
Research	4	4	2
Reading online news	5	6	3
Downloading software for professional use	6	7	8
Computer games	7	9	10
Downloading music	8	5	6
Downloading software for amusement	9	8	7
E-shopping	10	11	11
Doing business	11	13	13
Visiting pornographic sites	12	9	12
Gambling	13	12	9

Table 5.

Ranking of Internet services used in the Internet cafés.

In their research from Indonesia, Wahid et al. (2006) have found that the purpose of Internet usage in Internet cafés change over time. With higher education, there is a tendency to use the Web access in Internet cafés for more 'serious' purposes. Also our data reveal that well educated people in the rural areas use their Internet access for more instrumental purposes, like information seeking and research.

6. CONCLUSIONS.

The Internet users in Internet cafés are surprisingly uniform over the three levels of centrality. We can see, however, some small traces of difference between urban and rural Internet users, in the way that the users are becoming more "elite" in the rural regions, where access is scarce. Rural users tend to be younger, better educated, and they are willing to spend relatively more money on Internet use. They are also, to some degree, using the net for more "instrumental" purposes, like research and information seeking. Another, more obvious difference, is the "gender divide" – showing that the share of female users is considerably lower in rural regions.

Our study tells that the digital divide within a developing country like Tanzania is first and foremost a question of differences in the possibility of access to the Internet and ICT in rural and urban areas. It is mainly a technological divide but the problems when it comes to bridging this divide seem to be a combination of political and financial obstacles. Our policy recommendation is therefore to make the conditions favourable for entrepreneurs and organisations to set up public Internet access points, and to give people in rural and geographical distant regions the same necessary qualifications to utilise the Internet for their own human development, and thus bridge the divide.

A limitation in our study is the lack of information about non-users. To expand the knowledge of the digital divide within countries, we need to know more about the "have nots", the people that are not using the Internet and ICT today. Therefore, this study might be followed up by collecting data from a sample of non-users in the same social and economical contexts as the users, and even from areas with no Internet access at all.

In general, we have found it suitable to group the digital divide concept into four categories, infrastructural, socio-economic, demographic, and cultural divide. Even if we mainly have studied the first three groups, we are aware of the cultural aspects and see that studying this dimension as a next step, might bring us into an uncovered and interesting field of research.

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REVISITING THE ROLE OF ICT IN DEVELOPMENT

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Abstract: It is now widely accepted that Information and Communication Technologies (ICT) have an important role in national development. However, the nature of the link between the two remains unclear. Much of this state is due to lack of clarity on how ICT is conceptualized in this context.   While some conceptual frameworks have been proposed, they lack important aspects that can give a more comprehensive picture. In this paper, we attempt to further clarify how ICT is conceptualised in development. Using secondary data, we evaluate two conceptual frameworks that bring together the range of views of ICT, their manifold impacts, and the assumptions and perspectives of the range of actors in any given development project that involves ICT. The specific case we examine is an e-Government initiative called e-Seva in the Indian state of Andhra Pradesh. We found that even when using the two frameworks in conjunction, many aspects of the ICT initiatives remain unclear. We suggest ways of combining different frameworks to provide a sharper lens to give us a better understanding of why ICT for development projects may fail or succeed.

Keywords: ICT, national development, e-Government, conceptual frameworks, ICT in development paradigms.

REVISITING THE ROLE OF ICT IN DEVELOPMENT

1. INTRODUCTION

While the developmental potential of information and communications technology (ICT) has been widely discussed in the literature (for example, Heeks and Arun, 2006; Madon, 2005; Bhatnagar and Schware, 2000; Avgerou, 1998), we still lack conceptual clarity on the role of ICT in national development (Sein and Harindranath, 2004). Indeed we argue that the extent of success or failure of ICT interventions to enable development will depend on how national and local governments, national and international development agencies, non-governmental organisations and public agencies conceptualise ICT and development.

There have been some recent attempts to conceptualise ICT in the context of development (Sein and Harindranath, 2004; Wilson and Heeks, 2000; Licker, 1998). Of these, the framework by Sein and Harindranath (2004) takes a comprehensive view by combining concepts from the development and information systems literature to describe how ICT should be viewed, used and what effect to observe. However, this model does not say 'who' will do this. In other words, who should conceptualise ICT within a given development initiative?

Clearly, there is a need to further clarify the way we conceptualise the role of ICT in development. In this paper, we attempt to do so by using the Sein and Harindranath (2004) framework in conjunction with concepts of ICT in development paradigms and associated actor roles as identified by Sein (2005). We evaluate these two frameworks by using them to examine the e-Seva project, an electronic government initiative In India.

The rest of this paper is organised as follows. In the next section, we discuss the two key theoretical approaches we use in this paper: first, the framework by Sein and Harindranath (2004) conceptualising the role of ICT in national development, and second, the framework by Sein (2005) that categorises paradigms of ICT in development to illustrate the perspectives of the various actors. The section that follows presents and analyses the e-Seva initiative. This is followed by a discussion of the implications of our analysis for the theoretical frameworks used in this study. We conclude by offering some suggestions on how different frameworks can be used to understand the role of ICT in development

2. CONCEPTUALISING ICT IN THE DEVELOPMENT CONTEXT

2.1. An integrative framework for ICT use, views, and impacts

The framework developed by Sein and Harindranath (2004) presents three different conceptualisations of ICT: its use, how it is viewed and how it impacts development (see Figure 1).

With regard to ICT use, they draw at least four different conceptualisations of the use of ICT in national development from the literature: as a commodity, as supporting development activities, as a driver of the economy, and directed at specific development activities.

With regard to how ICT is viewed, they use the classification of the ICT artefact proposed by Orlikowski and Iacono (2001) in terms of four different conceptualisations: tool view, computational view, ensemble view, and proxy view. They then argue that these views of ICT represent a hierarchy when applied in the context of national development.

With regard to impact of ICT on national development, they use the framework proposed by Malone and Rockart (1991) and adopted by Sein and Ahmad (2001) in the context of ICT and

national development. This model posits that new technologies impact society through three effects: the first order or primary effect (i.e., simple substitution of old technology by the new), the second order or secondary effect (i.e., an increase in the phenomenon enabled by the technology) and the third order or tertiary effect (i.e., the generation of new technology-related businesses and societal change).

The three conceptualisations presented above in terms of ICT use, ICT views, and ICT impact can be seen to affect national development (see Figure 1). Firstly, they argue that the manner in which ICT is viewed represents a hierarchy in that the tool and computational views, while essential for understanding the ICT artefact, do not have much developmental impact. They argue that we need to move up from the tool and computational view to the ensemble and ultimately the proxy view, where the proxy view is defined in terms of knowledge creation. Secondly, they state that the manner in which ICT is used categorise how different types of ICT-related development initiatives can be applied to affect development. Thirdly, although the impact concept has a hierarchy by definition (i.e., the tertiary effect of a new technology has a greater impact on society than the secondary effect), they emphasise that the primary and secondary effects are necessary conditions for development, but not sufficient. They argue that we need to look at the tertiary effects for an understanding of ICT influence on national development which they conceptualise in terms of human development.
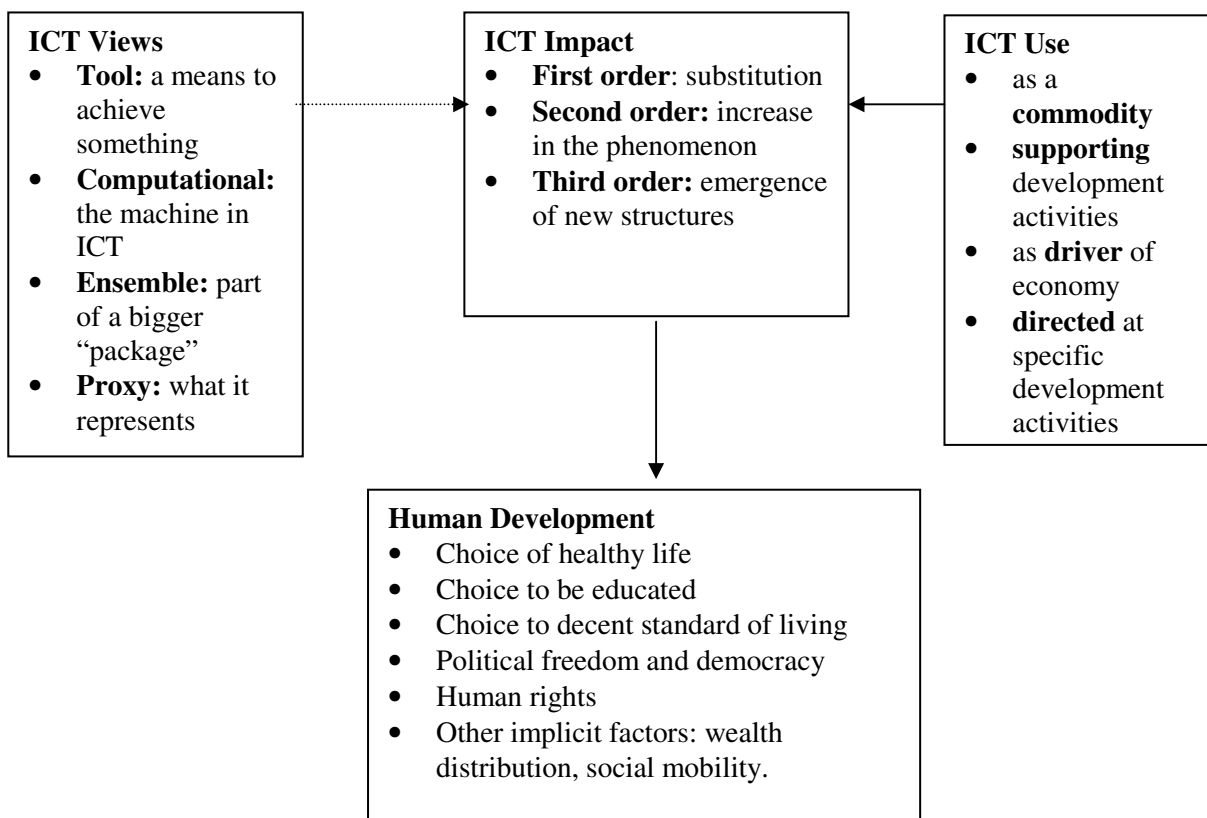

Figure 1. Integrative framework of ICT in development (source: Sein and Harindranath, 2004)

While the Sein and Harindranath framework aims to describe how ICT should be viewed, used and what effect to observe, it does not ask who the primary actors are in the ICT for

development process. For example, who should conceptualise ICT, or who should observe the effects? Second, it does not question the ideologies and logic behind the behaviour of these actors. In other words, what motivates or propels them to take these perspectives?

2.2. Paradigms of ICT in development

To gain some insight into these questions, we turn to Sein (2005) who argues that ICT is not neutral and that the paradigmatic premises of the ICT intervention affect the outcome. Based on IS literature, Sein proposes four different paradigms of ICT in development: functionalism, social relativism, radical structuralism and neo-humanism (see Figure 2). The paradigms result from the intersection of two axes: epistemological (view of application of ICT) along the horizontal axis and ontological (view of development) along the vertical axis. At the objectivist end of the epistemological dimension, ICT is seen as neutral and applicable in a context-free manner, while at the subjectivist end, ICT use is seen as situated and that its exact meaning depends on the context in which it is used. The ontological axis is anchored at one end by "order" exemplified by the developed world - stable, orderly and functional. Development means moving to this desired state, which is the modernisation perspective of development. At the "conflict" end, the view is of a world in constant state of flux and conflict. Development then is contextual with each country taking a unique path to development. This is termed the "alternative" view of development (Black, 2002). A combination of these two axes gives the four paradigms.
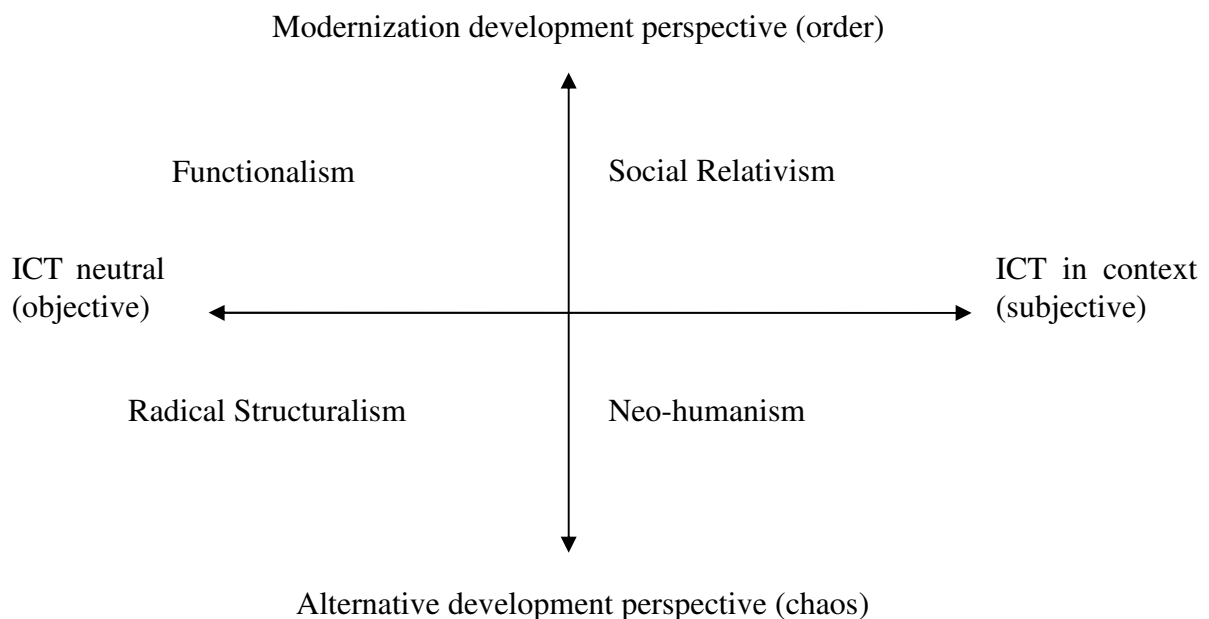
Modernization development perspective (order)

Functionalism   Social Relativism

ICT neutral   ICT in context
(objective)   (subjective)

Radical Structuralism   Neo-humanism

Alternative development perspective (chaos)

Figure 2. Paradigms of ICT in development (source; Sein, 2005)

2.2.1. Functionalism: modernisation perspective of development and neutral view of ICT

The main actors or roles in this paradigm are foreign experts from donor agencies who are the main drivers of the ICT intervention. The government of the host country takes a relatively passive role. Examples of this paradigm are projects aimed at reducing the digital divide, capacity building and infrastructure building. It is arguably the most common paradigm in ICT for development. ICT is viewed as a tool and often becomes the end instead of a means

towards development. Other criticisms include the danger that ICT can be a mechanism of control if existing social order prevails and increase the dependency of the underdeveloped countries on the donor countries.

2.2.2. Social relativism: modernisation perspective of development and situated view of ICT

The main actors or roles here are still from outside but are termed more as facilitators than as consultants. The host country is represented by an agent or representative of the local population (often an NGO) who is viewed as a partner. Examples include more "egalitarian" aid programmes such as the Norwegian agency Norad's support for cooperation between Norwegian universities and universities of the "south". ICT is viewed as an ensemble but the development perspective is still modernisation albeit with a "human touch". This paradigm is vulnerable to "covert" control through subtle implants of ideological meaning. It is also considered analogous to the debate surrounding appropriate technology which is uncritical of the potential dysfunctional side effects of using particular tools and techniques.

2.2.3. Radical structuralism: alternative perspective of development and neutral view of ICT

The main actors or roles here can be either from outside or inside the host country in the form of activists or partisans for the "exploited" class. As Sein (2005) described it, it is best understood through the debate on call centre outsourcing which is either hailed as a great success story or as exploitation (developed world dominating the developing world) depending on the stance one takes. ICT is used as a commodity. In the heat of the often rancorous debate, potential possibilities of ICT are often overlooked and a search for a win-win situation does not occur.

2.2.4. Neo-humanism: alternative perspective of development and situated view of ICT

The main actors or roles here come from within the host country in the form of activists whose aim is emancipation. Academics can also take this role. While not providing an overt example, Sein (2005) mentioned such initiatives as knowledge networks, e-Democracy, locally developed software by local personnel for local needs and the so-called South-South initiatives (e.g. open source based development). More recent "social outsourcing" projects (Heeks and Arun, 2006) such as Kudumbashree in the state of Kerala in India, come much closer to the tenets of this paradigm. The development perspective is often human development.

2.3. Using the frameworks to examine ICT-linked development initiatives

Taken together, the insights provided by the frameworks discussed above can serve as a powerful interpretive lens that helps us in our effort to understand and explain the relative success or failure of ICT for development projects and initiatives. The Sein and Harindranath (2004) framework conceptualises the role of ICT in development. Sein's concepts of paradigms, the actors and their paradigmatic assumptions complement Sein and Harindranath's framework by focusing on the volitional and motivational aspects of the actors involved.

To illustrate, we examine an area in which ICT's developmental potential has been widely recognised, namely, electronic government (Madon, 2005; ADB, 2002). A detailed review of the role of e-Governance in development is beyond the scope of this paper. Instead, we refer the reader to Heeks (2001) for a treatment of the topic in general and to Madon (2005) for an examination of the both the general area and the Indian context. The specific case we examine is e-Seva, the much heralded system implemented in the state of Andhra Pradesh in India. Our data was secondary consisting of published cases, government and agency reports and

evaluations. Our purpose here is not to analyse the e-Seva case per se but to evaluate the usefulness of our frameworks in this regard.

3. e-SEVA

3.1. Case description

The e-Seva project is a public-private partnership that offers a range of government-to-citizen services (G2C) at a single location. Located in the south Indian state of Andhra Pradesh, the services offered by e-Seva include payment of utility bills and taxes; issuance of certificates, permits and licenses, and, reservation of seats on public transport (Prashanth, 2004). Although e-Seva started by offering G2C services, it has now grown to encompass a range of business-to-consumer (B2C) services such as payment of credit card bills. The project had an immediate benefit for citizens in that they could now access a one-stop payment facility as opposed to dealing with multiple departments. e-Seva was also aimed at reducing corruption and improving government transparency.

e-Seva began as a government-funded pilot project called the"Twin Cities Network Systems" (TWINS) in December 1999. In June 2000, the state government decided to extend the project to cover the twin cities of Hyderabad and Secunderabad through a chain of 24 e-Seva centres. Currently, there are around 200 e-Seva centres located throughout the state's capital city and its municipalities. The centres are run by a private sector IT service provider (Kochhar & Dhanjal, 2005). These centres provide over 130 G2C and over a dozen B2C services from 16 state government departments and 10 private businesses (Syal, 2005). The apparent success of the project could be seen in the increase in citizen transactions using e-Seva from an estimated 4800 during its first month of operation in August 2001 to 750,000 transactions in February 2003 (Prashanth, 2004). By October 2005, e-Seva had completed over 2 million transactions (Kochhar & Dhanjal, 2005).

3.2. Audit report of e-Seva

Despite these successes, an IT audit report (INTOSAI, 2006) has criticised the implementation of the e-Seva project on a number of counts:

3.2.1. Project management issues

No feasibility study was conducted to explore the potential for scaling up the e-Seva project, both technically and commercially. There were time and cost overruns in identifying locations for e-Seva centres, in updating data in participating government departments, IT procurement, and software development.

3.2.2. Technical issues

The project did not create a system requirements specifications document with the involvement of the various government departments and user groups. Instead, all specifications were the sole responsibility of the private IT services provider. In addition, adequate documentation relating to software, hardware, error handling etc was not provided by the IT service provider. The audit also criticised lack of appropriate processes for periodic updating of programs, weak documentation, deficient software application package that accepted incomplete data inputs often leading to incorrect outputs, and inadequate control over the database administrators.

There were irregularities in the e-payments module of the system with incomplete data and incorrect amounts being accepted by the system for electricity payments, and incomplete data was being accepted for property tax payments.

3.2.3. Management issues

The audit found irregularities in the tendering process for selecting the private IT service provider for the project. Roles and responsibilities for the various e-Seva directorates were not clearly defined and ad-hoc administrative processes were used on a daily basis. The audit discovered numerous data irregularities, such as inconsistencies between the e-Seva database and participating departmental databases, incomplete data records, inconsistencies between the total transaction numbers as reported by e-Seva and by the audit, and gaps in transaction numbers in some e-Seva centres. There were no procedures to deal with operation problems such as the ability to delete a record without trace.

Finally, the report also pointed out inadequacies in the error management processes used by e-Seva. For instance, some of the e-Seva transactions showed zero payments when in fact the transaction had been completed, and to compound this problems various departments did not reconcile the amounts due and received by them from e-Seva centres. Furthermore, there was the possibility of deleting offline transactions undertaken when the systems were down.

The audit found that the disaster recovery and business continuity plans for e-Seva were inadequate, given the 20,000 daily transactions at e-Seva centres. Security management arrangements were also criticised for poor access controls and network security

3.3. Interpreting the audit report

These audit criticisms seem to indicate that the project appears to have been implemented in haste without adequate consideration for good information systems development and management practices. However, e-Seva was intended as a service to improve substantially the citizen's transaction experience with the government. As the INTOSAI audit report also states, "[the e-Seva initiative is] a unique and conceptually a good project to put e-Governance into action to provide a large number of services to the citizens on [a] one stop shop basis." In this sense, e-Seva was conceptualised with the citizen at its core. In its reply to the INTOSAI audit, the state government responded that "e-Seva was innovative and a new concept having no precedents and the progress was made through a constant process of experimenting".

3.4. Case analysis

In this section, we analyse the e-Seva case using the two theoretical frameworks presented above.

3.4.1. ICT use

The e-Seva initiative does not readily fall into any one of the four categories of ICT use in the Sein and Harindranath framework. The closest category we can identify is the one that is 'directed at specific development activities' because the aim of e-Seva is to improve transparency and reduce corruption.

3.4.2. ICT view

In the e-Seva project ICT is viewed as a 'tool'. The absence of an 'ensemble' view is obvious. For instance, there was inadequate alignment between the e-Seva centres and participating government departments. This resulted in data irregularities, and gaps in transaction data. The poor role definition for e-Seva Directorate workers and ad-hoc administrative and operational procedures also point to the lack of an 'ensemble' view that situates ICT within a given socio-organisational context.

3.4.3. ICT impact

Clearly, e-Seva has had a phenomenal primary or first order effect in terms of 'substitution' of manual transactions at multiple locations by a one-stop shop facility. The primary impact is

clearly exemplified by the massive increase in e-Seva transactions from 4800 during August 2001 to 750,000 transactions in February 2003; by 2005, e-Seva centres had completed over 2 million transactions. We do not have adequate data to assess secondary effect. For instance, we do not know whether the e-Seva initiative has resulted in a reduction in the number of unpaid utility bills or an increase in the tax collected at the state level. In terms of tertiary effects, there is anecdotal evidence regarding reduction in corruption (for example, bribes paid to middlemen) and empowerment of women (Karan and Mathur, 2006). However, as the INTOSAI audit report shows, e-Seva could potentially have the perverse effect of providing new opportunities for abusing the system. For example, the lack of audit trails implies that the system itself could be compromised.

3.4.4. ICT paradigm

e-Seva has the characteristics of a functionalism paradigm. ICT is viewed as a tool and as neutral. The development perspective is clearly one of modernisation in that the 'one-stop shop' aspect of e-Government is a phenomenon developed in the West, and with e-Seva it was applied with little or no adaptation to local context beyond system localisation. One can of course argue that the 'one-stop shop' concept is universal and requires little or no local adaptation.

However, the main actor in the e-Seva initiative was not a foreign expert nor was the main driver a foreign donor agency. As opposed to the functionalist perspective, the government took a very active role in the project. Therefore it does not precisely fit functionalism paradigm as defined by Sein (2005). In fact, the project has the potential to move to the neo-humanism paradigm. It is apparent that there was a strong motivation and drive for e-Seva so much so that recommended good project management practices were bypassed in the interest of getting the project completed and on line. The main actors are in place. What is needed is to reorient the development perspective to some form that is appropriate to the local context (admittedly, it can well be modernization. However, that realization should come from critical reflection not simple adoption). In developing innovative governance, India has a tradition arguably as rich as anywhere in the world. Thus, India will have its own trajectory to development. In that endeavour, an ICT initiative such as e-Seva can be a great supporting technology. As we pointed out above, projects with a neo-humanism paradigm or ones coming close, such as Kudumbashree, already exist in India.

Table 1 summarises our findings.

Framework	Concept	e-Seva finding
ICT in development conceptualisation	ICT use	Supporting specific development activity
	ICT view	Tool
	ICT impact	• Primary – phenomenal impact • Secondary – inadequate data • Tertiary – anecdotal evidence of reduction in corruption: empowerment of women
ICT in development paradigm	Paradigm	Functionalism in character
	Actor/Role	Local experts and local champion

Table 1. Summary of findings

4. DISCUSSION

4.1. Implications of the case analysis for the two frameworks

Our purpose in analysing the e-Seva case was to enable us to evaluate the two conceptual frameworks (Sein and Harindranath, 2004; Sein, 2005). Based on our case analysis, the verdict is mixed. In general, we found the two frameworks useful in evaluating e-Seva. However, in applying the frameworks, serious deficiencies were revealed. At the very least then, it calls for a re-examination of these frameworks and their possible enhancements.

In general, we found the Sein and Harindranath framework fairly straightforward to apply. It was quite obvious that ICT was being viewed as a tool and that an ensemble view was missing. As Kling (2000) notes, the standard 'tool' model of ICT often tends to underestimate the costs and complexities of computerisation and even when these are managed the resulting impacts are merely at the operational level. We see this to a great extent in the e-Seva case. We can clearly see its success in the G2C sphere in terms of improving service delivery and interaction with citizens. However, the widely held perception that ICT are merely tools that can be used to automate processes to improve governmental efficiency is perhaps a key reason for the as yet unrealised potential to achieve major developmental objectives. e-Seva needed to take an ensemble view which would have pinpointed the vital importance of aligning processes across different organisations such as the various agencies and government departments and the e-Seva centres.

How ICT was being used was less obvious. We resolved finally that e-Seva can be categorized as supporting a specific development activity. Whether an e-Government project can be classified as such is debatable. Clearly, a category that incorporates foundational applications such as infrastructure and e-Government is needed in the framework. Determining the impact of ICT was also fairly straightforward, especially the primary and secondary effects. While identifying tertiary effects is also mechanically straightforward, the catalysts for such effects need to be incorporated in the framework. We argue that those ICT for development interventions that are sustainable in the long run may actually lead to third order impacts. In turn, tertiary effect could be seen as essential for the sustainability of the developmental impact of the ICT intervention. The mechanisms and policies needed to sustain ICT interventions need to be studied. In the e-Seva case, a private-public partnership model was used which was instrumental in sustaining it.

When we turn to the paradigm framework, more deficiencies were revealed. For example, we found it difficult to place e-Seva into a specific paradigm. This is not entirely surprising since Sein (2005) cautioned that the paradigms were not as parsimonious as one would like and that simultaneous existence of multiple paradigms was possible. As we discussed in the previous section, it has features of functionalism but with local actors as the main drivers.

Yet, we see specific areas where deficiencies exist. One example is the role of the actors. It is clear that the origin of the actor – whether from outside or from the inside the country – is not as important as his/her perspective. We also note the absence of the 'government' as an actor in all but the 'functionalist' paradigm. While it can be argued that the role of the local actor in any of the paradigms could be played by the government, the framework still ignores competing stakeholders within the government (e.g., between local, regional and national authorities) or between groups of local actors (e.g., between an NGO and the local or national authority). Therefore, the framework needs to account for such potentially competing priorities amongst stakeholder groups or even within a particular stakeholder group. Stakeholder theory may provide us with insights to further enhance the frameworks. As Flak and Rose (2005) noted in the case of e-Government initiatives, stakeholder groups differ

along the dimensions of power, urgency and legitimacy. Those who possess all three dimensions become the dominant stakeholder group and their priorities prevail.

4.2. Further work

The very fact that we used two frameworks immediately indicates that neither was adequate by itself as an interpretive lens to study ICT for development. We specifically chose to use these two frameworks because we recognized that the volitional component was missing in the Sein and Harindranath framework and that Sein's paradigm framework provided this aspect. We found that using the two in conjunction sharpened the interpretive lens. To carry the work further, two alternatives are open to us.

The first alternative is to combine the two frameworks to form a new enhanced framework. One straightforward way is to add the paradigms to the Sein and Harindranath framework to complement the ICT use, the ICT views, and its impacts.[1] However, such combination is more than a simple addition. The epistemological axis that distinguishes the paradigms is about the application of ICT depicting a continuum from a neutral view and applicable in a context-free manner to one that is applicable in a situated context. This is conceptually similar to the "ICT view" aspect of the Sein and Harindranath framework. These issues need to be resolved if integration is the alternative chosen. One possible approach is to start with identifying the main actor in the intervention and identifying his/her paradigm.

Enhancing and combining frameworks has other drawbacks. In many e-Government cases, what is observed is that political issues, interdepartmental rivalries, power losses (or perceived loss of power) play a greater role in these failures than any concept from these frameworks. It is tempting to suggest that perhaps these factors should be included in the frameworks. However, this will result in a cumbersome framework with an inordinate number of variables making it practically useless.

The second alternative is to simply use multiple frameworks in evaluating an ICT for development initiative. Examples are frameworks that focus on poverty reduction and meeting millennium development goals. A prominent one is DFID's Sustainable Livelihood framework (DFID, 1999). A good example of its application is presented by Heeks and Arun (2006). Specific to evaluation of e-Government initiatives, an innovative approach is the use of Amartya Sen's capabilities view by Madon (2005). This is particularly germane to our analysis because the "what people can do" with capabilities mirrors the "knowledge enabler" view of the Sein and Harindranath model while "what people do with the opportunities" aspect can lead to tertiary effects. It will be a fruitful exercise to evaluate projects such as e-Seva from these perspectives to get a better understanding of such e-Government initiatives.

4.3. Conclusion

As we stressed earlier, our paper is an examination of two conceptual frameworks on ICT for development. That these frameworks were developed by us should not detract from the merits or the conduct of the exercise. Reflecting on and re-examining specific aspects of the literature is an essential activity in the progress of a field. Our paper is such a reflection. It contributes to the literature in two ways. First, by building on existing work, we add to the building of a cumulative tradition in ICT for development research. Such a tradition allows the academic community to compare findings across studies and re-interpret prior findings. Second, while our paper contributes to the building of 'descriptive' (explanatory) knowledge, it may also be useful as the basis for developing 'prescriptive' (actionable) knowledge. Guidelines can be drawn for action in the field, for example to evaluate specific ICT for

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[1] We are indebted to an anonymous reviewer for this insight. The essence of this paragraph is based on the reviewer's comments.

development initiatives.   We are aware that we are far from this desirable outcome.   Our invitation to the research community is to continue to reflect, explore and ultimately influence the use of ICT in developing countries.

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TOWARDS IMPROVING INTER-ORGANISATIONAL TRUST AMONGST SMEs: A CASE STUDY FROM DEVELOPING COUNTRIES

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Abstract: Electronic commerce, particularly business-to-business (B2B) electronic commerce has experienced exponential growth in recent years. So huge has been the volume of trade conducted on the Internet that various estimates paint a picture of B2B in trillions of dollars.

Unfortunately, however, there is considerable evidence to show also that small and medium sized enterprises (SMEs), particularly those in developing countries, have not been reaping any or adequate benefits of this new commerce opportunity as their counterparts in North America and Europe resulting to another form of *Digital Divide.* One of the major factors responsible for this state of affairs has been identified as low level of trust affecting the relationships between trading businesses.

Trust is very fundamental in every business relationship and transaction. In B2B e-commerce, it is even more imperative, especially given the unique nature of this kind of business in which the major participants do not, and may not, have face-to-face contact with each other.

In this paper, the issues surrounding inter-organisational trust (IOT) in B2B e-commerce relationships and transactions, particularly as they affect the SMEs in developing countries, are explored. The paper also proposes suggestions on how trust can be built through identifying and strengthening the critical trust factors (CTFs) which will allow SMEs and indeed, other businesses in these regions, to leverage their B2B potential.

Keywords: trust, inter-organisational trust (IOT), B2B eCommerce, trust-transactions typology, developing economies.

TOWARDS IMPROVING INTER-ORGANISATIONAL TRUST AMONGST SMEs: A CASE STUDY FROM DEVELOPING COUNTRIES

1. INTRODUCTION

Studies have shown that, in spite of the progress being recorded in the developed economies of North America and Europe as well as some Asian Pacific nations like India and Indonesia in the area of information and communication technologies (ICTs), the *Digital Divide* is still widening (Mbarika et al, 2005; Mensah et al, 2005). Part of the problem is that developing countries, especially those within the sub-Saharan Africa (SSA) region, are still experiencing considerable problems in their bid to engage in meaningful digital exchange with the rest of the word.

Modern business activities are very complex and competitive in nature. This has given rise to a situation where it is no longer adequate for entrepreneurs to rely solely on their professional skills to give them the competitive edge and the significant market advantage they require to thrive in their business. Therefore, developing professional trust with their customers becomes a very important contributory factor to their success (Moment, 2001). No matter what business you are engaged in, the most powerful value-added ingredient you can contribute in any business strategy is the trust factor. Burkert (1994) identified three broad facets to trust which are necessary for people when relying on information technologies for communication. These facets are: trust in people, trust in organisations, and trust in technology.

Trust is a fundamental requirement of every economic activity (Clarke, 2002). Business activities in the normal sense are very complex and require a great deal of trust in order to be fully and successfully carried out. This trust requirement becomes even more challenging and complex when the type of business is electronic commerce, particularly B2B. One major contributory factor to this heightened state of trust requirement is the fact that this type of commerce is characterised by the "invisibility" factor (Moor, 1985; IDA, 2000) and is conducted in the virtual realm which, in most cases, does not offer fact-to-face contact among the participants. This lack of direct, physical contact is particularly a problem for small and medium sized businesses (SMEs) (Deelmann and Loos, 2002). One major part of the reason is that the people in the region are still used to the traditional method of trading in which trading partners conduct their businesses by physically interacting with each other. One of the major impediments to adopting B2B e-commerce for SMEs, particularly those operating in developing countries, is the prevalence of high entry barriers brought about, in part, by lack of effective reliance mechanisms aimed at enhancing system trust (Patton & Josang, 2004).

2. NEED FOR TRUST IN B2B

The emergence of globalisation facilitated by developments in ICTs has created more impetus for collaboration and partnership as avenues for achieving commercial success (Bryant and Colledge, 2002). For such collaboration and partnerships to succeed however, trust plays a central role. Trust, as a concept, can be seen as the assured reliance on the character, ability, strength or truth of someone or something (Merrian-Webster Online). Trust is a *sine qua non* in every interpersonal and commercial relationship. This is so because, as McKnight & Chervany (2001) observe, "it (trust) is crucial whenever (and wherever) risk, uncertainty, or interdependence exist". It is even so if such a relationship is business oriented. Trust has been described as "the glue" in dyadic buyer-seller relationships (Pressey and Mathews, 2004).

In the online environment, the decision to engage in a business relationship is a daunting one, especially when viewed from the perspective of the myriad of uncertainties in the area of product quality and vendor reputation which task the buyer's decision making process (Grabner-Krauter, 2002). This is why trust is regarded in online business as "a mental shot-cut" to a buying decision (Kutteinen, 2005). Business to business (B2B) e-commerce has been found to be the largest and most dominant sector of the online business in terms of turnover (Barlett, 2001; Laudon and Traver, 2002; UNCTAD, 2002).

According to the Infocomm Development Authority of Singapore (IDA) (2000), a Gartner survey reveals that 12 times more fraud exists in Internet transactions while WebAssured found that fear of fraud is the primary reason users decide against making online purchases. The result is that even though the technology is available, some consumers and businesses still lack the trust and confidence in the network to conduct online transactions, and to optimise the vast opportunities offered by electronic commerce.

This situation is more so in developing countries, particularly those in SSA.

As Clarke (2002) puts it, trust is crucial to enable some kinds of transaction to take place. Such contexts often exhibit a combination of such characteristics as a significant risk exposure for one or more of the parties; a significant elapsed time during which the risk exposure exists; and little knowledge by one or more of the parties about one another, the tradable item, the trading process, and the contingent outcomes. Trust is a catalyst for human co-operation as it allows people to interact spontaneously and helps the economy to operate smoothly (Patton & Josang, 2004).


3. COMPONENTS OF TRUST

In an electronic commerce relationship trust can be inter-personal; inter-organisational; as well as intra-organisational. Of the three aspects of trust however, inter-personal and inter-organisational are the more prevalent and indeed, relevant ones to e-commerce relationships between parties. This is because they affect the business relationships between parties. *Inter-personal trust* (IPT) is the trust relationship existing between two individuals, especially in a consumer-to-consumer (C2C) setting, or an individual's trust toward another specific party or the trustworthiness of the third party (Tan & Sutherland 2004). *Inter-organisational trust* (IOT) on the other hand, is the trust relationships existing between two business enterprises as found in a business-to-business (B2B) setting. While *intra-organisational trust* is that which exists within an enterprise, between divisions, departments, sections, offices and branches.

Three dimensions of trust in an e-commerce vendor-customer relationship have been identified as: competence, integrity and benevolence (Yin, 2001; Putman, 2001; Chen & Dhillon, 2003). According to them, 'competence' is the ability of a company to fulfill promises made to the customers; 'integrity' looks at how consistent, reliable, and honest the company's acts are; while 'benevolence' refers to the ability of the company to hold its consumers' interests ahead of its own self-interest and indicates sincere concern for the welfare of the customers.

In a collaborative B2B electronic business environment, trust issues are viewed from four broad perspectives: the vendor, the customer, the technology, and the interactions (relationships, transactions) between the vendor and the customer. However, further analysis

of trust literature indicates that there exists a fifth element: the intermediating agencies or facilitators (Fig 1).

Fig 1: Collaborative B2B Trust Environment
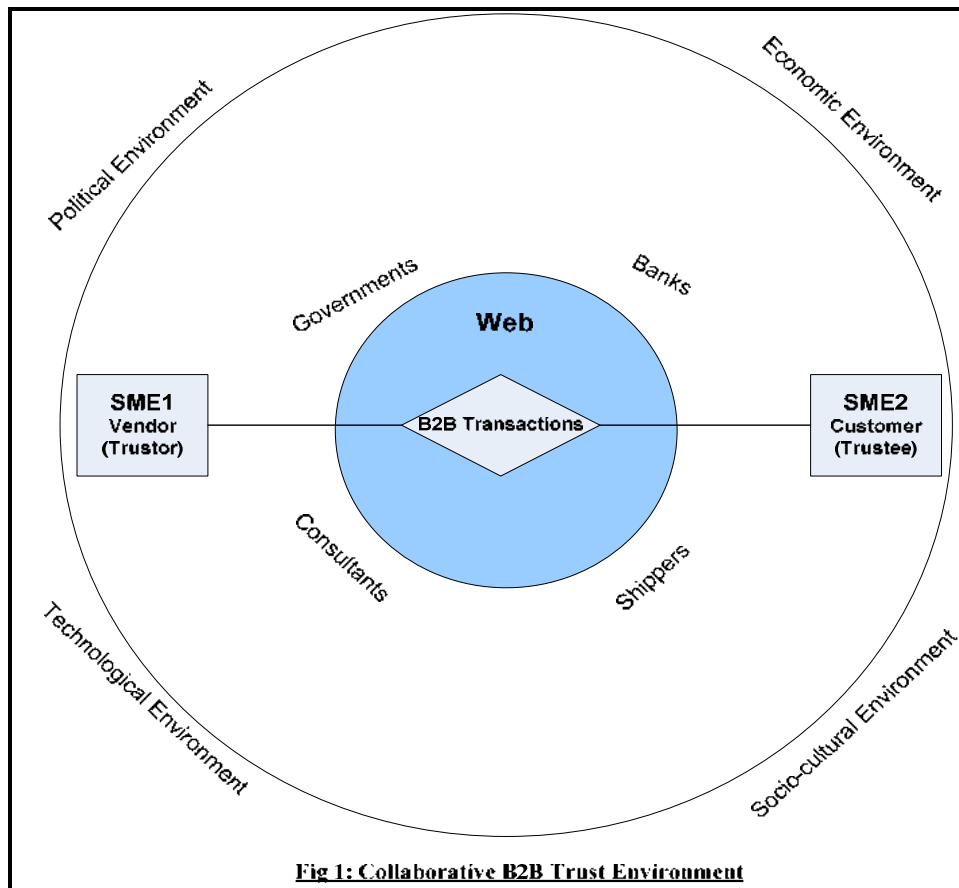
Facilitators include: governments, banks (and other financial institutions), consultants/experts and, in some cases (depending on the nature of the relationship) shippers (or postal and shipping agents). Governments create the enabling environment (through legislative and enforcement functions), banks act as both media for financial exchanges and assurance (or insurance) agents to the parties in the relationship; consultants advise, maintain and upgrade the technology that facilitates both the security of the transactions and the privacy of the participants; while (again, depending on the nature of the commodities being traded) shipping agents (like postal services, DHL, UPS, etc) facilitate the exchange of the commodities from the vendor to the customer. The vendors, customers and facilitators therefore make up the main stakeholder groups in the B2B relationship. As shown in Fig 1, the activities of the stakeholder groups are influenced by such external environmental factors as political, economic, technological and socio-cultural.

For an initial transaction to take place there is a strong element of trust between the parties. One party must be willing to reduce the complexity involved in deciding whether to depend on another (known as the "trustee") or not (Meents et al, 2003). This becomes more imperative given that there is inherent inability on both parties to control the actions of each other or to correctly predict each other's behaviour. Furthermore, the trustworthiness of each

of the parties is not easily verifiable as is the case in a traditional face-to-face transaction (Pavlou, 2002). However, as Gefen (2000) explained, as long as the trustor is convinced that the other party (trustee) can be trusted in living up to their agreements, the trustor can reduce the decision complexity by ignoring any other potentially negative behaviours of the trustee.

In any B2B relationship, the trustor-trustee roles are interchangeable as either of the parties can assume the role of a trustor or trustee at one point or another in the life of a transaction. If for instance, SME1 supplies a commodity to SME2 before receiving the payment for the item, SME1 becomes the trustor and SME2 the trustee in this particular transaction. If on the other hand SME2 makes payment in the understanding that SME1 will deliver the goods, then SME2 becomes the trustor for the transaction. The roles of the partners are enriched when customers themselves become vendors of similar or different products and services. Early positive experiences can enhance their trust in such dealings. However, a negative experience may destabilise an otherwise smooth operation. Provided that the payment takes place before SME1 dispatches the commodity to the shippers or directly to SME2, SME1 does not have to worry in the same way that SME2 is concerned. SME2 can part with their money and 'trust' that everything will operate in the expected manner and therefore they will receive their goods. In turn these goods will be of the correct specification and quantity.

In a business to consumer (B2C) scenario however, the trustor-trustee role is not usually exchangeable. The business (vendor) is usually the trustee while the consumer (customer) the trustor. One good example of this kind of relationship exists between Amazon.com and its customers where the customer pays for the goods and hope that Amazon.com delivers the goods paid for. From this standpoint, the customer is the trustor (paying for commodity) and believing the trustee (Amazon.com) to deliver the goods after processing the payment.

4. CHARACTERISTICS OF IOT IN B2B SETTINGS

Electronic commerce (E-commerce) is the sharing of business information, maintaining business relationships, and conducting business transactions by means of telecommunications networks (Zwass, 1996). In today's business environment where the operational boundaries between firms have become fluid, it is often both pragmatically and analytically unfruitful to separate inter-organisational and intra-organisational business processes. In this context therefore, B2B E-commerce includes the sell-buy relationships and transactions between companies, as well as the corporate processes that support the commerce within individual firms.

The early stages of most B2B transactions feature most of these characteristics observed by Clarke (2002) in one form or the other. For instance, there is always little knowledge by one or more of the parties about one another, especially before the relationships get started. Trust therefore, becomes very important if such transactional relationships have any chance of blossoming. Furthermore, the outcome of the initial interaction is very critical in determining the nature and level of trust to be developed in the relationship (Sherrie Xiao, 2003).

One major characteristic of B2B relationships is that the parties commonly have little or no knowledge of one another at the beginning of the relationships. They are also usually in different locations. They therefore cannot depend on physical proximity, hand-shakes, body-

signals, a common legal jurisdiction, or even necessarily a definable jurisdiction. Trust can be used in establishing and reinforcing business partnerships (Ratnasingam, 1998).

In a study conducted in two Latin American countries of Brazil and Chile, Avgerou et al (2005) explored the distinctions existing in such aspects of trust as trust in *technological artifacts or processes;* trust in a specific *ICT-mediated service*; and trust in *government.* They also explored the distinction between trust as an *interpersonal relationship* and trust as a *social or institutional phenomenon,* and posit that in the second situation, trust "captures citizens' expectations of fairness, impartiality and reliability *vis a vis* the impersonal and less tangible mechanisms, structures or processes underlying modern state and society at large".

Inter-Organisational Trust (IOT) is the directional relationship existing between one organisation and another or between one group of organisations and another group or another single organisation in which one party (the trustor) is willing to believe that the other party (the trustee) is willing to honour the terms of their business obligations. This kind of relationship has a scope which means that it applies to a specific purpose or domain of action (Josang et al, 2005). IOT can also be bi-directional. This is what is often referred to as the mutuality or reciprocity of trust in which both parties trust each other for the same purpose (Josang et al, 2005).

One noticeable characteristic of IOT is its fragility. Slovic (1997) observes that trust is easier to destroy than to create. IOT takes a long time to establish and is vulnerable and susceptible to falter through a combination of other extraneous factors. These factors include hacking, viruses and worms, as well as such fraudulent activities as phishing, identity theft, and advance fee scam. There is growing evidence that the e-commerce market is growing. According to eMarketer, in 2003, US retail e-commerce generated $56 billion, up from $44.3 billion a year earlier (eMarketer, 2004). However, as the market grows so also the magnitude and number of fraud in online business increase.

Some Identified Factors Affecting B2B Transactions	Responses on Willingness to Participate if the Identified Factors are Remedied (in %)			
	Very Willing	Willing	Unwilling	Very Unwilling
Cost of Internet Technology	30	39	17	13
Trust in Internet Tech	47	38	10	6
Trust in Customers	34	38	20	7
Protection against Fraud	28	47	16	10
Security of Online Transactions	46	35	12	7
Availability of Relevant Tech	23	44	21	11
Availability of Relevant Skills	37	34	16	13
Trust in Suppliers	14	39	27	20
Legal Protection of E-commerce	33	47	14	7

Table 1: Respondents' Responses on their Willingness to Participate in B2B if Inhibiting Factors are Remedied

The seventh annual fraud survey conducted by CyberSource (a provider of electronic payment and risk management systems) showed that in the US alone, scams siphoned off $200 million more in 2005 than it did in 2004 resulting to an 8 percent increase in ill-gotten gains (Kuchinskas, 2005). Nigeria (Smith et al, 1999) and Uganda (Shelly, 2004) are two of the countries in SSA where such fraudulent activities as advance fee fraud and other criminal activities have built a generation of techno-sceptical entrepreneurs. In our recent study conducted in Nigeria, it was observed that a lot of the country's SMEs shy away from using the Internet to conduct their businesses. Their main reasons range from trust (in technology, customers and consultants), fear of fraud to fear of security of online transactions. As shown in Table 1 however, most of the SMEs used in the study still expressed strong willingness to participate in e-commerce activities if the underlying problems are rectified.

The situation in Nigeria and Uganda is by no means peculiar to the two countries alone. In fact, according to UNCTAD (2003) report, several developing countries experienced digital attacks in 2002 resulting to negative media attention which undermined public confidence and trust in Internet transactions. Furthermore, as observed by Shelly (2004), African business scene is characterized by increasing level of poverty, low level of formal employment and (for example, Kenya) a high level of cheque fraud "sometimes with the help of bank staff". All this impact greatly on the level of IOT between trading partners as well as the society generally.

5. TRIGGERS FOR ENGENDERING IOT

Lasting IOT like trust generally is based on experience over time. One of the major difficulties in establishing IOT is the challenge of making a success of the initial exchange. As Pichler (2000) observed, establishing initial trust can be a major challenge to newcomers in e-commerce, particularly those who do not have well established off-line brands. Initial trust therefore is very important as merchants can not build transaction history which is a major building block to lasting IOT (Patton & Josang, 2004).

Some factors are very central in enticing Internet users to trust an e-commerce web site (Sisson, 2002; Lee, 1999; Riegelsberger & Sasse, 2001; Lumsden & MacKay, 2006). Most traditional cues for assessing trust in the physical world such as the warmth of a shop assistant offering to help you, the size and layout of the shop floor and the ability of the consumer to see or feel the products before making a purchase decision are not available online (Patton & Josang, 2004). In order therefore to attract and keep online customers' trust, some more affective approaches have to be adopted. This becomes even more imperative given that e-commerce involves interactions over space and time, and hence requires more trust cues than traditional shopping (Riegelsberger,2003). Most current strategies in e-commerce trust-building centre mainly on cognitive trust even though some human trust decisions are based on affective reactions, which can be triggered by interpersonal cues.

Some cues capable of engendering B2B IOT include (but not limited to) Professionalism of Design, Longevity, Service, Selection, Testimonial (positive anecdotal comments from previous users), Personal experience, Trust-Assurance indicators (eg presence of known security vendors like VeriSign, etc). There is also the need to avoid such Human Computer Interaction (HCI) pitfalls as Difficult Interface, Poor Navigation and Poor user-friendly designs (Fogg et al, 2001).

Table 2 shows the responses generated from the 122 SMEs that participated in the study. They were asked to score how the issues surrounding IOT (including trust in Online Transactions) would affect the decision of small business entrepreneurs to participate in B2B e-commerce activities.   It shows that a significant majority of the respondents feel that Trust plays a significant role in determining why a lot of small businesses in SSA do not conduct their businesses online.

How the following Trust factors affect SME Decision to Participate B2B in SSA	Response (in %)
Trust in Online Transactions	73
Trust in Customers	71
Trust in Internet Tech	82
Trust in Experts	50

Table 2: Trust Factors affecting SMEs' B2B Participation Decision

While a huge majority of the Respondents (82%) view Lack of Trust in Internet Technologies as being responsible for lack of B2B participation by many small businesses in SSA, 73% of them blame that reluctance on Lack of Trust in Online Transactions. One interesting feature of these results is that SMEs are equally divided on the effect of Internet Experts on their decision to conduct their business activities online.

6. HOW TO ENHANCE IOT AMONGST SMES IN DEVELOPING COUNTRIES

SMEs in developing countries suffer from a plethora of disadvantages which hamper their efforts to join the rest of the world in exploiting the benefits of e-commerce. According to Goldstein & O'Connor (2000), a lot of SMEs in developing countries are still grappling with some governmental, institutional and technical problems such as e-commerce requirements, legal norms and standards covering among other aspects contract enforcement, consumer protection, liability assignment, privacy protection, intellectual property rights). There are also those problems relating to process and technical standards (e.g. regarding the way payments are accepted on the Internet and products are delivered to the final user, security, authentication, digital signatures, and connectivity protocols).

There are indications however that some of these and other problems have been receiving due attention by both the governments and private-sector entrepreneurs in some of these countries. In Singapore for instance, the government in 2000 announced plans to position the country as an e-commerce hub through the implementation of such initiatives as:

   a) Establishing a secure e-commerce environment;

b) Building confidence in e-businesses;

c) Building confidence in consumers to transact on the Internet; and

d) Educating and increasing awareness of the benefits of e-commerce (IDA, 2000).

It is therefore not surprising that of the 115 nations which featured in the current World Information Technology Report published by World Economic Forum (WEF, 2006), Singapore comes second after the US as the country with the highest networked index. However, Singapore's ascendancy and position in the global rankings is not reflected on the other developing countries' positions, particularly those from SSA. According to the rankings, 15 of the 56 countries on the bottom half of the table are from SSA.

One other obvious way in which SMEs in developing countries can engender IOT is to use technological solution to directly address the risks involved in B2B transactions. This therefore calls for improved payment systems like using the escrow (or mediator) approach favoured by most of the respondents in the IDA (2001) study and as suggested in this paper. Banks are known to be amongst the facilitators of B2B relationships. If a customer is assured that the payment he has made can be retrieved if the goods paid for are not received, then, all things being equal, he may be willing to deposit his payment into a bank.

Approaches to trust building in B2B relationships can be both cognitive and affective (Corritore et al, 2001; Riegelsberger, 2003). One of the affective IOT building strategies is communicated through the web interface. Fogg et al (2001) established that people's perceptions of web credibility can be determined by such factors as physical address details and high quality photographs of employees. There is also the need for the provision of company information that is easy to find; prices (including taxes and shipping costs) early in the interaction.

Furthermore, web designers in these regions must strive towards establishing secure online environments for users. One of the ways of achieving this is through the use of public key infrastructure (PKI) which addresses the key issues of authentication, confidentiality, integrity and non-repudiation required for secure online transactions. *Authentication* control ensures the establishment of the right identity for the parties involved in the transaction. *Confidentiality* is concerned with keeping personal details of the participants out of reach by a third party. *Integrity* addresses the data and information shared online making sure no alteration takes place; and *non-Repudiation* control ensures that the parties cannot disown the transaction by, for instance, exploiting the non-personal nature of e-commerce.

7. A TRUST-TRANSACTIONS TYPOLOGY

In any B2B IOT relationship, the levels of Trust and the volume of Transactions move (in general) along the same direction. If therefore the level of Trust is low, then invariably the volume of Transactions would fall. We encapsulate this kind of relationship in the B2B Trust/Transactions (TT) typology shown in Fig 2. This typology demonstrates the fluidity of IOT in business relationships.

We assume that the ideal situation (i.e. high level of Trust and high volume of Transactions – 'H,H') is where all organisations aim towards. This is when previous successes enhance IOT and generate a high volume of Transactions in a constant improvement loop. An increase in

the volume of Transactions whilst the level of Trust remains low (as shown in quadrant 'H,L') engenders fragility (even though there may be relative success in the relationships currently). Also it is highly unlikely to build high level of Trust just on the strength of a low volume of Transactions, and if that is so it is not financially viable.

Fig 2: Showing B2B Trust/Transactions Typology
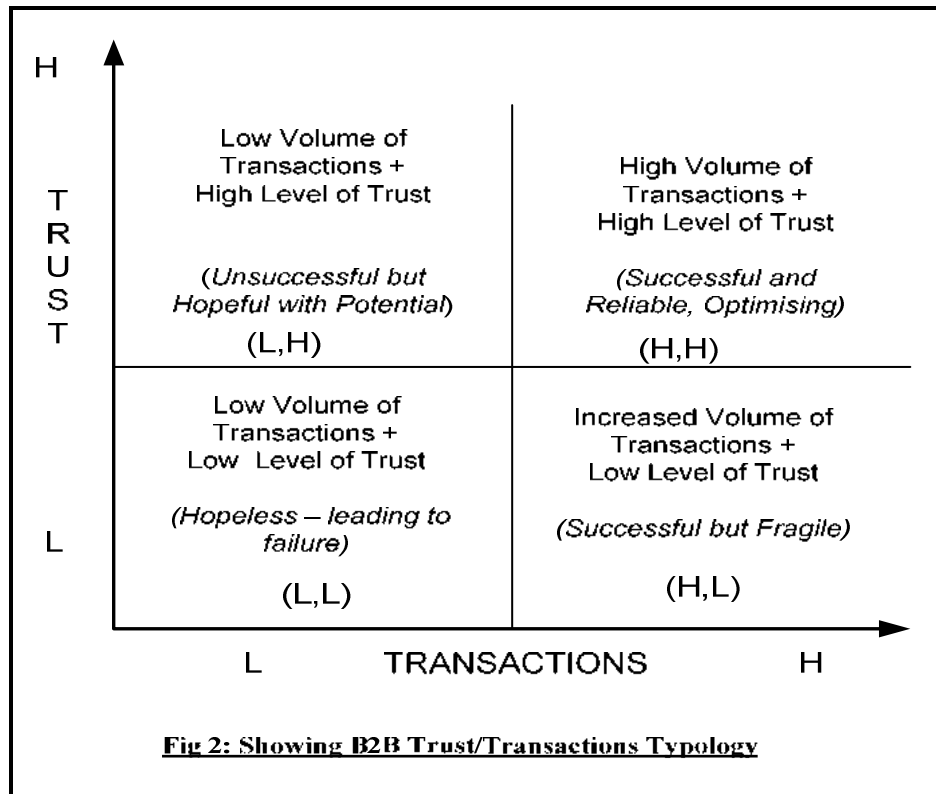
The IOT levels as well as the volume of Transactions vary depending on a lot of other factors. Some of these factors have been identified to include competence (the confidence in the business partner's ability), credibility (size and reputation of the firm), integrity (honesty and reliability of the business partner), and benevolence (the courtesy, friendliness and goodwill between the business partners) (Yee, 2001; Chen & Dhillon, 2003).

8. ASSESSMENT USING THE TRUST/TRANSACTIONS TYPOLOGY

The TT typology can be used in achieving critical trust factor (CTF). In every business relationship, there is always the need to build the trust level to such an extent that the partners feel 'safe' in dealing with each other. CTF refers to the point in the life of a business relationship where the partners have known each other enough to take bigger risks. That point marks a kind of watershed point in the relationship. Once the critical trust factor (CTF) stage is reached, success is more likely.

The TT typology can be used by consultants and companies to assess or self-assess the current state of technology-enabled transactions and the level of IOT. Once this is established, a customised programme of trust building can be designed provided that the organisation is, at least in principle, interested in increasing their transactions volume.

Once the SMEs attain the CTF in their business relationships, then their relationships will start moving towards mutuality. In that state, they can trust each other so much that they can deliver goods on the promise that payment would be made at a future date. It is important however not to compromise the viability of the organisation through increase of the transaction value if the trust remain low. Similarly, if the trust is already low, it will be difficult and dangerous to increase the volume of transactions. Ideally, it is desirable to move from the 'L,L' quadrant or sector to the 'L,H' sector in that order. A high volume of transactions may back-fire if many of them fail in some way eroding the level of existing trust.

9. CONCLUSIONS AND FURTHER WORK

IOT is a very essential ingredient in the establishment and nurturing of business relationships between two organisations. In a collaborative B2B environment, IOT plays a key role in attaining the CTF which can contribute greatly to a high volume of transactions. SMEs in developing countries are major contributors to the economic growth of their respective economies. For them to adequately play this role however, they need to earn the trust of the global community in their business relationships. For this to happen, their IOT with businesses across the globe must be enhanced and maintained at a high level.

More research needs to be conducted on the other ways of building IOT and on how much effect developed IOT can have on the volume of transactions between parties participating in B2B relationships. There is also the need to further study the relationships between IOT and Transactions with a view to fine-tuning the TT typology.

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TELECENTERS AND LEARNING IN MICRO AND SMALL ENTERPRISES: THE CASE OF CAMPOS DOS GOYTACAZES, RIO DE JANEIRO

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Abstract: Telecenters have been considered important tools for digital inclusion and ICT training in developing countries, having as main objectives the promotion digital inclusion of people and of micro and small enterprises (MSEs) as well. However, those enterprises will only be digitally included by telecenters if, as a result of their implementation, learning processes that promote innovation and competitiveness take place This article will explore this issue, based on the results of a survey conducted in Campos dos Goytacazes, a city located in the state of Rio de Janeiro. The article is divided in five sections, After the introduction, in the second section, some arguments on how telecenters may work as tools for digital inclusion and socioeconomic development will be provided. This section includes a discussion of the main characteristics of MSEs that justify the design of specific initiatives of the telecenter directed to those enterprises. The third section presents the survey and its methodology. The fourth section describes some results of the survey, focusing on issues related to learning and training. The fifth section will compare the results of the survey with the issues discussed in the previous sections, and will provide concluding remarks.

Keywords: Information and communication technologies; Micro and Small Enterprises; Telecenters

TELECENTERS AND LEARNING IN MICRO AND SMALL ENTERPRISES: THE CASE OF CAMPOS DOS GOYTACAZES, RIO DE JANEIRO

1. INTRODUCTION

Telecenters have been considered important tools for digital inclusion and ICT training in developing countries (Fontaine and Fuchs, 2000). In those countries, telecenters are built to promote digital inclusion of people and of micro and small enterprises (MSEs) as well, because the latter are regarded as important sources of employment and wealth. For the purposes of this article, we define micro and small enterprises as those that have up to 100 employees. However, those enterprises will only be digitally included by telecenters if, as a result of their implementation, learning processes that promote innovation and competitiveness take place (Proenza *et al.*, 2001). Therefore, telecenters must meet the needs of MSEs in order to be effective in promoting digital inclusion and improvement of competitive intelligence of those enterprises. This article will explore this issue, based on the results of a survey conducted in Campos dos Goytacazes, a city located in the state of Rio de Janeiro. This city was chosen for the study because it is a medium-sized city located on the north of Rio de Janeiro state, outside the area of influence of the city of Rio, thus being a regional pole of development (La Rovere and Carvalho, 2005). The city has a very high percentage of MSEs (98% of registered enterprises have less than 100 employees) and it is one of the cities that were chosen to locate a telecenter for information and business (TIB) financed by the Brazilian Ministry of Development, Industry and External Trade (Brazil's MDIC). The hypothesis that oriented the research on Campos dos Goytacazes was that the small degree of digital inclusion of MSEs in this city enhances the importance to design the activities of the telecenter so that digital inclusion of those enterprises is effectively promoted.

The article is divided in four sections, besides the present introduction. In the second section, some arguments on how telecenters may work as tools for digital inclusion and socioeconomic development will be provided. This section includes a discussion of the main characteristics of MSEs that justify the design of specific initiatives of the telecenter directed to those enterprises. The third section presents the survey and its methodology. The fourth section describes some results of the survey, focusing on issues related to learning and training. The fifth and last section will compare the results of the survey with the issues discussed in the previous sections, and will provide concluding remarks.

2. TELECENTERS AND SOCIOECONOMIC DEVELOPMENT

Telecenters may be described as "places that provide public access to information and communication technologies" (Proenza *et al*., 2001). Proenza *et al.* argue that telecenters have a potential to break some of the main barriers to development faced by low-income populations, because they provide access to: i) goods and services that are far away geographically; ii) best business practices; iii) information about markets; iv) information about support services; v) opportunities for work and telework; vi) people with similar social interests. While the first four sources of information are more important for enterprises, the last two are more important for individuals. However, the authors warn that telecenter implementation must be done together with several complementary initiatives, such as: provision of adequate infra-structure, with digital or wireless connectivity; user training initiatives; specific information policies directed to MSEs; community involvement in the project; legislation initiatives to make easier the access of small enterprises to electronic commerce; and support to virtual activism as a means to empower local populations.

The initiatives listed above are indeed necessary, especially to small enterprises. The literature on organizational characteristics of MSEs suggests that those enterprises have several limits to use ICTs in an intelligent way. First, as owners/managers of small companies tend to give more value to tacit knowledge than to codified knowledge (Rodrigues, 2000), they employ low-qualified workers that are mainly trained as production takes place. Second, owners/managers of MSEs tend to concentrate management in themselves, thus failing to perceive their real necessities of ICTs and adopting ready-made systems (La Rovere and Mattos, 2005). For instance, computers are normally bought by MSEs based on impressions or intuitions of the owner/manager, and the software installed that is bought with the computer is frequently underutilized. Third, MSEs normally aim the local market (La Rovere and Carvalho, 2005) and have small access to finance sources (Canuto, 2002). As a result they are sensible to economic cycles, having thus a limited capacity to invest in new technologies. Fourth, the restrictions of markets and finance induce a small insertion in the global market. In Brazil, for instance, a study on MSEs exports form 1997 to 2002 showed that despite 64.4% of exporting companies were small, only one third exported continuously, that is in every year of the period (Markwald and Pessoa, 2003). Finally, MSEs present different patterns of ICT use according to the sector they belong to (La Rovere and Hasenclever, 2003). As a result the adjustment of ICT diffusion policies to the needs of MSEs is difficult.

The main challenge to the implementation of telecenters is therefore their capacity to meet the needs of MSEs. As observed by La Rovere (2006), ICT diffusion policies may be divided in supply-oriented policies and demand-oriented policies. The first assumes that infra-structure provision is sufficient to promote access of enterprises to ICTs and their use for competitive strategies. The second assumes that, besides infra-structure, awareness and training initiatives have to be implemented to enable improvements in innovative and competitive abilities related to ICT diffusion. The manager of the telecenter must try to avoid the supply-oriented vision if he wants to effectively promote digital inclusion of MSEs.

In Brazil, telecenters have been implemented by both government and non-government organizations. The federal Government initiatives to support telecenters are organized by Brazil's Ministry of Development, Industry and External Trade (MDIC). The main objective of the "Telecenter for Information and Business" program is to promote "intensive use of ICTs to empower the different actors that are involved in the strengthening of national (small) enterprises that employ and offer opportunities of economic and social insertion to the main part of the population" (MDIC, 2004). The main benefits related to ICT diffusion perceived by MDIC are related to the training of entrepreneurs and their employees in the use of ICTs, the possibilities to improve goods and services offered by MSEs and the inclusion of the community in the Information Society. Besides those, there are benefits related to the reduction of the technological distance that divides MSEs from their competitors, and benefits related to the improvement of competitiveness of these enterprises that lead to the creation of jobs and wealth (Marinho, 2006). Telecenters are being implemented as a result of a partnership between MDIC and the Brazilian Service of Support to Small Business (SEBRAE). The planning and implementation of telecenters includes a systematic evaluation of their activities through questionnaires that are distributed by local institutions. In 2002, a total of 81 Brazilian institutions were already qualified to implement telecenters in their regions (MDIC, 2004).

The Federal Center of Technological Education of Campos (CEFET Campos) was qualified by MDIC to implement a Telecenter for Information and Business in this city in 2006. This implementation involved partnerships with local institutions, such as the local branch of SEBRAE, the local Informatics Professionals Union, the Association for Industry and Trade of Campos (ACIC), the Federation of Industries of Rio de Janeiro (FIRJAN), the city Government and a local Internet service provider called Acesso Total. The telecenter occupies a total area of 50 square meters and has 11 computers connected in a network with access to

Internet. The link is provided by radio MMDS by Acesso Total and has a velocity of 600 kbps.

As it will be shown in the next section, MSEs of Campos present characteristics related to their size mentioned in this section. It is essential that the telecenter of Campos provides training initiatives that can meet the needs of local enterprises.

3. METHODOLOGY OF THE RESEARCH

The research was conducted among micro and small enterprises of Campos dos Goytacazes. As observed by La Rovere and Carvalho (2005), this city has the second largest population of cities in the state of Rio de Janeiro and its economy is dominated by a large number of small enterprises. Data of the Brazil's Ministry of Labor for 2004 show that Campos has a total of 6.223 micro and small enterprises, that represent 98.03% of the total number of enterprises of the city and account for 47.62% of formal employment.

The choice of the enterprises surveyed followed two criteria. The first was the importance of their sectors in total employment; the second was the importance of their sectors in local GDP. The combination of these criteria was necessary because some productive chains, such as food production, are not very well captured by statistics on employment due to the use of non-registered labor in those activities. The use of the first criterion was made by Britto (2004) in his study of activity concentration and local productive systems in the state of Rio de Janeiro, and in the case of Campos it leads to the choice of the sectors that produce garments, red ceramics and medical services. The use of the second criterion leads to the choice of food production and building. Food production represents more than 80% of industrial GDP in Campos, a percentage that is very high when compared to the average of the state of Rio de Janeiro (10%), as observed by La Rovere and Carvalho (2005). If we exclude from GDP the revenue related to oil royalties, building appears as the third more important sector in total GDP generation of Campos, after rentals and services, according to the data of the Center for Information and Statistical Data of the State of Rio de Janeiro (CIDE). The research covered 146 enterprises: 64 garment producers, 30 medical service providers, 28 building companies, 13 food producers and 11 red ceramics producers. The total of enterprises interviewed account for 8% of the total number of enterprises. As observed by Weisberg *et al.* (1996), surveys generally take more than 100 interviews because the error rate for samples of that size is too high. The authors warn that, as the number of interviews increases, so does the cost of the study, therefore the researchers must decide at which point the sample must stop, balancing added precision and extra cost. In the case of this research, the choice was to design the sample in a way that it represented 8% of the total number of enterprises, so that this sample could be compared with the sample used by La Rovere and Carvalho (2005) in their study. The sample was built by random selection of the enterprises to be interviewed, and maintains the proportion each sector has in the total of enterprises.

Thus the research was conducted using a survey. According to Pinsonneault and Kraemer (1993), surveys can be defined as a method to obtain data or information about characteristics, actions or opinions of a given number of people, used as representatives of a target population, by applying a tool or research, normally a questionnaire. In the case of this study the questionnaire used had 57 questions, divided in groups according to the subject. The groups are: characteristics of the enterprises, plan of investment in ICT, characteristics of ICT use (frequency, objectives, perceived obstacles) and training of employees in ICT. The survey was conducted between September and December 2005.

The next section will present the results of the survey concerning training and learning processes in the micro and small enterprises of Campos. Since training depends on the ICT infra-structure enterprises have, the results related to hardware, software and networks will

also be presented.

4. RESULTS OF THE SURVEY

4.1 Infra-structure and use of ICTs

The survey found that 71.23% of enterprises have computers, but the percentage of enterprises that have computers vary according to the sector. The highest percentage (96.4%) is found in the building sector, while the lowest (38.5%) is found in the food products sector (see Table 1).


Sector	%
Building	96.4
Red Ceramics	81.8
Medical Services	76.7
Garment	62.5
Food Products	38.5

Table 1: Enterprises that have computers (% of the total)

To compare the level of ICT use between enterprises, regarding computers, networks, servers and Intranet, the following classification was created:

- ❖ C1: Enterprises that do not have computers;
- ❖ C2: Enterprises that have computers, but do not have networks;
- ❖ C3: Enterprises that have networks, but do not have servers;
- ❖ C4: Enterprises that have networks and servers, but do not have Intranet;
- ❖ C5: Enterprises that have networks, servers and Intranet;

The results of the survey on ICT use regarding the classification proposed above are presented in Graph 1.
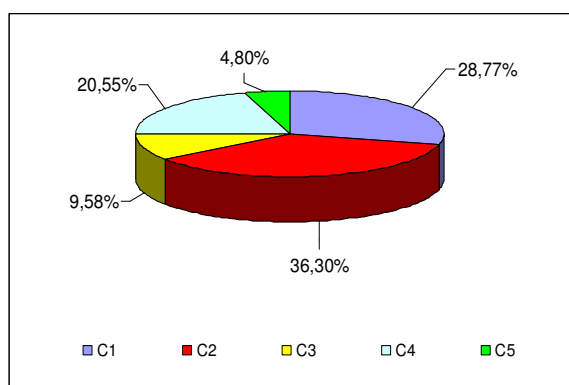
Graph 1 – Type of ICT use among enterprises

C1: Enterprises that do not have computers; C2: Enterprises that have computers, but do not have networks; C3: Enterprises that have networks, but do not have servers;C4: Enterprises that have networks and servers, but do not have Intranet;C5: Enterprises that have networks, servers and Intranet

Therefore, most enterprises surveyed have computers but do not have networks. The survey also found that most enterprises that have networks do have servers but few of those enterprises that have networks have Intranet.

Table 2 shows that the type of use of ICT also varies according to the sector. Only enterprises from the garment, medical services and building sectors have networks, servers and Intranet. Table 2 also shows that the use of ICT among food and ceramics producers is done at a very basic level.

When it comes to Internet use among those enterprises that have computers, the survey found that this use is very high: 100% in the building, food and ceramics sectors, 82.6% in medical services and 67.5% in garment. However, the use of Internet for services that could enhance the competitiveness of enterprises, such as e-learning, website sales, discussion lists, electronic auctions and e-commerce is very low: less than 5% for most sectors. Services that could contribute for cost reduction like telephone calls based on VoIP are also used by very few enterprises. The type of Internet connection that is used by most enterprises is still dialed access (52.9% of enterprises), followed by ASDL (28.7%), cable (10%) and radio (8%). Only 15 of the 146 enterprises surveyed have a webpage, and again there are differences between the sectors: while in the medical services sector 6 enterprises have webpages, not a single enterprise from the food sector in the sample had a webpage. Also, out of the 15 webpages found only 2 were hosted by servers owned by the enterprises themselves.

Sector/Type of Use	C1	C2	C3	C4	C5
Medical Services	23.3	20.0	10.0	36.7	10.0
Garment	37.5	39.1	4.7	14.1	4.7
Building	3.6	35.7	25.0	32.1	3.6
Food Products	61.5	23.1	7.7	7.7	0.0
Red Ceramics	18.2	81.8	0.0	0.0	0.0

Table 2: Type of use of computers in the enterprises, by sector (% of total)

C1: Enterprises that do not have computers; C2: Enterprises that have computers, but do not have networks; C3: Enterprises that have networks, but do not have servers;C4: Enterprises that have networks and servers, but do not have Intranet;C5: Enterprises that have networks, servers and Intranet

In order to better understand better the use of Internet among the enterprises, especially related to e-commerce, a classification for use of Internet was created, as follows:
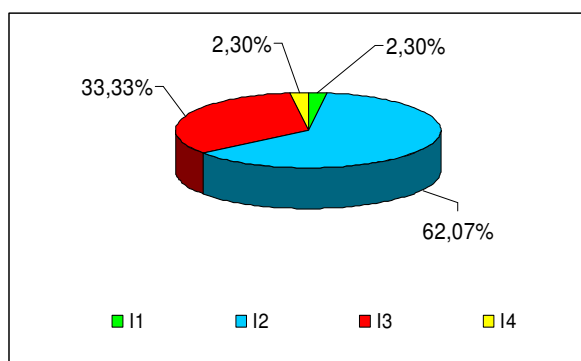
- I1: Enterprises that have access to Internet but use it only for navigation (access to information);

- I2: Enterprises that use all Internet services with exception of e-commerce

- I3: Enterprises that buy using Internet, but do not sell using Internet

- I4: Enterprises that sell over Internet

The results of the survey on Internet use regarding the classification proposed above are presented in Graph 2. The graph shows that most enterprises use some services of Internet but do not use e-commerce. The percentage of enterprises that sell their products using Internet is very low.

Although there are some differences in the type of use of Internet by sector (see table 3), in all

sectors use is concentrated in use of Internet for all purposes except buying and selling products.

The average number of employees using ICT as part of their regular work in the enterprises for the whole sample was 5.3. Only 29.8% of the enterprises that had computers in of the sample had more than five employees using ICT. Also, the majority of enterprises (93.3%) do not have employees for software development and ICT support. During interviews, the entrepreneurs explained that they prefer to buy ready-made software and adapt them to the enterprise's needs rather than employ software developers. Software support is also viewed as a costly function, so they prefer to hire other enterprises or individual service providers to do this work.

Graph 2: Type of use of Internet

I1: Enterprises that use Internet only for navigation; I2: Enterprises that use all Internet services with exception of e-commerce; I3: Enterprises that buy using Internet, but do not sell using Internet: I4: Enterprises that buy and sell using Internet

Sector/Type of use	I1	I2	I3	I4
Medical Services	5.3	63.2	31.6	0.0
Garment	3.7	66.7	25.9	3.7
Building	0.0	51.8	40.7	7.4
Food Products	0.0	60.0	40.0	0.0
Red Ceramics	0.0	66.7	33.3	0.0

Table 3: Type of use of Internet, by sector (% of the total)

I1: Enterprises that use Internet only for navigation; I2: Enterprises that use all Internet services with exception of e-commerce; I3: Enterprises that buy using Internet, but do not sell using Internet: I4: Enterprises that buy and sell using Internet

The survey also investigated how the enterprises of the sample used software. Software was classified in four types: Software for general purposes, software for specific use, management of information systems and decision support systems. Regarding the use of software for general purposes, the survey found different percentages of use of software according to the sector, as shown by table 4. This table presents some interesting data to assess the needs of enterprises: first, the use of email is astonishing low in most enterprises, with the exception of those in the building sector. Second, the use of software for needs specifically related to competitiveness, such as business plan, project implementation and project management is also very low. Third, the number of enterprises that declare that they do not use any software for general purposes is very high in the sector of food products.

The use of software for specific uses is described in table 5. This table shows not only that the use of software for specific use varies with the sector, but also that in the food and ceramics sectors, the number of enterprises that do not use this type of software is very high.

Software/Sector	Medical Services	Garment	Building	Food Products	Red Ceramics
Agenda	10.0	6	28.6	7.7	0.0
Antivirus	70.0	46.9	89.3	23.1	81.8
Backup	56.7	32.8	64.3	15.4	18.2
Browser	63.3	42.2	96.4	38.5	81.8
Business Plan	3.3	4.7	0.0	0.0	0.0
Data base	40.0	45.3	46.4	15.4	27.3
Email	13.3	20.3	57.1	15.4	27.3
Groupware	0.0	0.0	7.1	0.0	0.0
Project implementation	0.0	0.0	28.6	0.0	0.0
Project Management	0.0	4.7	21.4	0.0	0.0
Slides	36.7	6.2	32.1	0.0	9.1
Text processing	76.7	46.9	89.3	30.8	81.8
Worksheets	60.0	40.6	89.3	30.8	63.6
Do not use	23.3	37.5	3.5	61.5	18.1

Table 4: Use of software for general purposes by sector (% of the total)

Software/Sector	Medical Services	Garment	Building	Food Products	Red Ceramics
Accounting	16.7	21.9	25.0	7.7	0.0
Budget	0.0	0.0	42.9	0.0	0.0
Finance	40.0	35.9	32.1	15.4	18.2
Human Resources	3.3	12.5	28.6	7.7	0.0
Inventory	30.0	56.2	21.4	23.1	18.2
Marketing	3.3	4.7	3.6	0.0	0.0
Production control	40.0	18.7	10.7	15.4	18.2
Property	10.0	10.9	0.0	0.0	0.0
Sales	13.3	53.1	7.1	38.5	18.2
Other	26.7	3.1	3.6	7.7	18.2
Do not use	26.7	39.1	28.6	61.5	63.6

Table 5: Use of software for specific uses by sector (% of the total)

Table 6 confirms that few enterprises use ICT with the specific aim of enhancing competitiveness, and also presents differences according to the sector. This table presents the

results related to the use of Management Information Systems (MIS) and Decision Support Systems (DSS). In this case, more enterprises of the garment sector use MIS and MSS. Also, these systems seem to be totally unknown to enterprises of the Red Ceramics sector.

| Systems/Sector	Garment	Medical Services	Building	Food Products	Red Ceramics
Management Information Systems	30.0	8.7	18.5	20.0	0.0
Decision Support Systems	22.5	0.0	11.1	0.0	0.0

Table 6: Use of management systems by enterprises (% of the total)

Two questions may be proposed after an analysis of the data presented in this section. The first question is whether the differences in the pattern of use of ICT can be explained by sectoral factors such as the degree of organization of information flows and the training of the workforce. The second question is whether the socio-economic context of the enterprises surveyed influence the pattern of adoption of ICT. We will explore these questions in the following section.

4.2 Sectoral factors and socio-economic context

As suggested by La Rovere and Hasenclever (2003), ICT adoption results from a learning process within the firm that is cumulative and dependent of the way the firm organizes its internal information flows. The more complex the activity developed by the firm, the more need the firm will have to organize its internal information flows. Well-organized internal information flows ease ICT adoption. However, as learning is cumulative, ICT adoption will also depend on the level of education of managers and employees in the firms. The data presented in the previous section suggest that the enterprises in the food and red ceramics sectors have a lower degree of organization of their internal information flows, since their use of specific software and management systems is lower. The data collected by the survey concerning the training of employees in ICT use gives clues on how enterprises consider the benefits of use of ICT by their employees. Graph 3 shows the percentage of enterprises that have computers that also invested in ICT training for their employees.

To assess the real importance of investment in ICT training for enterprises, the survey also verified the planned investment on ICT training in the following 12 months. At the time of the survey, a basic course on informatics, with a workload of 20 hours, had a cost of R$ 100,00 (one hundred Brazilian Reais), meaning an hourly cost of training per person of R$ 5,00 (equivalent to approximately US$ 2 at the time of the research). For specialized training, this cost is much higher: for instance, a course on how to configure an operational system, with a workload of 40 hours, costs about R$ 1.000,00, meaning an hourly cost of training per person of R$ 25,00 (US$ 10).
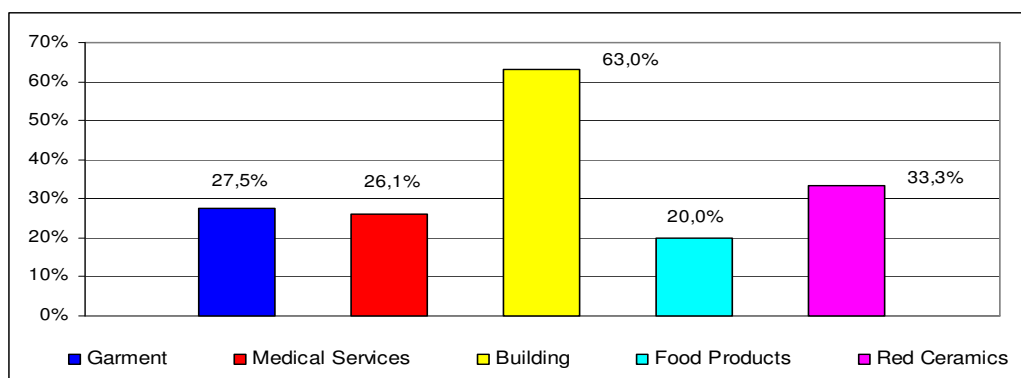
Graph 3: Enterprises that invested in ICT training of employees (% of the total)

Table 7 presents the planned expenses in ICT training in Brazilian Reais of the surveyed enterprises. Since most enterprises did not have any planning concerning ICT training, this table suggests that most of the investment declared for graph 3 would not be repeated the subsequent year. Table 7 also shows sectoral differences. The building sector appears as having more enterprises investing on ICT that the other sectors. The food sector presented the highest average investment in ICT training: R$ 754,00, corresponding to approximately 150 hours of basic training and 30 hours of specialized training. However, this high average may be related to the fact that one enterprise was doing a much higher investment than others and the size of the sample is smaller in the case of food products (13 enterprises). The lowest average investment is from the medical services sector. As the investment is concentrated in few enterprises, the main conclusion drawn from the results of this table is that most enterprises surveyed are not aware of the importance of ICTs for business development.

Graph 3 and table 7 show that the building sector appears as the only one whose enterprises invested more consistently in ICT training, because it has a high percentage of enterprises investing in ICT and it presents the highest number of enterprises that will invest on ICT in the future.

The survey also investigated whether enterprises stimulated their employees to learn about ICT use permanently and in an interactive manner, by exchanging knowledge and experiences. Graph 4 shows the results concerning this question. Again, sectoral differences seem to be very important. Building and medical services, in this case, are the sectors whose enterprises are more attentive to the issue of interactive learning.

GARMENT		MEDICAL SERVICES		BUILDING		FOOD PRODUCTS		RED CERAMICS	
Number of enterprises	Value (R$)	Number of enterprises	Value (R$)	Number of enterprises	Value (R$)	Number of enterprises	Value (R$)	Number of enterprises	Value (R$)
1	5.000	1	1.100	1	4.000	1	6.000	2	1.000
1	2.000	2	500	1	2.000	1	1.800	1	300
3	500	1	300	2	1.500	1	1.000	8	0
1	400	26	0	3	1.000	2	500		
1	300			1	500	8	0		
57	0			2	400				
				2	300				
				16	0				

Table 7: Planned investment in ICT training of employees by sector (number of enterprises and value in Reais)
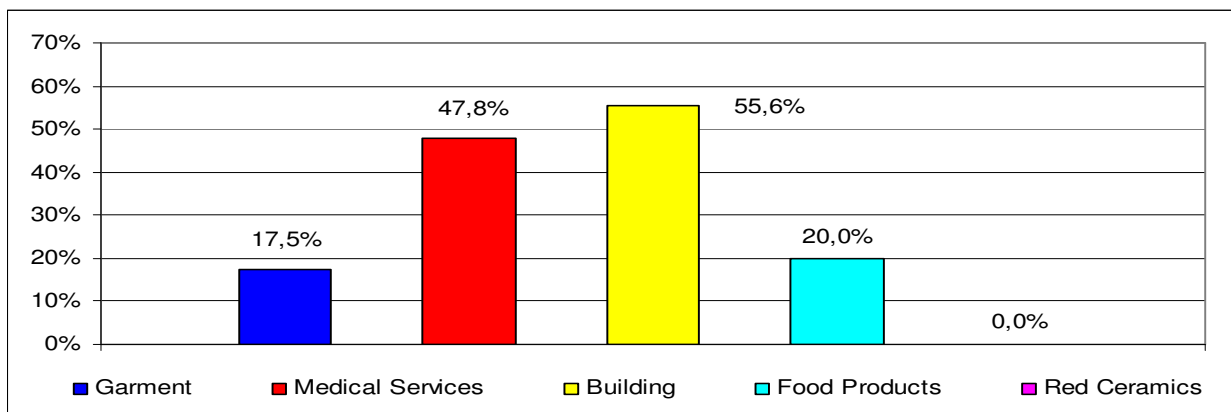
Graph 4: Enterprises that stimulate ICT interactive and permanent learning (% of the total)

Finally, the survey investigated how employees learn to use ICT. There are several types of learning forms: by internal training, by external training, during production, by exchanging experience with colleagues and by constant use of the technologies. In the majority of enterprises surveyed the most used type was learning on production, as shown by table 8. This result confirms what is suggested by Rodrigues (2000) concerning learning processes on micro and small enterprises. Table 8 also shows that, with the exception of the building and ceramics sectors, few enterprises use external training and fewer use internal training as tools for ICT learning.

The survey also inquired whether enterprises considered lack of training of the workforce a significative obstacle to ICT adoption. The red ceramics and the food sector appear as the sectors with the highest proportion of enterprises that considered the training of the workforce a relevant obstacle.

Form of learning/sector	Garment	Medical Services	Building	Food Products	Red Ceramics
Internal training	12.5	21.7	18.5	20.0	0.0
External training	27.5	21.7	51.8	0.0	66.7
Exchange of information with colleagues	35.0	47.8	40.7	20.0	11.1
Learning in production	90.0	82.6	92.6	80.0	100.0
Constant use of ICT	30.0	21.7	51.8	20.0	44.4

Table 8: Form of learning in the enterprises (% of the total)

The sectors where this problem is viewed as more important were the sectors that have a relative low use of ICT, such as food products and red ceramics. Therefore it seems that enterprises from these sectors are stuck in a vicious circle low use/low training/low investment in training/low adoption. We tried to verify whether low training of the workforce stems from lower levels of education in these sectors or are related to a lack of understanding of the importance of ICT.
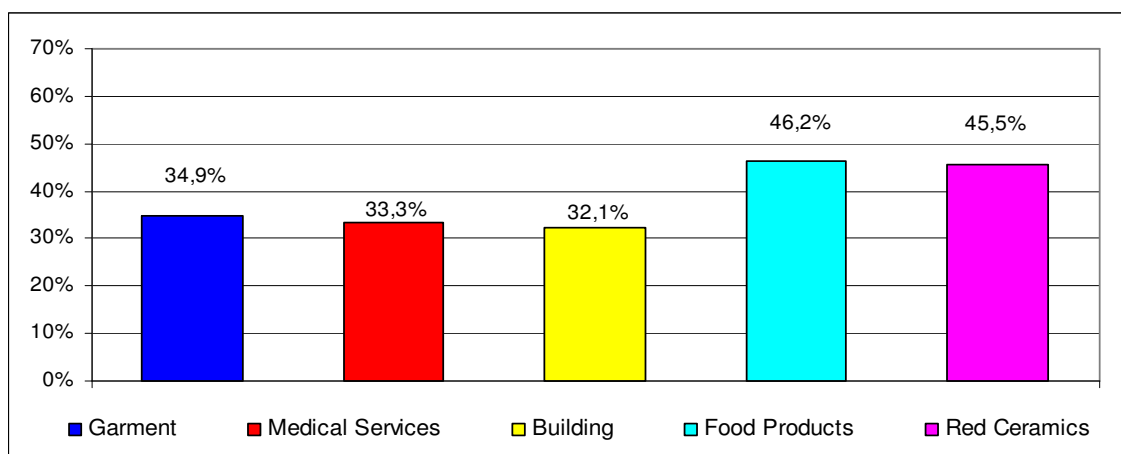
Graph 5: Enterprises that consider lack of training a significative obstacle for ICT adoption (% of the total)

Data collected from Brazil´s Ministry of Labour Statistics show that levels of education are indeed different among employees of different sectors (see table 9). Table 9 confirms that formal education of employees in the food and ceramics sectors is lower. However, results related to the building sector suggest that formal education is not the only element that explains a low degree of ICT adoption. In fact, the percentage of employees that have until 8 years of education in this sector is much closer to the percentage found in the food and the ceramics sector than to the percentage found in the other two sectors.

Number of years	Garment	Medical Services	Building	Food Products	Red Ceramics
0-4	5.0	4.0	38.0	54.0	69.0
4-8	32.0	14.0	45.0	24.0	22.0
8-11	58.0	54.0	14.0	19.0	9.0
More than 11	5.0	23.0	3.0	4.0	0.0

Table 9: Levels of formal education in number of year of employees (% of the total)

The data seem to suggest that we have to look further into the socio-economic context of the enterprises surveyed. Although the survey did not focus on this issue, data collected during the interviews and also by La Rovere and Carvalho during their research show that the sectors surveyed have a very different pattern of insertion in the economy of Campos. Both medical services and building sectors are growing very fast due to Campos´ position as a regional development pole. The garment sector, on the other hand, is trying to expand its activities based on specialization in certain types of garment (jeans and night underwear), a strategy that has been successfully adopted by another cities in the state of Rio de Janeiro. In contrast, the red ceramics and the food sectors are traditional sectors that are mostly focused on local markets or low-quality/low price regional markets.

5. FINAL REMARKS

As mentioned in the second section of this paper, telecenters must provide demand-oriented initiatives together with ICT infra-structure. The results of the survey among a representative sample of micro and small enterprises in Campos dos Goytacazes, state of Rio de Janeiro, suggest that the telecenter that has been recently implemented in this city has to focus its initiatives beyond the simple provision of ICT-related services.

The survey showed that several training initiatives must be provided to enable local enterprises to start using ICT to promote competitiveness. First, a collective action to promote ICT training among employees of local enterprises is necessary. Lack of training of the workforce was viewed as a significant obstacle by a significant percentage of enterprises, especially by those enterprises in the food and ceramics sectors. The data presented on section 4 also suggest that enterprises rely a lot in learning processes in the workplace and few enterprises invest in ICT training. The constitution of networks of enterprises could help to reduce costs involved in training. However, benefits related to ICT training of the workforce are limited since the level of formal education of employees is very low in some sectors. Therefore, enterprises are stuck in a vicious circle where low degree of formal education limits not only ICT adoption but also the benefits related to ICT training of the workforce.

Second, as urgent as training initiatives are entrepreneur (owners and/or managers) awareness initiatives, as the survey found a very limited use of ICT among enterprises. However, to promote the awareness of entrepreneur is a necessary but not sufficient condition to attain local enterprises successfully. The survey confirmed the results of La Rovere and Mattos (2005) on the tendency of local MSEs to adopt ready-made ICT solutions that sometimes are not the more adequate for their use. The absence of professionals dedicated to ICT in most enterprises enhance the need for those enterprises to have access to qualified and regular ICT support services. As costs of maintaining such services may be too high for the enterprises, especially the very small, a possible solution would be to organize networks of MSEs with the specific aim to disseminate and support use of ICT among those enterprises and promote business improvement. These networks, together with networks for ICT training, could be the first step towards setting a backbone for local productive systems. The telecenter could seek the constitution of this backbone, together with local institutions, especially SEBRAE´s local office, that are interested in supporting local productive systems.

The survey also showed sectoral differences in ICT use, confirming the results found by La Rovere and Hasenclever (2003). Therefore the initiatives of the telecenter must consider sectoral differences of local enterprises. The fact that most employees learn these technologies during production confirms the suggestion of Rodrigues (2000) and enhances the importance of designing courses that may be attractive for local enterprises. The basic use of software, the low level of management systems and the relative low stimulus to learn ICT in a continuous form are all results that enhance the importance of training for effective adoption of ICTs. The fact that enterprises perceive lack of training as an obstacle to ICT adoption demonstrates that the telecenter is indeed a welcome initiative. However, its activities must be carefully planned so that it can attain effectively local enterprises, thus contributing to socioeconomic development.

Finally, beyond the implications for the telecenter initiatives provided by the research, the results of the survey presented in this article call for more qualitative research on local MSEs. Additional research must be done so that we can improve our understanding of the organizational framework of local enterprises and of the challenges related to their socio-economic environment.

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ICT and citizens' trust in government: lessons from electronic voting in Brazil

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Abstract

The electronic voting system of Brazil is widely trusted by the citizens of the country and international observers as an efficient and reliable mechanism of producing elections results that accurately represent the choices of the electorate. In this paper we examine the conditions contributing to such an attitude of trust towards a government institution. We argue that the observed trust is only partly attributable to the trustworthiness merits of the technical system and its enactment procedures. Two other factors play a significant role in the formation of this trust, namely a positive predisposition of citizens towards ICT and towards the institutional actors responsible for the elections – the Superior and the Regional Electoral Courts. We therefore conclude that, unlike common assumptions about the potential of e-government to restore trust in government institutions in developing countries where such trust is lacking, the production of trust in ICT-mediated government services relies on the competencies of these institutions and citizens' perceptions of their trustworthiness.

Keywords: electronic voting, institutional trust, trustworthiness, Brazil, developing countries, e-government.

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Introduction

The research we present in this paper has been triggered by the concerns of international development agencies about the Latin American citizens' low degree of trust in democratic government institutions, as indicated by various opinion surveys (Latinobarómetro 2004; UNDP 2004). In current development thinking 'good government' - comprising transparency in decision making, efficient administration, effective accounting, a reliable legal system, social cohesion, avoidance of corruption, state capability and credibility - is a required for economic growth (Meier 2001). Economic development in understood to rely on effective institutions for well functioning markets (World Bank 2002). Lack of citizens' confidence in democratic institutions is a worrying sign of lack of propensity to cooperate, thus being an obstacle to economic growth. Against the background of such concerns, e-government programmes are generally expected to improve citizens' access to government services, to bring transparency of governments' decisions and activities, and to combat corruption in state administration, thus remedying the perceived problem of trust.

The opportunity for our research arose due to the Inter-American Development Bank's (IADB) interest in determining the potential of its sponsored e-government projects in the Latin American region to impact on citizens' trust in their governments. One of the ICT applications we chose to study is electronic voting in Brazil[i]. A study of the use of ICT to support the conduct of elections is particularly pertinent to the question of citizens' trust in democracy because it concerns one of the most fundamental institutions of democracy and is used by all citizens above the age of 18[ii].

In our research we take trust in democratic government to be a matter of trust in political institutions, such as the various agencies that deliver the services of the modern state. This notion of trust is distinct from trust in particular individuals occupying positions in government and administration.

In our empirical research we found a great deal of evidence that Brazil's electronic voting system is widely used and appreciated, and that the election results it produces are, with few exceptions, trusted to be the correct aggregate of individual citizens' actual votes. Yet, the formation of plausible cause and effect relationships between a technical/institutional arrangement and trust as expressed in citizens' opinion surveys and demonstrated by their actions posed a theoretical challenge. Despite a substantial literature on trust in political theory and a growing body of research on the issue of trust in the field of information systems, we did not find a satisfactory theoretical platform that could direct our research in terms of what socio-technical properties and associations we should look for to explain, predict, or direct action towards maintaining trust. Thus, the research we undertook sought to form theoretical associations between ICT uses in government and trust and to explore empirically their validity.

The paper is structured as follows. In the next section we introduce the concepts pertaining to the question of trust in this research and identify distinctions and relationships to investigate in the empirical study. We then describe our research in terms of data collection method and process of analysis. In the following section we describe the electronic voting system and its government institutional setting and broader social context and present an assessment of its role on the election process and its results. In the discussion section that follows we use our analytical concepts to unravel the way this technology innovation may be associated with changes in the Brazilian citizens' attitude of trust in elections and in democratic government at large. Finally, in the conclusions we draw some answers to the question whether and under

what conditions e-government can be a mechanism for restoring citizens' trust in government institutions.

Disentangling concepts

A large and dispersed literature has highlighted the significance of trust in modern society[iii]. Indicatively, in economics and politics trust is a necessary condition for the functioning of the market and the political system (Fukuyama 1995; Putnam 2000; Williamson 1975); in sociology and organizational theory trust is often juxtaposed to the need for control of social systems (Gambetta 1988; Giddens 1991; Luhmann 1979). Giddens pointed out the significance of actively creating trust in the expert systems that make the fabric of late modernity (Giddens 1990; Giddens 1994). In IS, a stream of publications have reported research on trust as it pertains to new forms of business enabled by the internet, such as virtual teams, and e-commerce and e-government (Ba et al. 2002; Jarvenpaa et al. 1999; Jarvenpaa et al. 2004; Piccoli et al. 2003).

This literature convincingly argues for the significance of individuals' attitude of trust towards others as well as towards mechanisms of their societies. But beyond agreement on the general thesis on the importance of trust in modern society there are many controversies regarding the nature of 'trust' and the conditions that foster it. One area of contention, for example, is the extent to which trust in government institutions depends on interpersonal trust (Levi 1998; Putnam 2000). Some political theorists argue that the trust individuals form through their lives towards strangers and collectives of strangers in their communities plays an important role in developing trust in the impersonal political institutions of modern democratic societies (Hardin 1998). Others reverse the causality between interpersonal and political trust. They argue that face-to-face, community based, relations play a limited role in building trust in the institutions of complex societies. Instead, they emphasize the importance of legal and institutional mechanisms, such as the courts of justice, elections, property rights, for fostering trust in other members of a society (Cohen 1999; Fukuyama 1995; Levi et al. 2000; Zucker 1986).

Thus, current theory does not provide an answer to the question of why and how ICT use may strengthen citizens' trust in government. Therefore, we set out to construct a theoretical suggestion for our research question. We start by exploring the conceptual distinctions and relations that may allow us to unpack the common sense view that considers ICT-related improvements of transparency, efficiency, corruption, etc., in the operations of government organizations as a mechanism to increase citizens' trust in government institutions.

The first such distinction we draw is between *trustworthiness* as a property of a system, a government service, or an institution, and *trust* as a behavioural attitude of citizens. We point out that increases in the trustworthiness of a system may not be accompanied by increases in citizens' trust in the system. The second distinction we need to make concerns the 'systems' which are implicated in the formation of citizens' trust. In other words, we need to demarcate relevant levels of analysis regarding the object of trust: ICT, an e-government service, a government institution, or a regime of government at large. The main focus of our analysis in this paper is the association between an ICT system and the government institution within which this system is embedded and is intended to support.

Trustworthiness vs trust

The concept of trustworthiness refers to the properties through which a trusted entity (whether another person or an institution) serves the interests of the truster, while trust reflects the truster's beliefs, or perceptions, of the entity's trustworthiness (Levi et al. 2000). This distinction between trustworthiness and trust has received a great deal of attention in studies of trust in advanced democracies where surveys show widespread suspicion to the performance of almost all established institutions, such as schools and health care systems.

One of the paradoxes in that context is that measures designed to monitor and demonstrate trustworthiness, such as performance indicators, tend to accentuate the problem, perpetuating a climate of suspicion (O'Neill 2002). That is, even when performance indicators suggest improvements of services, citizens continue to place low trust in the institutions delivering them.

Two main reasons are discernible in the literature for the mismatch between the trustworthiness merits of a government service and the trust it enjoys (Levi et al. 2000; O'Neill 2002). First, the willingness of citizens to rely on a service depends on their judgment of the overall social and political context that sustains them and is shaped on the basis of more general beliefs and political predispositions. Second, the perception of trustworthiness relies on the cognitive and emotional capacity that individual citizens bring to bear on their experience of a service, on indicators used to describe aspects of trustworthiness, or on informants, such as the media. All of these may misinterpret or misrepresent the merits of the service, either towards misplaced trust, or towards excessive suspicion.

Therefore, while it is reasonable to expect that the development of trustworthy e-government services potentially contributes to citizens' trust in the agency, it does not determine it. Citizens' perception of the trustworthiness of a government agency is mitigated by their expectations and beliefs about its political underpinning. For example, citizens' view of the merits and fairness of the policy legislation that a government agency enacts may contribute to a general attitude of suspicion towards it, which conditions the way they perceive its services.

Trust in ICT and trust in ICT-mediated services

The expectation that improvement of the trustworthiness of government agencies through the use of ICT will result in citizens' trust in government entails the assumption that ICT itself will be a trusted interface to a government agency, or a trusted actor involved in the performance of the agency's task; but the validity of such an assumption cannot be taken for granted.

In the information systems literature it is recognized that, even if successfully implemented, the e-government services themselves may not be trusted adequately to be used and therefore their adoption is itself in need of trust-building mechanisms (Carter et al. 2005; Warkentin et al. 2002). Based mainly on the technology acceptance model (TAM), the literature has suggested that, in order to be adopted, e-commerce and e-government technologies must be perceived to be useful and easy to use. In addition the IS literature on trust has emphasized the importance of the technology-based transactions being perceived as secure (Carter et al. 2005; Gefen et al. 2003; Salam et al. 2005). The usefulness of e-government services are usually associated with specific performance improvement objectives, such as efficiency and effectiveness in delivering a range of services, reduction of corruption, or transparency in the conduct of administration. The issue of security is understood to point to the need for institutional mechanisms that safeguard integrity of transactions, such as certification and escrows (McKnight et al. 2002; Pavlou et al. 2004; Warkentin et al. 2002).

One of the limitations of TAM-based explanations is that, taking a narrow perspective of a user-artifact relationship, they cannot account for the origin of the user perceptions. The more crucial question why citizens may perceive an ICT-mediated transaction as trustworthy (useful, easy, and secure) requires consideration of their existing pre-disposition to ICT, as was demonstrated in a study of the implementation of a GIS system in India by Barrett et al (Barrett *et al.* 2001). Such a pre-disposition is formed from prior experience of citizens with ICT, as well as from a shared community view of the practical and symbolic significance of ICT, which is generally captured in the term 'ICT culture' (Leidner et al. 2006).

Research Process

We identified the electronic voting system of Brazil as a case suitable for understanding the ICT and trust in government relationship through its reputation as a case of successful use of ICT in the government sector. The Brazilian author of this paper confirmed the validity of the reputation and offered valuable insights for the conduct of the case study and the interpretation of collected information.

Most central in our research effort has been our observation of two occasions of Brazilian elections: the second round of the municipal elections in the city of Sao Paulo on 31 October 2004, and the first round of the general elections of 2006, on 1st October, for President, Senate, Federal Congress and States Government offices. During the 2004 elections we were part of a group of visitors at the Tribunal Electoral Regional (TRE) of the state of Sao Paulo and observed the 'system in action' in two voting stations. During the 2006 elections two of the authors were part of a group of foreign visitors at the TRE of the state of Rio Grande do Sul, in Porto Alegre. We followed a three-days programme that involved demonstrations of the system and description of its technical features and institutional setting, and observation of the installation and preparation of the system in a voting station, of the voting process in three voting stations, of the closing of the ballot and the collection of results in a regional results collection centre.

On both visits we conducted a series of interviews with technical staff at the TREs of Sao Paulo, and Porto Alegre and at the Tribunal Superior Eleitoral (TSE) in Brasília. Thus we formed detailed descriptions of the technology features of the e-voting system and its development process. We held interviews with TSE and TRE officials at both senior and operational levels and formed an in-depth understanding of the organizational setting and institutional features of the elections in Brazil, as well as the changes these have undergone as part of the implementation of the electronic voting.

Also, we interviewed five individuals who have criticized the trustworthiness of the electronic voting system and we sought to understand their concerns. In addition, we collected relevant documentation and academic literature and sought the opinion of local political and social scientists, as well as members of staff of three NGOs, namely, Transparency International in Sao Paulo, INESC in Brasília, a Jesuit mission in a favela of Porto Alegre.

Our study followed a gradual process of research question and argument refinement through the formation of a succession of general conjectures regarding ICT and citizens' trust and case-specific analyses. The first cycle of our empirical study, during the 2004 elections, started with a broad sensitization from the general multi-disciplinary literature about trust – as presented in the previous section of this paper - and sought to establish the features of trustworthiness of the system and the conditions that made these features possible. From that study we became aware of technology security concerns voiced by computer engineers and some political scientists and noticed that, despite of such voices, voters and the political parties did not show signs of mistrust of the election process. Two other observations emerged from our data collection: first, that the TSE and TREs were continuously cultivating trust in the electronic elections process and second that the trust in the electronic voting system was reinforced by a general positive attitude towards ICT among citizens. We therefore formed the conjecture that trust in the Brazilian ICT-mediated elections implicates three analytically distinguishable elements of trust: the perception of trustworthiness of the electronic voting system; the trust predisposition of citizens towards the election authorities; and their trust predisposition towards ICT.

Consequently the second round of our theory review and empirical research focused on confirming the validity of this conjecture and exploring its consequences regarding the role of ICT as a mechanism of trust.

Electronic voting in Brazil

The institutional context

Brazil is a presidential and federative republic composed of twenty-six states and the Federal District (Brasília). The authority responsible for the conduct of electoral affairs is the Tribunal Superior Eleitoral (TSE). TSE has jurisdiction over all aspects of elections and regulates the functioning of political parties. The electoral law in Brazil is revised every two years, in correspondence with a new turn of elections. It is the TSE's responsibility to draft a law resolution to submit to the legislative power for approval. The TSE, over the years, has developed a high reputation for trustworthiness, competence, and autonomy in the management of the electoral process. Therefore, the content of this draft is rarely debated by the legislative.

The management of the elections process is delegated to the Regional Electoral Courts (TRE – Tribunal Electoral Regional). Each Court is formed of three judges, who belong to the State Court of Justice. Each State is divided into Electoral Zones, and the total number of electoral zones in the country is 2,900.

The development of the e-voting system

At the beginning of 1995, the TSE formed a task force comprising staff from the TSE and the TREs and financed by the World Bank. The objectives of the task force were to stop fraud and to strengthen political participation and inclusion by simplifying the voting system. The existing system required people to read the names of candidates from a list and to write down their names on the ballot paper, but the level of illiteracy in Brazil was very high, close to 30% of the population. Therefore, they perceived a pressing need not only to improve the user-friendliness of the interface (the ballot paper), but also the knowledge-base required to participate to the process.

After six months the task force produced a proposal for the development of a computerized ballot box and invited technical experts from Federal ministries to participate in defining the system's technical requirements and specifications. At the beginning of September 1995, a team of fourteen technical specialists started working on the system's development and in May 1996 the first copy of the electronic voting machine was released. The machine was tested for the first time in the Municipal elections of October, 1996. The test included all cities with more than 200,000 voters and all state capitals, which involved 33% of the voters. A second test was run for the general election of 1998. This test included all cities with more than 40,000 voters, reaching 67% of the voters. Finally, the system was used in the whole country for the municipal elections of 2000.

Elections preparation

The preparation process starts in December of the year before the elections when the TSE submits to the parliament a draft resolution to update the electoral law. The document does not include technical descriptions of the e-voting system; it reflects the changes needed to enact the law into a new version of the system. The resolution proposed has to be approved by the parliament in March. The TSE, at this point, has one month to review the system according to the requirements specified in the approved resolution.

180 days before elections the software development stops and the new source code is made available to the technical experts of political parties to detect whether the system complies with the law approved. Sixty days before the elections the software is sealed during a public ceremony. Political parties' and civil societies' representatives are invited to participate in order to digitally sign the compiled copy of the software code. During this ceremony a sequence of major events take place. The first is the generation of hash function tables. The second is the digitally signing of the compiled version of the software source code. Finally, the software applications, digitally signed and encrypted, are distributed to the TREs.

A few days before the elections each TRE loads all e-voting machines with the candidate (name, number, party or coalition abbreviation and photo) and voters tables and the software applications. Political parties' representatives are required to attend this loading process. The validation of the loading process is made on a sample of three per cent of the overall population of e-voting machines randomly selected by Parties' representatives.

The day before the elections e-voting machines are put in place. However, a percentage of these machines, depending on the number of voters in the State, are taken back to TRE for a simulation of a voting session that consists of two ballot boxes: the electronic voting system, and the traditional ballot box. A sample of randomly collected votes are cast in both systems and the results are compared for consistency.

At 7.30 a.m. on the election day, the president of the precinct turns on the e-voting machine at the presence of voting board's representatives and political parties' ones. The e-voting machine prints out automatically a report, called "zeresima", which certifies that the ballot box is empty, i.e. that there is no candidate with a pre-assigned number of votes.

Functional description of the e-voting system

The voting machine consists of two terminals installed in each polling station. The first is the voting board representatives' terminal and has a numerical keyboard with a two lines liquid crystal screen. It is used by the board representative to type a voter's identification number. If he or she is registered in the precinct, his or her name is displayed on the screen and the identification is accomplished. The board representative checks on the screen the status of the voting machine and, if available, presses 'enter' to turn the machine on the ready state.

The second terminal is the voters' one. When the voter enters the booth, the machine should be on the ready state. The voter terminal is also formed of a keyboard and a liquid crystal display. The voter expresses his/her preference by typing their candidate identification number. The screen shows the candidate's name, initials of the party or coalition he or she belongs to and his or her photo, and if these are correct, voters press enter to confirm. The keyboard has two additional keys: the first is the correction key that allows voters to re-start the process, the second is the blank vote key.

At 5 p.m. of the election days the president of the precinct uses his or her password to close the voting machine and to print a voting machine report for the precinct. This report contains the following information: precinct's identification code; voting machine's identification code; number of voters who attended and voted; total voting results for each candidate.

The report is printed in five copies. These five copies are signed by the president of the precinct and by the representatives and inspectors of the political parties. One copy is displayed announcing the results of the precinct. Three copies are enclosed to the precincts register and sent to the electoral committee. The last copy is delivered to the political parties committee. If required, the machine can print out five additional copies that can be distributed to the district attorney of the political parties, to representatives of the press and to the public prosecution office. The copy that is delivered to the political parties committee is extremely important, because it allows parties to check whether the data have been modified during transmission. Upon data reception, the TRE and the TSE send an electronic receipt to political parties.

The voting machine program saves the data on a diskette in an encrypted format to prevent data modification and the diskette is delivered to the local electoral committee. Data are then decrypted and uploaded with a "guiding program". The process, at this point, varies according to the type of election. In the case of municipal elections the data is totally-added at the precinct of the municipality and then transferred to the local TRE and to the TSE. In the case of general election the data are read at the precinct that corresponds to the municipality and transmitted to the local TRE and to TSE. The data on votes for the President of the Republic are added up and announced by the TSE.

The technical trustworthiness of the entire system is ensured by a security infrastructure aiming at preventing data from being intentionally or unintentionally modified and/or deleted. The security of the system comprises the system audit program, which records all transactions performed on the particular machine, and the system security program, which prevents any tampering with the voting machine, such as the removal of the diskette on which election votes are stored.

Discussion

System trustworthiness

The electronic voting system of Brazil has several qualities that make it, and consequently the electronic voting process, trustworthy. First it satisfies the basic criteria of easiness of use and usefulness suggested in the IS literature on trust. The voting machine has a very simple interface, comprising an unambiguous presentation of voting options, confirmation and cancellation procedures, pictures of candidates and Braille coding on the buttons to secure universal access including illiterate and blind people.

There are clear efficiency benefits. The fast and un-crowded voting experience created a relaxed and almost celebratory atmosphere at the voting stations we visited. Many parents took their young children with them to the voting booth to show them how they used the machine. The judges do not now spend time at voting stations overseeing the voting; instead they concentrate their attention to other potential types of electoral fraud, such as political parties influencing the voting choices at the vicinity of the voting stations. Moreover, there are large efficiency benefits in the counting of votes and therefore the speed in announcement of the election results. Indicatively, in the 2004 municipal elections 99% of the votes (more than 100 million votes) were counted within five hours from the closing of the voting stations.

The security of the system is a contentious matter. The system makes extensive use of digital authentication mechanisms and encryption techniques (for the software loaded on the machines as well as the votes cast) as well as physical security measures, such as the paper sealing and signing of the disk and flash card entrance slots of the machines. There is also a range of possibilities provided by the TSE for auditing of the system. Yet, some computer scientists, political scientists, journalists, legal experts, and a small political party have voiced concerns[iv]. Central among their criticism of the system security is the lack of a paper log of votes. Although the system has recently been amended to record individual votes (in random order in order to maintain anonymity of voting) the totally electronic form of the votes precludes resorting to the counting of votes recorded on paper in case there is a dispute. There are also concerns about inadequacy of the auditing allowed prior to the elections. Complains include the limited parts of source code available to political parties for inspection (the commercial operating systems of some of the machines is a particular cause of concern) and the lack of testing of the systems performance by political parties representatives and other interested individuals. Moreover, the current identification of voters at the voting station is considered unsatisfactory.

This last point is the only concern the TSE acknowledges as valid and is now considering the implementation of electronic means of voters' identification, such as checking of fingerprints. The TSE considers the printing of votes to be a source of inefficiency and, potentially, of fraud [v]. Similarly, limitations of auditing are considered necessary precautions against external interference with the system. For example, allowing hands-on testing of the system may open possibilities of altering the software code before the digital sealing.

Evidence of trust

It is generally difficult to get a reliable assessment of citizens' trust. Results of opinion surveys are often contradicted by citizens' behaviour (O'Neill 2002). In this case both opinion surveys and behaviour indicators suggest that the Brazilians' trust in their country's election process is

high. A survey of citizens' trust in institutions conducted by non-governmental agencies[vi] in 2004 showed that 81.5% of the respondents have full of partial confidence in the Electoral Justice institution, with 89.5% of them judging positively the services it provides, and 96.7% judging positively the speed of the counting of votes.

Moreover two behavioural indications suggest trust in the elections process: lack of disputes of election results and increases of valid votes. We found no disputes over results, even in cases that the votes gained by competing candidates were very close. There are no incidents of challenging the validity of the votes counts such as those in the much publicised cases of electronic voting in USA states.

Voting is compulsory in Brazil, and therefore the number of people voting is not a good indication of their trust in the elections institution. However, there has, at various periods, been a large proportion of invalid votes. In the 1990 and 1994 elections (i.e. before the electronic voting system) the rate of invalid votes[vii] exceeded 40% of the ballots cast. In 1998 the invalid votes fell by half, and in 2002 - when the system as used in the whole country - they fell again to 7.6% of the total number of votes cast. Although there may be several factors contributing to the reduction of invalid votes, political analysts attribute it partly to the introduction of the electronic voting system and explain it as a matter of simplifying the previous too complex manual system of voting and counting of votes[viii] (Limongi 2006).

E-voting system trustworthiness and institutional trust

There is therefore evidence that the electronic voting system is contributing to a general attitude of trust in the voting part of the Brazilian elections[ix] and, as we discussed above, this is partly justified by the trustworthiness merits of the electronic system. Two other factors seem to be implicated in this attitude of trust, namely a general predisposition of trust towards ICT and the perceived trustworthiness of the TSE and TREs.

Trust in ICT as a modernizing and facilitating means for government and the economy is widespread amidst the middle income population of Brazil. The country made an early start in the use and production of IT and pursued sustained computerization efforts despite its frequent crises of economic and political instability (Tigre 2003). Government computerization (and more recently e-government) tapped onto and further contributed to the development of local ICT expertise[x]. Advanced ICT use in the banks at the period of hyperinflation of the 1980s familiarized citizens with ICT as a trusted facilitator of services. Today Brazilians make extensive use of electronic payment systems and e-commerce increases rapidly [xi]. They came to expect similar convenience from their transactions with the government sector. There have been many efforts by Federal, State, and Municipal governments, as well as by NGOs to provide access to ICT in poor communities throughout the country, spreading the message that ICT is *sine qua non* for inclusion in the modern economy. Today the Brazilian government has in place layers of IT infrastructure in most of its agencies, electronic transactions with business and banks, and an increasing range of internet transactions with citizens.

Existing trust in the TSE and the TREs complements the technical trustworthiness of the electronic voting system and the procedures for its auditing. In effect, the security of the system is considered robust in terms of preventing external fraud – though not un-breachable - but relies heavily on the guardian authorities, the TSE and the TREs. Indicatively, in addressing requests for strengthening the technical and auditing means for the security of the system, the TSE replied 'the guarantee of the security of the electronic elections is us'[xii]. The TSE is a competent and powerful actor in the political system of the country. It is actively cultivating trust in the election system by demonstrating the electronic system through television and school education, and creating publicity about the preparation of the electronic elections.

In short, while the e-voting system is undoubtedly contributing to the perception of Brazilian elections as an efficient and fair exercise of a democratic right, it relies on trust in the

competent protection of the TSE to play its facilitating role securely. The system is trusted to the extent that the TSE is trusted not to abuse its power. The TSE, already very powerful in the Brazilian politics [xiii], has boosted its legitimacy by modernizing elections through a domestically made trustworthy technology that is highly praised internationally and is now transferred to other countries. At the same time, its own trustworthiness is a necessary element for fraud-free use of the electronic system. The positive ICT culture has contributed to the wide acceptance of electronic voting[xiv]. And through the electronic elections, ICT further gained in popularity as means that modernize the state and boost the economy, used by all, rich and poor, and facilitating a democratic institution.

Conclusions

We can now address the question that triggered our research regarding the possibility of e-government to restore citizens' trust in democratic government. The voting system in Brazil is one of few cases of electronic elections that enjoy high level of trust by all categories of stakeholders: the judges that manage the election process, the voters, the political parties, the NGOs promoting development, the press. It is, therefore, indeed a successful show-case of e-government and trust.

However, as we argued in our discussion, this is not a case of ICT remedying the broken confidence of citizens in a political institution, but a case of mobilizing ICT by a powerful political actor with the reputation of a trustworthy guarantor of democratic elections. It is very doubtful that the electronic voting system would have increased citizens' trust in the elections had the TSE itself not been trusted to be committed to its mission of fair elections. Moreover, this case of e-government built on existing technological competence and a propensity of citizens to welcome government initiatives for ICT innovation. Such conditions of ICT competence and culture are not common in many developing countries, most of which rely on transferring ICT from abroad and often face suspicion about its appropriateness. Thus, we interpret this case as demonstrating that e-government requires active trust formation in ICT and government institutions, rather than overcoming their perceived trustworthiness deficiencies.

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[ii] In Brazil voting is obligatory for citizens aged 18 to 65 and voluntary for those aged 16 to 18.

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[v] Up to the 2002 elections the voting machines produced printed votes too. The printing of votes was deemed a source of inefficiency, causing delays in the voting process with frequent printer failures. Moreover, printed votes were considered by the TSE to be a further source of fraud, as voters could potentially corrupt them and claim inconsistency between their printed vote and the count of the electronic system. The digital recording and signing of every vote, introduced in 2004, is considered by the TSE a more effective proof of the accurate counting of votes produced by the system.

[vi] TV Cultura and the Nexus Institute.

[vii] Invalid votes includes blank votes and null votes, both of which are discarded at the election results counts.

[viii] Electronic voting appears to have made a difference in the null votes of the proportional elections for the House of Parliament and State Congress, which had very complicated ballot papers. They made no positive difference in the majority elections for President, for which indication of choice of candidate was relatively simple in the paper ballot too.

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[x] The e-voting system itself (hardware and software) has been developed with indigenous expertise and there are deals to sell it in other Latinamerican countries interesting in adopting electronic elections.

[xi] For indicators of use of electronic payment systems, see http:www.bcb.gov.br; for indicators on e-commerce in Brazil, see http://e-commerce.org.br.

[xii] From an interview with a political scientist, activist of 'voto seguro'.

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"MAKING IT WORK": NAVIGATING THE POLITICS AROUND ART SYSTEM IMPLEMENTATION IN ETHIOPIA

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Abstract

The empirical focus of this paper is on the design, development, implementation, use and scaling up of an information system to support ART (Antiretroviral Therapy) management in Ethiopia. The overall set of these processes, technical and political, which has its end objective to ensure that systems are embedded in organizational routines and produce outputs that are beneficial to the users, is what we call as "making it work." With our normative research goal of making this ART system work in Ethiopia, we found the politics surrounding it to be a key challenge, especially in the processes of gaining entry and scaling up the system. Through our empirical analysis, we propose three sets of strategies to making it work politically: promising the future, but addressing the current problems; exploiting the "windows of opportunities" created through political hesitancies; playing the politically charged "Free and Open Source Software" card.

Keywords: ART Management, Ethiopia, FOSS, Action Research, Work, Politics.

"MAKING IT WORK": NAVIGATING THE POLITICS AROUND ART SYSTEM IMPLEMENTATION IN ETHIOPIA

"If compliance and careful follow-up of patients is not achieved, we will see a dramatic increase in multi drug-resistant HIV mutants whose further spread will only exacerbate the epidemic." – **Drs. Robert Gallo and Luc Montagnier, co-discoverers of HIV (WHO, 2005, p. 5)**

"The health care sector in developing countries is intrinsically political. It circles around the inherent scarcity of resources and involves a number of actors with different agendas such as donor agencies, health activists, non-governmental organizations, vendors, consultants, and politicians" – **Braa, et al. (2004, p. 357)**

1. INTRODUCTION

The research landscape of IS (information systems) in developing countries is packed with stories of failures (Heeks et al., 1999). As the research in this domain has matured over the years, researchers have found more elegant and theoretically sophisticated ways of describing these failures, while not placing equal emphasis on describing why things work. Furthermore, we argue that even lesser importance is given on elaborating strategies and approaches for "making it work" given the adverse infrastructure and human resource conditions that are experienced in the context of IS projects in developing countries (Sahay, 2001).

Out of the multiple facets around "making it work", we argue is the often neglected issue of politics. Understanding it, and dealing with it, is crucial given the inherently political nature of health information systems (HIS), the focus of this paper, in the context of developing countries. The application domain which is the analytical focus of this paper concerns HIV/ADIS management, specifically related to ART (Antiretroviral Therapy). HIV/AIDS management in developing countries is especially embedded in a political quagmire created from the pandemic nature of the disease, the reality of death and poverty associated with it, the huge amounts of donor funds being pumped into the treatment of the disease, and the multiplicity of actors that have jumped on to the disease bandwagon including donors, NGOs[*], researchers, politicians and medical specialists. In developing and implementing systems to support the management of this disease, negotiating this political quagmire is crucial, and is no trivial task.

Despite the alarming increase in the levels of incidence of HIV/AIDS in developing countries, the value of information in strengthening its management has not been explicitly recognized. Typically, conferences around this topic focus on clinical issues or the politics of drugs and pharmaceutical companies, with nearly no discussion on how information can play a vital role in supporting monitoring and treatment. Typically, the routine reports in many developing countries (for example, as seen in India and Ethiopia) contain cursory information on how many patients were counseled for HIV/AIDS or referred for treatment, and these statistics are rarely used for supporting disease management. There are limited examples we have seen or read about of working patient specific information systems around HIV/AIDS, which is a matter of urgent concern.

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[*] NGO(Non-Government Organizations)

One interesting example in this regard concerns a system called OpenMRS (www.openmrs.org) which is an open source electronic medical record (EMR) system for developing countries focusing primarily on managing information to facilitate treatment and management of patients with HIV infection The core application of this system was originally developed from the AMPATH medical record system (AMRS) implemented in Eldoret, Kenya and, since then, it has been implemented for HIV and TB patient and treatment management in Kenya, Rwanda and South Africa. Several other pilot implementations are still being developed or tested in some developing country contexts, notably in Lesotho, Malawi, South Africa, Tanzania, Uganda and Zambia (Mamlin et al., 2006; Mamlin and Biondich, 2005; Siika et al., 2005; Allen et al., 2006;)

As various countries are desperately going for a "rapid and mass scale-up" (FMOH/NHAPCO, 2005) of their ART programs so that to be able to treat more positive cases, there is the concurrent need to also scale up their supporting IS to be able to better track patients over their course of the treatment so as to analyze issues such as drop outs and adherence to treatment. Given this urgent need for patient based systems, especially those under ART, the analytical focus of this research is on the following questions:

1. *What does "making it work" mean more generally in the context of information systems to support HIV/AIDS management in the context of developing countries?*

2. *Specifically, what are the political conditions that influence the "making it work" of ART systems?*

3. *What are some specific strategies to "make the politics work" around such systems?*

The empirical setting for the analysis of these questions is provided by an ongoing action research project to design, develop and implement HIS in Ethiopia. We especially focus on understanding the political aspects that surround these processes, and how to try and practically address them. On a more philosophical note, our research also seeks to respond to the call by Geoff Walsham (2001) to IS researchers to use technology to make our world a better place to live in.

The rest of this paper is organized as follows. In the next section, we discuss theoretical considerations which inform our research. Following which, we describe the details of the empirical approach adopted. In section 4, we provide some background information on the Ethiopian HIV/AIDS system particularly on its ART program. We describe the case study in section 5, following which the analysis of the case is presented in section 6. Finally, some brief conclusions are presented.

2. THEORETICAL CONSIDERATIONS: POLITICS AND HIS IMPLEMENTATION

Issues of politics in shaping IS implementation has been a common theme underlying IS research. Markus's (1983) seminal article helped to emphasize the role of power and politics in shaping IS implementation. Markus proposed a political variation of interaction theory to try and understand the issue of resistance. She argued:

The best prescriptions for an implementation strategy and for the specific design content of a system will follow from a thorough diagnosis of the organizational setting in which the system will be used (p.441).

In the specific context of HIS in developing countries, the issue of politics is prominent. For example, Chilundo and Aanestad (2003) have argued that the politics of donor funding which is geared towards supporting vertical disease specific programs contributes to the proliferation of multiple systems and an ensuing fragmentation. In the context of Mozambique, similar arguments about the role of politics in shaping HIS implementation have been made by Mosse (2004) and Nhampossa (2006). The political nature of participatory processes in HIS design and implementation have been made by Puri et al. (2004) in the context of India, South Africa and Mozambique, and also by Byrne (2004) in relation to community based IS in South Africa.

In a recent paper, Braa et al. (2004), in the context of their HISP (Health Information Systems Project), have emphasized the inherently political nature of the health care sector more generally in developing countries, and have argued "to make health information more visible and accessible … is often in conflict with the agendas of vested interests that prefer to keep the problem invisible." This then requires the building of a kind of counter-network (cf., Castells, 2000), to try and counter the mainstream power dynamics originating through donor funding and big money vendor interests. In discussing how political strategies to counter these political influences can be made effective, they argue:

Dealing with the politics of health networks requires strategies that are reasonably open-ended, which encourage improvised action (p. 357).

This, in effect, requires dealing with the complex and constantly changing political, institutional, and cultural configurations at various levels of the health care structure, a challenge which researchers need also to take up. The role and involvement of researchers in these countries is far from being simplistic and singular – "has to mirror the variety in the type of actions" (Braa et al. ibid). Given this political nature of the health sector, it requires researchers to establish a measure of alignment and secure the official mandate of the health department in power, and try and mobilize their support and resources. The authors go on to argue:

The delivery of primary health care services is a task mandated by the official health authorities, so a minimum of support is required—or needs to be mobilized—to legitimize any change. … To tip a political controversy in your favor, it is necessary to mobilize your network to gain sufficient support (p. 355).

Researchers working in this domain thus need to take power into consideration and gain official support, and then play multiple roles required to make the IS work. In support with the advise of Braa et al. (2004) stated above to "develop strategies which are reasonably open-ended, which encourage improvised action," we argue the need to fully understand and be integrated with the micro-level practices of people in the ground who are engaged with the everyday work around the HIS. It is through these practices that the more macro-level political structures are constituted, for example, the development of alliances with the national ministries and donor agencies. Without having a grounding in the practices on the ground, we argue, it is difficult to have a firm base to develop political legitimacy. In a similar although within a more theoretical vein, inspired by Structuration theory, Orlikowski (2000) has argued for adopting a "practice turn" in IS studies. This turn concerns the focus on practices and how they are constituted in structures. In our case, the focus is on the practices around the making it work of the ART system, and their role in the constituting of political structures.

In summary, our theoretical perspective to understand and practically materialize our aim of "making the system work," has two key interrelated facets. One is the need to understand the political nature of the HIS introduction and implementation processes, and two, to be deeply

integrated and rooted with the micro-level practices on the ground. These two facets have the potential to mutually support each other in a structurational logic, and provide the basis for the development of a counter network that has been alluded to more generally by Castells (2000), and attempted to be operationalized by Mosse and Sahay (2003) in the context of the health sector in Mozambique.

After this elaboration of our theoretical basis, we turn to describing the methods used to conduct our empirical research.

3. RESEARCH METHODS

The research is set within the broader framework of the Health Information Systems Program (HISP) initiative currently ongoing in Ethiopia since 2003. This initiative, based on a formal collaboration between the Departments of Informatics and Information Science from the Universities of Oslo, Norway, and Addis Ababa, Ethiopia respectively, seeks to link within an action research framework, education, research, and practical support to government for the health sector reform efforts. Given the urgent problems surrounding HIV/AIDS, developing a system to support its management is one of the declared priorities. The mechanism through which this collaboration is being operationalised is scholarships for Ethiopian students, both at the Master's and Doctoral levels, through the Norwegian government. These students, as a part of their thesis, work on solving practical HIS related problems, within an action research framework. Two of the Ethiopian Master's students have collaboratively spearheaded the entire initiative to design, develop and implement the ART system. They, along with their Professor who was also involved in the processes of gaining entry and scaling up, are the co-authors of this paper. Also, participating in the process was a medical doctor whose inputs were very useful in understanding the medical terminologies used in the various input forms and reports as well as providing very useful insights into understanding the analysis needs of the medical doctors. The software development was also initially supported by a Vietnamese Masters student.

The guiding principle to our empirical efforts has been to try and understand the overall set of interconnected challenges to make such a system work in Ethiopia. This necessarily has involved taking an approach which goes beyond the mere technical, and to also incorporate into the analysis the social, political, cultural, and institutional aspects. A starting point in this effort was to understand how the pre-existing manual system was working in the ART clinics, especially the underlying practices shaping the information flows.

Given the nature of the research where we were so deeply embedded in the everyday world of the staff in the clinics, we were engaged with multiple conversations, and are thus not able to easily list down the total numbers of interviews carried out. However, given this limitation, we have tried in Table 1 to provide a summary of the data collection methods. Through a series of interviews, observations, discussions with clinic staff, study of existing data capturing forms, and registers and report formats an attempt was made to understand the existing work practices. We were struck by seeing the alarming number of patients who were visiting the clinics, and how poorly the information systems were organized. For example, despite the promise of anonymity, we saw prescription slips and follow-up cards of patients just scattered around the table in full view of everyone who visited. We also tried to get multiple perspectives of people involved in ART systems, from the data clerks and nurses at the clinics, to the regional and national level program managers as well as other international researchers and agencies involved in similar efforts.

People involved	Data collection methods	Number	Average duration
Clerks, HISP members	Visits made at clinics	92 (min.) (continuing)	1 hour
Researchers only	Observations	throughout	throughout
Mainly researchers	Participant observations	2	2 weeks
Mainly researchers	Document analysis	NA#	NA
Clerks, doctors, clinic head, a regional program manager, a regional bureau head	Meetings and discussions	91	1 hour
Clerks, doctors, clinic head, IT specialist, regional program manager, regional bureau head, HISP members	Telephone calls	200 (min.)	20 minutes
Clerks, doctors, IT specialists, HISP members	Semi-structured interviews	15	30 minutes
Clerks, doctors, clinic head, IT specialist, data manager, regional program manager, ART team leader, regional bureau head, HISP members, some staff from regional health bureau, some HIV/AIDS stakeholders	Prototype and system demonstrations	21	30 minutes
Regional program manager, regional bureau head, some staff from regional health bureau	Presentations	2	30 minutes
Upwards of 200 people with IS and HMIS background	Conferences	3	2 days
HISP team from Ethiopia, India, Norway, Vietnam, and South Africa; some staff from Department of Informatics at Pretoria University in South Africa, a researcher from Meraka Open Source Centre in the CSIR in Pretoria, South Africa	Workshop	6	3 days
Clerks in ART clinics where the system is implemented so far	Feedback rom system users right after installations and trainings	25	1 hour
Developers, IT specialists from health bureau and some HIV/AIDS stakeholders, HMIS people from federal ministry of health, clerks, clinic head, health bureau head	Attended system demonstration of other vendors	5	1 hour
Clerks and doctors	Backlog and other data and report quality investigation	throughout	throughout
Clerks	Manual and system generated reports discrepancy study and verification	4	1 day
HISP members and a researcher from Meraka Open Source Centre in the CSIR in Pretoria, South Africa	e-mails exchanged	85 (min.)	NA

Table 2. Summary of means of data collection

Not applicable

In addition to this primary data collection, we extensively studied various documents and relevant literatures obtained from 9 ART, 1 VCT, 1 PMTCT* clinics and an ART pharmacy from two of the regions (Addis Ababa and SNNPR) in the country. This multi-site research was performed longitudinally (and still continues a year since it started), wherein development and implementation have been carried out mostly in parallel. The research was also carried out at multi-levels (local ART clinics, regional bureaus, multiple HIV/AIDS programs, and also at a South African ART clinic). The researchers played multiple roles (such as developers, consultants, political dealers, implementers, supervisors, and trainers) in the process. The empirical investigation was focused on a pilot ART clinic (Zewditu Memorial Hospital) in Addis Ababa, strategically selected due to the fact that it is the first and biggest (in terms of patient number – more than 10,000) clinic, and is seen as a model one for the country. Since the two researchers (also the authors of this paper) live in Addis Ababa, research access was also facilitated. The large size of this clinic helped to obtain a representative picture of the work practices surrounding the ART related information flows. Data collection was carried out at the clinic and regional bureau levels.

Data were gathered primarily through the conduct of semi-structured interviews and discussions with various staff including data clerks, doctors, clinic heads, a regional program manager, the IT specialist and data manager both working at the regional level. The interviews and discussions were carried out primarily in Amharic by the 2 Ethiopian students and in English when the Professor was present. A summary of the discussions took place after the meeting when the three researchers were co-located, and through email when not. Discussions, especially with the data clerks, typically took place at their respective work sites and the length of the meeting was adjusted to cater to their very busy work schedules. A number of telephone conversations took place when it was not possible to meet the respondents in person, or when the bureau staff called us to get some clarification mostly on technical issues.

Among other things, clerks were asked questions primarily pertaining to the use of register books and formats, ways of recording data, their feelings of data and reporting quality, work load, and their views on the importance of computer-based systems for the work. At the regional level, the focus of the issues discussed was different from that in the clinics, and the questions asked related primarily to past attempts to introduce ART software, and the need to integrate the information flows pertaining to the different programs under HIV/AIDS. A research diary was maintained to document notes and our individual impressions. Table 2 summarizes the list of people with whom the interviews and discussions were made along with the issues raised.

Actors	No.	Issues discussed
HISP team members	**5**	- **experiences learnt from the implementation of DHIS† and how to deal with formalization of the development and implementation work with regional health bureaus**
Regional program manager, regional bureau head, CDC manager, ART Team leader in Oromia region, other stakeholders.	**8**	- **about needs of patient-based system in the regions' HIV/AIDS system and priority areas** - **the problems in the HIV/AIDS system and in the ART program in particular** - **about unfulfilled system promises and system failure stories in the ART program** - **difficulty of data handling and problems in ART** - **the increment of number of patients and importance of ART management software during scaling up treatment**

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* PMTCT (Prevention of Mother-to-Child Transmission), and VCT (Voluntary Counseling and Testing).

† DHIS (District Health Information System) developed and implemented by HISP.

		and taking stable patients down to health facilities from hospitals - **how to make the development, implementation, and data entry work formal** - **how to make the software a national system** - **how to collaborate and proceed the implementation work in the different regions** - **vision of integrating the programs under HIV/AIDS**
Data clerks from two regions and federal hospitals	**9**	- **how data is captured and reports are prepared and where the reports go and some related work procedures such as transferring patients in and out** - **problems surrounding such works as data capturing, file searching, and reporting** - **work load, number of (new) patients visiting the clinic each day, time takes to produce reports and how much they delay, and felling concerning the need of software to manage the work** - **past system experiences, system failure stories and unfulfilled promises** - **their feeling of data and reporting quality**
Medical doctors and a clinic head	**3**	- **file management problems, software needs and past software experiences** - **problems in the data entry and reporting formats** - **meanings of some medical terminologies** - **problems f relating to learning a patient's progress from the manual records**
An IT specialist and a data manager from Addis Ababa city administration health bureau	**2**	- **expected requirements an ART system has to fulfill** - **implementation procedures and clinics prioritized to use the system** - **issues relating to back log data entry, backups and security, maintenance, support, system follow-up and upgrading, procedures of accountability, and user training**

Table 2. Summary of interviews and discussions

Another mechanism for data collection was participant observation, and during the initial phase of the project it lasted for more than three weeks observing and understanding the forms, data elements and surrounding work procedures. We observed how the clerks actually captured data and prepared reports, the time taken for these tasks, the number of patients visiting the clinic a day, and other events of interest. These observations helped to develop a richer and deeper understanding of the embedded work practices, the context, and the social conditions shaping the information flows. For example, we could better understand how because of the heavy patient-loads and difficulties in retrieving data, the clerks were often forced to compromise on the quality of the reports. For instance, we once found a patient registered 4 times, 2 of which were done on the same date, by the same clerk and on the same page of the register. We also observed 4 people (2 nurses and 2 data clerks) failing to find information about a patient after searching nearly multiple registers over half an hour. Most importantly, we observed clerks inventing their own formats and procedures to ease their reporting work which adversely influenced data quality. Furthermore, through the process of observation, we developed a trust based relationship with the data clerks, who soon started to give us intimate details of the problems they faced with previous systems. These insights were very useful to us in defining the scope and details of system design.

Yet another very important source of data collection was the system prototyping process, where we focused on developing rapid versions of the system, placing them in the clinics, or making demonstrations to the program managers, and getting their feedback. These were very useful inputs

for making quick revisions to the system, and also helped to build a sense of involvement and system ownership amongst the users. For example, as the frequency of our interactions with the user community increased, we gained insights into their analysis needs such as of patients who dropped out, missed follow-ups or had poor adherence to the prescribed drug regimes. On our own initiative, we designed an individual patient's progress report in order to depict the entire history of the patient from the first day of treatment till the current time, including key details of CD4 count, weight, adherence levels, and functional status during each follow-up (see Figure 1 for a sample report).

We now describe the case study context followed by the case description itself.

Patient ART Progress Report

First Name	Sample		Sex	Male
Father's Name	Patient		Unique ART No	14/08/00001
Age	22		Card Number	1007/1999

Follow up Date	Follow-up Status	CD4	Weight	Functional Status	Regimens	ARV Adherance
01/01/1999	OnTreatment	125	40	Bedridden	1a(30)	None
01/02/1999	Lost	—	—	—	—	Poor
01/03/1999	Restart	150	55	Bedridden	1a(30)	Poor
01/04/1999	OnTreatment	150	56	Ambulatory	1a(30)	Fair
01/05/1999	OnTreatment	155	56	Ambulatory	1a(30)	Fair
01/06/1999	OnTreatment	160	56	Working	1a(30)	Good
01/07/1999	OnTreatment	200	62	Working	1a(30)	Good
01/08/1999	OnTreatment	220	62	Working	1a(30)	Good
01/09/1999	OnTreatment	220	62	Working	1a(30)	Good
01/10/1999	OnTreatment	230	65	Working	1a(30)	Good
01/11/1999	OnTreatment	230	65	Working	1a(30)	Good
01/12/1999	OnTreatment	300	65	Working	1a(30)	Good
03/01/2000	OnTreatment	300	65	Working	1a(30)	Good
03/02/2000	OnTreatment	300	66	Working	1a(30)	Good
05/03/2000	OnTreatment	300	66	Working	1a(30)	Good
03/04/2000	OnTreatment	300	66	Working	1a(30)	Good
01/05/2000	OnTreatment	321	67	Working	1a(30)	Good
01/06/2000	OnTreatment	333	67	Working	1a(30)	Good
01/07/2000	OnTreatment	333	68	Working	1a(30)	Good
01/08/2000	OnTreatment	333	68	Working	1a(30)	Good
01/09/2000	OnTreatment	333	68	Working	1a(30)	Good
01/10/2000	OnTreatment	333	68	Working	1a(30)	Good
01/11/2000	OnTreatment	350	69	Working	1a(30)	Good
01/12/2000	OnTreatment	350	70	Working	1a(30)	Good
04/01/2001	TransferOut	350	70	Working	1a(30)	Good

Number of Follow-ups = 25

Figure 1: Screenshot from the system: a patient progress report in a printable format

4. HIV/AIDS AND ART IN ETHIOPIA: THE STUDY CONTEXT

Based on the 2005 sentinel surveillance findings, the report titled "*AIDS in Ethiopia*" estimates that the cumulative number of PLWHA (People Living with HIV/AIDS) to be about 1.32 million, reflecting a prevalence rate of 3.5% for the total estimated population of 73 million in the country. The estimated number of new adult AIDS cases was 137,499, suggesting that 353 new cases were being added to the pool of positive cases per day. There were also reported 134,450 (368 per day) AIDS-related deaths. The number of AIDS orphans aged 0-17 years was reported to have reached 744,100, and the number of PLWHA in need of ART was 277,757. Out of the 1.32 million PLWHA, only 81, 745 are enrolled in the HIV care since 2003. Out of these, only 50,119 have ever started the actual ART since then. Currently only 39,984 are on ART, indicating drop outs or people having died during the course of treatment (FMOH/NHAPCO, 2005).

Having these devastating figures of PLWHA along with the prospect of an alarming growth rate, fighting HIV/AIDS is now both an urgent global and national priority. Given this backdrop, it is not surprising that there exist a number of initiatives towards alleviating and also eradicating the problem. The HIV/AIDS system in Ethiopia comprises of a multiplicity of programs including ART, PMTCT, TB, VCT, Home-Based Care, ART pharmacy, STI, and OI[*]. A number of agencies – government, non-government, missionary organizations, international and also private – are in different ways, trying to provide support services to the implementation of these different programs. These different agencies often operate with their own budgets, reporting systems, manpower, and are minimally coordinated with each other, contributing to the proliferation of a plethora of IS.

Alongside the various initiatives to prevent and control the epidemic, there is also the urgent need to treat the PLWHA. This is where ART comes into the picture, and concerns the administration of at least three different medications known as ARV (Antiretroviral) drugs in order to suppress the replication of the virus. Once ART is started (when patient manifests signs and symptoms of WHO Stage III or when the CD4 count falls below 200 – the laboratory definition of AIDS), treatment has to be taken for life with a better than 95% adherence to achieve viral suppression, and is costly. ART is not a cure, but just seeks to transform a uniformly fatal disease to a manageable chronic illness. The successful use of ART suppresses HIV viral replication, consequently slowing down disease progression, improving immunity and delaying mortality. Thus, while ART is not a cure, it helps to prolong and enhance the quality of life of PLWHA (See Figure 2). Therefore, those patients who are lost, have dropped follow up, or show poor adherence need to be tracked to ensure timely cure. There are now new arrangements being made in Ethiopia, for example, the use of telephone lines to track dropped out patients.

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[*] STI (Sexually Transmitted Infections), OI (Opportunistic Infections), and TB (Tuberclosis)

Top left: Joseph Jeune before treatment for HIV/AIDS /TB co-infection, March 2003,
Top right: Joseph Jeune having gained 20kg six months later after treatment for HIV/AIDS /TB co-infection, (David Walton/PIH)

Bottom left and right: Ravaged by opportunistic infections, Ana Maria Muhai was barely alive when she was first brought to a Sant'Egidio clinic in Maputo in 2002. Three weeks of ARV treatment brought her back to life and she started a new mission—advocating for more AIDS education.

Source:
http://www.who.int/3by5/treatmentworks/en/index.html and (WHO, 2005)

Figure 2: How treatment may improve life

In Ethiopia, like in most developing countries, which are faced with competing demands of scarce resources, some may question whether the high financial investments on ART are justifiable. Arguments against such a view are that HIV/AIDS is affecting every sector of the Ethiopian society, including economic. There are thus indeed also the cost-effective arguments to invest in ART. The Government of Ethiopia, in support with various international organizations (particularly North American) has launched in 2003 its ART initiative which today is providing treatment free of charge to patients. There are now 231 ART sites in the country, with ambitious plans underway to scale them up in terms of treating more patients, for example through including new treatment centers in the government health facilities. Despite these various efforts, initiatives to strengthen the information support for the management of this program is sadly lacking, even though it is universally recognized that it is an urgent priority. As stated in a report by the Federal Ministry of Health (FMOH) (2005):

All key players need to be informed on the latest development concerning ART. Therefore, a mechanism to disseminate accurate and timely information to these various stakeholders … must be set-up. A well developed information management and communication…becomes a crucial component of the ART program because:

- *It is a very complex treatment program which is being scaled up very rapidly;*

- *Treatment is to be taken for life and high rate of adherence is expected, allowing no room for supply interruption. Information is thus required over time and is patient specific; …*

Therefore…Strong information management…will serve as a backbone for this program (p. 23).

Direct implications of this FMOH statement are as follows:

1. An urgent need for a computerized ART management system;

2. The need for patient specific system which can follow the patient over the lifecycle of a long drawn treatment program; and,

3. To integrate the ART program with other related interventions (such as PMTCT, VCT etc).

In addition to this local call, that ART has to be taken for life once it is started and that a virtually perfect adherence is expected is underscored by many researchers. This requires effective patient based systems to follow up on individual patients, including their drop out and adherence rates. For example, an alarming, but rightly cautionary statement was made by Drs. Robert Gallo and Luc Montagnier, co-discoverers of HIV, at the onset of discussions on making ART available for millions in resource-poor countries (WHO, 2005):

If compliance and careful follow-up of patients is not achieved, we will see a dramatic increase in multidrug-resistant HIV mutants whose further spread will only exacerbate the epidemic (p. 5).

Thus an ART clinic has to make sure not only that a particular patient is being regularly followed-up but also adhering as required. Adherence is an extremely vital issue in ART because a patient not adhering as expected may open room for drug resistant viruses, which has devastating economic and social impacts. Finding an effective patient-based system that can help in managing drop outs and adherence is an urgent challenge for many developing countries, including Ethiopia.

An acknowledgement of this need by us served as the driving impetus for this research which focused on the design, development and implementation of an "Integrated HIV/AIDS Management System" (IHAMS) with ART as its initial focus. This initial focus thus had to be amenable to scaling (both geographically and functionally) so that it could support the scaling of the ART perse, and also the overall integration and coordination of the comprehensive HIV/AIDS management in the country. A key challenge that we had to deal with during this action research effort has concerned the politics of gaining entry to initiate the process, and then also for its subsequent scaling. Describing these processes is the focus of the case study which we elaborate in the next section of the case study.

5. THE CASE STUDY

5.1 Gaining entry

During our study of the existing manual system, a clerk in an ART clinic, which served as our pilot site, told us:

> *I am really tired of the manual work. If they don't get me software soon I will leave the job. You don't know how tired I am. I was employed to work on a computer system but they don't yet have any system. …Any working system that comes first, I will immediately start using it without even having permission from my bosses. It is only me who knows how much I am suffering.*

The above quote reflects the magnitude of manual work that the clerks at the level of the clinics experienced. They appeared tired of the promises being made by the powers to be about the arrival of a new system, and were now ready to be subversive and adopt any system that could meet their local needs, with or without the consent of their "bosses."

In addition to the staff at the clinics that were directly affected by the absence of an effective system, there were several foreign stakeholders including the Center for Disease Control, Atlanta (CDC) and John Snow International (JSI). Furthermore, CDC within the framework of the US aid

regime had divided the country into four regions (not necessarily corresponding to the Ethiopian health boundaries), and assigned four American Universities to each administer one region. We were told by the CDC manager in Ethiopia that funding requests for region specific activities (such as the purchase of computers) need to be routed through these universities. As a result, we felt the local national university (Addis Ababa University) was being marginalized at the expense of the American ones. Maybe that is but the reality of international aid.

We had strong support from one regional program manager working at the Addis Ababa City Administration Health Bureau, who was in his words "tired" of waiting for the mythical system, which was being promised by the American donors for the last 2 years, but showed little signs of appearing. He said more than 3 system demonstrations were scheduled by the Americans before and in January 2006, but in the last moment were always cancelled. His private inference was that maybe there is no system, and anyway, when that system does (and if) comes, he will be happy to evaluate it and see how it fits into his scheme of things for regional program management. A key concern which he expressed to us was the need to coordinate the various (uncoordinated) interventions being carried out within the framework of the HIV/AIDS program. With respect to the problem of weak coordination, he gave the example of how a patient under ART, when he/she returned home, was expected to go to the nearby NGO to obtain home-based care. However, because of the lack of coordination, the same patient would go to multiple NGOs to obtain the same services. This was causing a severe drain to their very scarce resources. Another need of this program manager was of a patient specific system to follow how a patient is taking treatment over time, and to be able to analyze cohort patterns and the prevalence of drop outs. He felt the existing reporting system (of aggregate numbers on patients counseled and referred), while maybe useful for the HMIS department, was completely inadequate to support his very program specific needs.

This program manager had worked with the HISP team earlier over the last 3 years as they were designing and developing the routine HIS (called DHIS). He had experienced the successful introduction and scaling of the DHIS to all the facilities in the region, and was thus well aware of the potential and capacity of the HISP team. Also, given the fact that the HISP team was locally based in the national university, he felt it would be easier to coordinate with them to develop the system. Given these considerations, he decided that it would be worthwhile to give the HISP team a chance to try and develop such a system, and see how that shapes up. His approach was quite simple and logical "let the best system win", which translated into the view that if and when the American system would come, it would be evaluated and compared with the HISP system, and the region will adopt that one which was more suitable to their needs.

From the HISP side, we presented the logical design of the system which: was patient specific; would meet existing reporting needs; and, could be slowly expanded from the initial ART system to an IHAMS. We proposed the use of a Free and Open Source Software platform for the development of the system, and the cost of the two Masters students for the health bureau was zero. The financial cost of this experiment from the perspective of the program manager was zero, and he decided to go ahead with this experiment, and called one of the ART clinics (we selected) in the region and accorded permission to us to start the design and development processes.

5.2 Scaling up

The two HISP researchers started to go regularly to the pilot clinic and study the existing work processes (depicted in Figure 3).
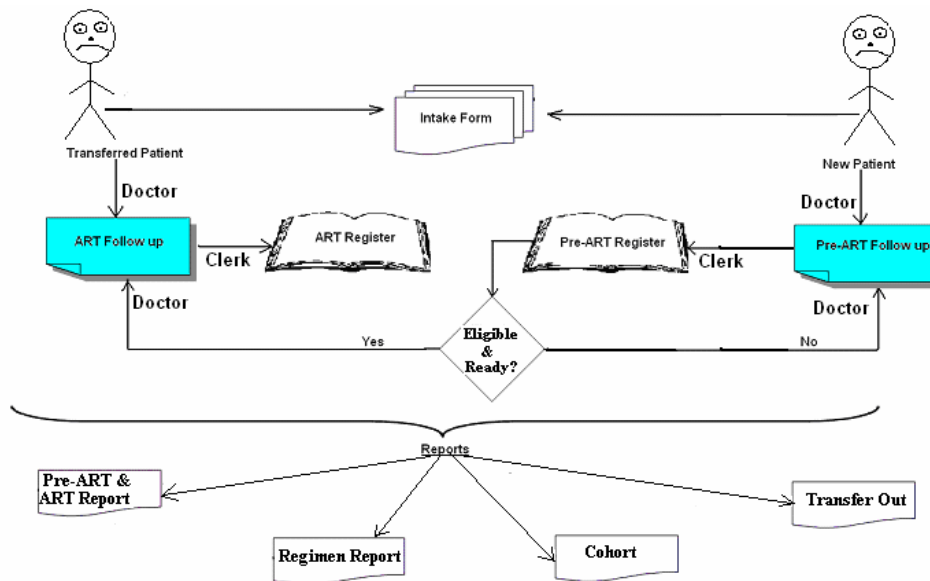
Figure 3: ART Work-flow made simple

We identified various urgent problems especially related to fragmentation. For instance, while ART of pediatric and adult patients was done at two different locations, the data clerks were supposed to record this in the same format, and create aggregated reports. We saw various examples of how the same data around a patient was being captured again and again. As another instance of fragmentation, before a patient started the actual ARV drug, he/she needed to be under Pre-ART treatment, taking place in the same ART clinic. However, when the patient moved from Pre-ART to ART, demographic details already captured in Pre-ART were recaptured in a different register. Furthermore, after a physician filled in some data about a particular patient on a Follow-up form, that same data had to be copied and filled in to either the Pre-ART or ART registers by the clerk. Large amounts of time were spent in entering details about a single patient, and with nearly 250 patients arriving every day, a significant proportion of the data clerks time was on filling forms.
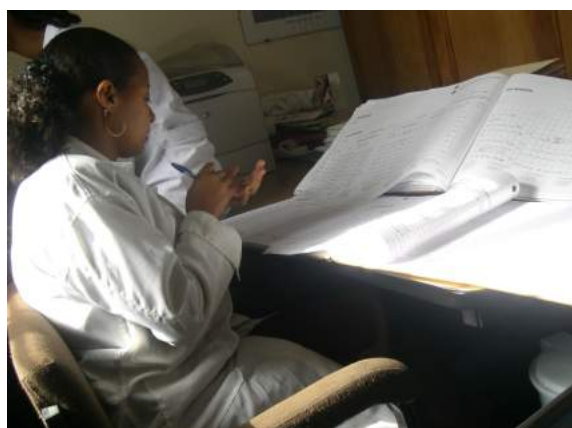

Figure 4: A clerk at work

In addition to the problems about data capture and entry, there were additional problems of data and report quality and slowness in generating reports. For example, clerks told us it took about 2-3 days

to prepare a monthly report which may be was delayed up to 6 days, and it took 4 clerks 2 months to prepare a cohort[*] report working overnight (see Figures 4-6).

Figure 5: Poor quality report

Figure 6: Clerks preparing reports

(See different figures in one column)

As system development proceeded, the clerks started to ally with us, as they found that they could discuss their problems with us, which we listened, and this mutual sharing process helped to instill trust in the relationship. This contributed to them taking ownership of the system. This also strengthened our political backing as they gave positive feedback about the system to their regional manager. This positive feedback, plus regular demos to the regional manager displaying steady improvements made him feel a sense of ownership, and refer to it as "our system." This positive attitude including a sense of trust and ownership was also heightened as he saw us responding rapidly to his requests for making technical improvements in the system. We also got the unique permission to access patient data, and through the services of a data entry person (paid by HISP), data was entered in the system. The clerks typically recommended the hiring of some of their friends for the data entry work, which we did, and this helped us to strengthen their favorable attitude towards us, and also to informally keep the data secure.

Figure 7: Understanding requirements

Figure 8: Development taking place

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[*] A cohort report shows what has happened (how many of them kept following up, have stopped, dropped follow-up, died, who are in which regimen split, and which functional status – working, ambulatory, or bed ridden – they are in) to ART patients of a particular month (6, 12, 18 and so on months up until today) after the start of ART and is done for each month in a year.

After data entry was carried out for one month, we compared and contrasted the reports generated from our system with the manual reports. Nearly a 99% matching of figures was seen, and errors were mostly identified due to illegible handwriting or data entry mistakes. The logic of the computer system was accepted to be correct, thus helping to build the users' sense of trust in the system (see Figures 7-10). So both on the technical and social fronts, we inspired confidence in them.

We have continued to gradually but continually scale up the system functionally by adding new features even though they were not formally required, but which we felt was needed. For example, we designed the cohort report in such a way that the entire history of a group of patients starting ART in a certain month could be seen from that month till today, not just up to 6, 12, and 24 months as was specified in the report formats. In addition, we incorporated an appointment scheduling feature, and also others for doing simple and complex searches, validation rules and patient transfer out approval letters. All the reports were designed such that they could be generated for any time period, and not just monthly which was the official requirement.

Figure 9: Discussion while data entry is going on   **Figure 10: Verifying reports**

News about the successful working of the Addis system spread through the informal network of staff from the different health bureaus. Other regions, also faced with similar pressing problems relating to ART as in Addis, also started to approach the HISP team to come and implement their system. In some cases (like in SNNPR region), we could successfully install the system in some clinics, and in others, we were thwarted due to various reasons. For example, in Oromia region, despite getting permission from the bureau to pilot the system, at the last minute this permission was cancelled when the region realized that Columbia University was also supposed to be doing a similar project. Interestingly, the bureau had not known about this effort, indicating that the university had started this work without the regional bureau's permission, probably on the behest of the Federal level. In another region, Amhara, we were again invited to pilot the systems, but because of the travel costs involved, which the region was unable to support, we could not start there. Support was not forthcoming, because the request for the system had come from a clinic level staff rather than a decision maker.

The allocation of clinics to American universities was not clear cut to us. For example, Johns Hopkins University was responsible for some ART clinics in Addis Ababa, some in SNNPR region, and others in Gambela region. This division was problematic as it implied the need for different regional bureaus to get involved. Given the relatively decentralized governance structure of Ethiopia, it may have contributed to the situation in Oromia where the region was not aware of the activities of Columbia University.

Given the aforementioned problems, we could initially scale up the system to 6 different clinics in 2 regions using individual resources (such as our scholarship as masters and doctoral students and HISP project support). In March 2007, we signed a Memorandum of Understanding (MOU) with the Addis Ababa City Administration Health Bureau so as to further scale up in a phased manner to all 67 ART clinics in the capital, including government hospitals and health centers, federal hospitals, private hospitals, and NGO clinics. At the same time attempts are being made to get a MOU signed in Amahara region. Efforts are also being exerted by us together with the regional program manager and the IT specialist to make the system a national one. With the political legitimacy provided by the Addis MOU, and our continuing improvements being made to the system, we believe the potential has been created for our system to gain a national recognition.

In the next section, we now discuss as our analysis the strategies to make the ART system work politically.

6. ANALYSIS: STRATEGIES TO "MAKING IT WORK" POLITICALLY

Theoretically, the term "making it work" has two key implications. Firstly, it emphasizes the need to look at system development and implementation as a set of activities that far transcends only the technical. This, of course, is not a new argument, and has been made by researchers working with web models (Kling & Scacchi, 1982), social theories like Structuration (Giddens 1984) and Actor Network, (Latour, 1987 and Callon, 1991; Monteiro, 1998) and also in recent years, with the information infrastructure perspective (Hanseth and Monteiro, 1998). However, what is emphasized by our notion is the need to also focus on the practices, and the opportunities (and challenges) that are created through political conditions, and how these can be used to embed new practices. This structurational kind of process linking practices and political conditions, for example through our work in the clinics we gained political legitimacy at the region, and vice versa, was at the heart of our approach. Secondly, the focus on making it work implied that the system and its outputs were seen useful by the actors themselves. Very often, IS projects in developing countries focus on the building of the software, conducting some training programs, but do not focus on the real challenge of how the system is made to work institutionally and become useful organizationally.

With this underlying principle of making it work in the backdrop, we focus on three key strategies employed by us to make our project politically work. While it may be too early to judge the success of our strategies, we will argue that a strong base has been established by our approach to navigation with the ongoing political issues. The signing of the MOU is a clear recognition of the confidence that the bureau has in our efforts and competence to make it a successful project. The three strategies used by us are:

1. Buying Time: Promising the future, but addressing the current problems;

2. Exploiting "windows of opportunities" created through political hesitancies; and,

3. Playing the politically charged "Free and Open Source Software" card.

1. Promising the future, but addressing the current problems.

Our vision was to integrate all the programs and services in the HIV/AIDS system, with the ART providing our point of entry. In our presentations to various groups, we deliberately called our system as IHAMS (See Figure 12) and not ART as it presented a futuristic vision within the desired government agenda of integrating the different HIV/AIDS related interventions.

Figure 11: The IHAMS Vision

Current problems around the ART system, for example the manual load of data entry, time taken for making reports, had been expressed in many forums and required immediate attention. Politically too, focusing on the ART was desirable, since the policy makers were urgently trying to scale up the ART intake, for which we argued there was the accompanying need to strengthen the information systems. We thus tried to gain political support from both the field and bureau manager levels.

Politically, we were also competing under the American threat of an alternative system. It was important for us to position our system as something much superior to what a regular vendor could provide. Presenting this integrated vision (of IHAMS) was one such way to compete. More importantly, the initial focus on developing an ART solution helped us to buy time to develop subsequently the other features. As the trust in us increased, the health staff were more willing to give us time, and also were content (for the moment) with the immediate solution to the ART problem they were experiencing.

2. Exploiting "windows of opportunities" created through political hesitancies.

The other important strategy we adopted to infiltrate the politics was using the existing openings available, for example, created through the delays and the undelivered promises of the American stakeholders. For example, in March 2006, around the time when we had requested permission to begin our work, we were told that a system from Geneva sponsored by WHO is already secured and a person was assigned to train and introduce the systems both at the regional and national levels. While this undelivered promise was disappointing especially to the program manager, it represented an opportunity for us to introduce our project, and we were successful in convincing the program manager to give us a chance.

We persuaded the program manager telling him that "that systems are promised does not necessarily mean they will come, and furthermore there is no guarantee that they will fulfill the requirements and succeed" at which point he concluded "let the best system win." The decentralized governance structure in Ethiopia, where there is a measure of autonomy to the regions to develop their own initiatives, provided us with another window of opportunity. Despite federal level endorsement being not easily forthcoming to us because of the involvement of a variety of actors, the regions still were able to accord us permission to start the implementation process, which we did in two regions, and had direct requests from 3 other regions. However, this regional autonomy proved to be a stumbling block when we tried to scale up our systems nationally because we still had not received federal endorsement.

3. Playing the politically charged "Free and Open Source Software" card.

We played the Free and Open Source Software (FOSS) card, ensuring the health department will not pay for licenses, to help gain entry and also in supporting the scaling process. In negotiating entry, the program manager did not need to take any permission from upper levels since there were no cost implications, and at his level could allow us access. The ready access to source code to fix bugs or to accommodate emergent requirements was very useful in supporting our rapid prototyping strategy, and with this building the users' trust in us. Scaling was also enabled as we could install the application on the machine of any user without having to worry about license requirements.

On the flip side, FOSS may also come with its disadvantages, particularly in the context of developing countries, as it closes out the room for passing favors often prevalent in software purchases from commercial vendors. A further downside is that managers often don't take FOSS providers seriously because the system is free and thus seen to be without value and unprofessional. On the positive side, FOSS provided a clear advantage to us when being compared on a cost-benefit criterion with other commercial software. Avoiding vendor lock-ins is another advantage of the FOSS approach which we provided. For example, the ART program head of an American University felt that a prior system developed by an American developer did not work because, as she said, he was hiding all the code and documentation.

6. CONCLUSIONS

Our empirical focus was on the design, development, implementation, use and scaling of an information system to support ART management, and to "make it work." The political perspective framed within a "practice lens" (Orlikowski, 2000), we argue is an approach that could be adopted also to other ISs within developing country contexts. In making the argument for developing political legitimacy and support, we are not trying to shun away from the hard work required on the ground, but in fact trying to argue that the hard work involves creating this political support, and also in addressing the competing challenges. Given the urgent nature of the ART problem, dealing explicitly with the political dimension to ensure the institutionalization of the system, we argue represents a situation where the means justifies the ends.

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SHAPING THE GLOBAL ECONOMY:
GENDER, ICTS AND DEVELOPMENT RESEARCH

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Abstract
In a recent key paper (Walsham and Sahay, 2005) outlining research on information systems in developing countries and suggesting potential areas for future research, a notable omission was the issue of gender and gender relations. In this paper we draw on the substantial gender and development literature to demonstrate the centrality of gender to our understanding of information systems in developing countries. In particular, we consider the relationship between gender, ICTs, and globalization to illustrate how changes in the global economy both impact on and are influenced by changing gender identities and roles

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SHAPING THE GLOBAL ECONOMY:
GENDER, ICTS AND DEVELOPMENT RESEARCH

'The agency of women as a force for change is one of the most
neglected aspects of the development literature'
(Drèze and Sen, 1995: 178).

Abstract

In a recent key paper (Walsham and Sahay, 2005) outlining research on information systems in developing countries and suggesting potential areas for future research, a notable omission was the issue of gender and gender relations. In this paper we draw on the substantial gender and development literature to demonstrate the centrality of gender to our understanding of information systems in developing countries. In particular, we consider the relationship between gender, ICTs, and globalization to illustrate how changes in the global economy both impact on and are influenced by changing gender identities and roles

Keywords: gender, gender relations, development, developing countries, information and communication technologies

INTRODUCTION

In a recent paper, Walsham and Sahay (2005) set out the current landscape of research on information systems in developing countries, identifying gaps in the literature and suggesting some areas for further research. It is our intention here to extend this landscape to include consideration of the important analysis of gender issues, which are absent from their conceptual overview. Drawing on the gender and development literature, in this paper we aim to show how a political economy of development is interwoven with ICT capitalist productivity, and how the lives of women in particular are shaped by emerging global patterns in the feminisation of employment. Homogenised by their gender, far from opening up chances for women, the spatial clustering of global and local economics and the feminisation of employment limits job opportunities, disperses family members, lowers their level of pay and constricts their bargaining power.

In offering a gender framework, critical reflection is applied to how this political economy of development is woven in national and international governance, in business practices and concerns, in public and private employment configurations. As Walsham and Sahay (2005) flag, the absence of such reflection within the IS literature on development is a serious omission, and by extending the analytical tools of feminist theorizing we may open up debates on how culturally specific practices of ICT adoption and work processes impose specific ways of being and acting in local arenas subject to developmental control. A gendered lens help us to unravel the variances in local socio-economic, political, cultural and personal arrangements, the areas of tension between these arrangements that are experienced, and the relation of ICT capitalist productivity to them. Within this analytical framework, the array of differences that emerge may be juxtapositioned against the myths of homogeneity and equity that ICT infrastructure deployment is said to give rise to.

The paper will proceed as follows. The next section begins by outlining our research approach before going on to briefly clarify some of the conceptual apparatus that we employ, namely: gender construction, gender relations, and gender differences. Gender mainstreaming

policies that seek to improve the visibility of women are then discussed and argued to be inadequate, since the logic of inclusion is based on homogeneity of outcome. The paper proceeds to outline a central exploitative relation between gender, ICTs and globalisation which takes the form of the feminisation of employment. Augmenting gaps in gender parity, the impact of ICTs on women's work and lives is explored by charting a number of economic profiles. Briefly contextualising the historical expansion of manufacturing and service sectors in developing countries, gendered practices are highlighted and the characteristics of employment for women reflect inequities and limited opportunities. That which emerges is the value-added utilisation of their cheaper labour to support global capitalist development and productivity. Taking the example of the call centre phenomenon in India, the construction of an alien cultural identity to meet non-local callers' culturally specific expectations neutralises difference and aims to standardise in an attempt to provide homogeneity of service. Furthermore, the clustering of economic activity, which is predominantly city based, is linked to the reorganization of international companies pursuing operational cost-cutting and new markets, and this spatial reconfiguration of local markets means many women turn to home-based employment or telework. These informal employment activities, untouched by mainstreaming gender initiatives, provide key sources of income and hence degrees of independence, but supply capitalism with flexible, extremely cheap and unprotected productive labour. The prevalence of patriarchal structures and relations of domestic labour contour women's bargaining power and social positioning as the household fluidly adapts to global trends. Finally, we offer some conclusions.

RESEARCH APPROACH

Given that our intention is to extend the landscape of research on IS in developing countries, as outlined by Walsham and Sahay (2005), the method that we adopted for our investigation began by conferring with the 13 journals which they had consulted in their inquiry (as listed in their appendices). We began by reviewing these journals from 2000 to 2006 to find out the extent to which the issue of gender, ICT's and developing countries had been addressed, before analysing how the issues had been tackled. We were interested in papers where gender and developing countries were the sole focus of the study or where gender and developing countries was an important feature in contributing to a related topic.

There was a limited amount of papers addressing these issues, aside from some notable exceptions (the European Journal of Information Systems with 4 papers; the Electronic Journal of Information Systems in Developing Countries with 3 papers; and Information Technology for Development with 2 papers). The low occurrence of papers of this nature is hardly surprising, given that gender in IS more generally is a neglected area of research (Adam et al 2004). However, since gender and developing countries featured in some of the journals, this suggests that it is an important and emerging field of study and one that needs a voice within the 'landscape and prospects' of ICTs and developing countries research.

Our next task was to review the three areas developed by Walsham and Sahay (2005) as a foundation for their analysis of the IS and developing countries literature. This included: key challenges of ICT's; the role of technology; and theory and method adopted when researching IS in developing countries. As our work is informed by the critical paradigm advancing a political agenda, exhibiting empirical sensitivity and uncovering systems of institutional repression and human resistance (Richardson and Howcroft 2006) we prefer to adopt a more holistic view when researching gender, ICT and developing countries. To this end we aim to develop a critical understanding of the world and the political, economic, social, historical and cultural context of global capitalist development. We assert that gender is shaping the global economy and thus gendered experiences in the gendered labour market, for example, cannot

be divorced from gendered experiences in the home. Therefore an appraisal of gender, ICT and developing countries research needs to be aware of gender mainstreaming and its impact on research, the feminisation of employment within various sectors in the context of globalisation and an analysis of women's role in the gendered household and community. As such Walsham and Sahay's (2005) key areas are broadened to embrace a more critical approach, which we argue is necessary for analyses of gender, ICT's and developing countries research.

Thus, in order to enhance our understanding of our subject of enquiry, our methodology expanded beyond the journals investigated by Walsham and Sahay (2005). As Richardson and Robinson (forthcoming) have suggested 'top journals' in IS represent a consensus on what is academically respectable and operate as a perceived 'regime of truth' (Introna and Whittaker 2004) that excludes certain types of submission. One illustration of this is highlighted by Adam et al (2004) and their survey of IS journals that reveals a dearth of gender and IS research publications. They suggest that a tacit lack of legitimacy of topics, such as gender and IS, result in little or no attempt to progress the area and thus it becomes viewed as unworthy for publication and projects. Consequently, researchers tend to submit their publications outside the mainstream IS reference disciplines, making a judgment on the futility of submitting to such outlets. Our review of the literature concurs with this observation in that research about gender, ICT's and developing countries is more likely to be submitted to journals with a multidisciplinary focus within the applied social sciences. Literature in this field is also published in single authored or edited books, with a specific focus on these issues. Therefore, the range of articles, books and book chapters utilised in our critical review of the 'landscape and prospects' of gender, ICT and developing countries research has led us to offer a less optimistic appraisal of the key challenges, the role of technology and theories and methods used.

GENDER CONSTRUCTION: AXES OF RELATIONAL DIFFERENCE

Given the paucity of studies in IS which consider the issue of gender, it is worthwhile outlining some key terms. Therefore, this section is intended to provide a summary of the meanings of gender, gender relations and gender differences, since these provide the conceptual tools for a gender, ICTs and development research focus.

While sex reflects biological difference, gender - although often based on biological sex - is a social construction (Adam, 2005; Elson, 1995; Kothari, 2002). Individuals are born and immediately classified as female or male, and over time acquire a gendered identity, that is, what it means to be feminine or masculine (Elson, 1995). Both gendered concepts are relational (Wajcman, 1998), that is they are construed in relation to each other by defining what the female is not in relation to the Western masculine norm; this varies from one environment to another and shifts over time. Reflective of Cartesian epistemology that categories the known world into dichotomist relations, conceptualisations of femininity and masculinity, developed and undeveloped, rich or poor, educated or non-educated present judgemental points of references for interpreting and responding to perceived qualities of sameness and difference.

Gender relations refer to the particular power dynamics embodied in our conceptualisations of difference and sameness, that is, unequal variances or assumed equalities between women and men. The gender regimes, or the array of "*institutional power relations between men and women where gender is a property of institutions and historical processes, as well as individuals*" (Wajcman, 1998: 3) is changing, from one which was based on women being predominately based in the domestic sphere, to one in which women are increasingly present

in the public sphere, although frequently segregated to unequal positions (Walby, 1997). Therefore, the main focus of a gender, ICTs and development approach is not on women *per se* but the socially constructed relations between women and men. Importantly, it recognises that women and men are positioned differently in society, and that not all women or all men share the same experiences. It recognises that the development process has affected women and men differently, with women being increasingly marginalized (Elson, 1995; Kabeer, 1994). However, a gender perspective does not simply focus on differences between women and men, but considers how this differentiation acts as the basis for the unequal distributions of power (Wajcman, 1998; Pearson, 2006; Perrons, 2004).

How the gendering of work, economics, development, skills, technology, the household, and indeed many other aspects of social, political and economic life constitute individuals as different types of value-added labourers can be made visible by documenting cultural values, beliefs and activities which contribute toward identity formulations, roles and responsibilities configurations, and personal aspirations and opportunities. How these micro dimensions of every day existence are informed and reinforced by community and institutional hegemonic ideologies and practices that support the normalised status quo provide the sources and structures of inequitable power relations. In the development of global capitalism, which sees these issues being extended beyond the Western arena, there is a prevailing economic and social system which generates inequalities albeit to different degrees in different places. However, gender inequality is both significant and universal (Perrons 2004). Women, relative to men, are experiencing higher rates of hunger and malnutrition, illiteracy, overwork, and sexual violence (Kerr et al., 2004). More women than men live in rural areas of developing countries where the infrastructure is far less developed and within poor households, women are the poorest of the poor (Hafkin and Taggert, 2001).

In order to provide detailed understanding of these issues a gender, ICTs and development research focus needs to anticipate the differential effect on women and men of development interventions, which are linked to the socioeconomic aspects of people's lives. This foregrounds gender ideologies, structures, and norms, which shape the diverse positioning of women and men (Pearson, 2006). For us, an appreciation of gender issues and relations also requires an understanding of the dynamics of the material world. Our approach draws on feminism since this challenges the existing canon, theorises inequalities, and has a vision of political change. While some may have reacted against the incorporation of gender issues into the development agenda, arguing that it reflects a Western and imperialist bias, we concur with Pearson (2000) that its relevance to development policy and institutions transcends the local. We will now turn our attention to how gender issues have become 'mainstreamed' in development policy.

GENDER MAINSTREAMING: EPHEMERAL ATTEMPTS AT HOMOGENISATION

Until the 1970s women were virtually invisible to development planners and policy makers (Elson, 1995; Kothari, 2002). Their economic activities were often ignored given that much of their labour was unpaid and undervalued as compared with men's labour. Elson (1999) eloquently argues that labour markets are gendered in the way in which they operate at the intersection of how people earn a living and care for others. Economic activities which contribute to national production are seen as the 'productive economy', whilst unpaid caring activities – the 'reproductive economy' – although crucial for reproducing the future labour force, fail to be acknowledged. This trivialises women's employment and ignores the gender division of labour where production outside the market and its contribution to economic

productivity goes largely unacknowledged. This lack of validity for women as economic actors justified their absence from the framework of what constituted development.

More recently, the centrality of gender to economic and social change has been understood by many in development agencies and international organizations, such as the United Nations (UN) (Kothari, 2002; Perrons, 2004). Since 1995, gender has had a higher profile in world politics, notably with the Fourth UN Conference on Women in Beijing which specified a platform to which many countries subscribed (Perrons 2004). This effort is referred to as 'gender mainstreaming' and has required an increased representation of women at all levels and greater significance of gender issues in their activities, playing a more central role in discussions on labour markets, poverty and debt issues for example. As international agencies have mainstreamed gender, international aid has become conditional upon gender impact assessments resulting in many less developed countries taking gender issues far more seriously than some OECD countries (Perrons, 2004).

Despite progress, there are some concerns. Pearson (2006) notes, that regardless of efforts to place gender at the heart of development activity, it remains '*a marginal and optional add-on*' (p. 190). There is evidence to suggest instrumentalization of these issues with projects that do not necessarily serve feminist goals or may in fact be in conflict with them (Bernería, 2003). While this 'efficiency approach' is important for women's advancement, the primary goal falls short of concerns with women's overall wellbeing (Beneria and Sen, 1981; Elson, 1991; Pearson, 2006; Sen, 1999).   As many Western corporations and governments attempt to recognise and validate difference through diversity policies in an attempt to address the failures of earlier equality initiatives, they in fact leave the power mechanisms of conformity unchallenged and intact, individualise the inequities, bypass tensions of co-existence and actually reinforce and homogenise difference (Wajcman, 1998; Gillard et al., 2006). Some of these initiatives and programmes have been described as an 'add women and stir' approach (Harding, 1987), as they fail to question gender-based power relations. Reducing activity to box ticking, culturally specific prescribed initiatives and unrealistic deadlines, the bureaucratisation of gender guidelines all too often tends to reinforce institutional influence and silences those whose voices rarely get aired in the development forums where decisions are made (Standing 2007). Women's agency in their own environments remains hidden and concrete activity necessary for their personal transformation or empowerment, such as comprehensive healthcare, childcare, education and equal pay, risks taking second place. In the rush to appear proactive, this reliance on bureaucratisation assumes that bureaucracies are engines of social and political transformation; they usually are not, but greater political agency may be (Standing 2007).

As the link between gender and development policy, implementation and social empowerment is inadequately conceptualised, combined with poor resources and tolerated non-compliance, gender mainstreamers within or close to the UN system and G8 have had a modest impact (Hambly Odame 2004; Standing 2007). They fail to factor in the recalcitrance of organizational practices, the dependency on willingness, the costs or time factors of implementation, or indeed the weaknesses of the legal foundations which rest on the capriciousness of politico-economic climates (Gillard, 2006). Predicated on normatively defined measures of equity and difference, on Caucasian, male, middle class, heterosexual, familial and other mainstream ethics, gender mainstreaming tokenizes difference and validates sameness, with women's individual rights and responsibilities tenuously oscillating on such policy trends. Evidence from gender mainstreaming in the European Union has shown that what may first appear as a radical way forward, in reality is far more concerned with the participation of women in the labour market *regardless* of low pay, poor working

conditions, tensions between working and domestic life, and other trappings of social injustice and inequality.

Therefore gender mainstreaming is ephemeral, particularly in the context of gender and ICT policy in examples such as UN ICT Task Force, the International Telecomms Union (ITU) and World Summit on the Information Society (WSIS) (Hambly Odame, 2005). ICT's are often seen as key to promoting development, offering opportunities for women to enter the workforce and become involved in enterprise (Morgan et al 2004). Yet there are vastly exaggerated claims about the likely 'impact' of new technologies on social, economic, cultural and working lives (Huws, 2003; Woolgar, 2002). Technology generally and ICT's in particular are often touted as an instrument for bridging the gap between developed and developing countries, yet these assumed economic and social gains, often perceived within a market regime, are dubious at best (Avgerou, 2003).

GENDER, ICTS AND GLOBALIZATION: THE FEMINISATION OF EMPLOYMENT

Changes in the global division of labour that came into existence in the 1970s have been facilitated by continued improvements in ICTs and have contributed to the feminization of employment[1] (Perrons, 2004). International trends have been for female labour force participation to rise, while the male participation rates are falling (Standing, 1999; Standing, 2006). Between 1975 and 1995, 74% of developing countries and 70% of developed countries had increases in women's economic activity rates, while during the same period male activity rates decreased in 66% of developing and 95% of developed countries (Standing 1999). This has been in parallel with the processes of labour market regulation and flexibilization arising from neoliberalism (Bernería, 2003), which has led to institutional changes at the micro level, including outsourcing and changes in the composition of the workforce. The new international division of labour and the accompanying structural, material changes are gendered, with differential consequences for women and men (Bernería , 2001). There has been an emphasis on the key role of women's labour to deal with international competition and global markets, as large numbers of women workers from developing countries entered both the formal and informal labour force. Feminisation is used to characterise the activities associated with 'women's work': ideologically constructed and with fluid definitions according to the role of the family within global capitalism and fulfilling the specific requirements of the local labour market at any given time. It also refers to the pattern of employment, which results in increasing numbers of women occupying certain jobs[2].

No country has industrialised without mobilising large numbers of women workers (Standing, 2006) and studies have documented a preference for women workers in different sectors, particularly in export-oriented, labour-intensive industries relying on low-cost production for global markets. Women predominate in industries were profit margins are protected by reducing labour costs, extending working hours or reducing the number of formal workers (Standing, 2006). The feminisation of employment expanded initially with the manufacturing sector, and more recently with the internationalisation of services, especially call centres and data entry. This phenomenon is most marked in Asia, but has also affected much of Latin America, with the growth of the service sector contributing toward greater polarization of

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[1] The term was intended to highlight the irony of integrating women as equals into the labour market at a time when women have been pushed into more precarious forms of work.

[2] Elson (1999) argues that rising labour force participation is in part a statistical artefact, arising from improvements in accounting practices of women's economic activity. Perrons (2004) also queries the extent to which the statistics represent material change.

earnings between highly paid 'knowledge' workers and poorly remunerated generic employees in the caring, cleaning and catering industries (Perrons, 2004).

These structural developments have affected women's work in developing countries in a number of ways (Mitter and Rowbotham, 1997; Perrons, 2004):

- By altering the process of production in manufacturing and service industries through automation, deskilling of workers, and augmenting skills of key jobs;
- By the introduction of new products and services into the market, such as electronics or computer peripherals;
- By shifting production to locations that are distant from the main sites of commercial units or to home-based workers.

We will now focus on these material changes by outlining a number of different economic profiles, illuminated by a gender analysis of global change.

A Manufacturing Sector Profile

With regard to the manufacturing sector, women now represent more than a third of the labour force in developing countries and almost one-half in some Asian countries (Mehra and Gammage, 1999).   The greatest increases occurred in countries which focused on low wage production for export – export-processing zones (EPZs) and informal employment in low-wage, labour-intensive manufacturing (Bernería , 2003) which were often exempt from labour regulations (Mehra and Gammage, 1999). Export-led industrialisation is based on significant inequalities, particularly as regards the gender division of labour and the gender wage gap (Bernería , 2001).   At the heart of low-cost production for global markets is 'flexible production' and women are seen as the most flexible labour supply in terms of their willingness to accept temporary contracts and unstable working conditions. Evidence of this discrimination can be seen in the report from the United Nations in 1995, which found that in none of the 37 countries for which data was available did women's wages in manufacturing equal that of men (Standing, 1999).

In the first phase of global migration to Asia in the 1970s, IT-related jobs were labour intensive, contingent, primarily assembly line or semi-skilled, low-wage, with long hours and harsh conditions (Castells, 1996; 1997; Mehra and Gammage, 1999). Much of the production focussed on low technology consumer goods, such as radios and televisions. Over the last 20 years, however, the pattern has changed from *making* IT to *using* IT in nearly every manufacturing industry (Hafkin and Taggert, 2002). Today, globalized manufacturing still demands cheap labour, but with greater technical and cognitive skills than in the first phase. Therefore the skills of female 'nimble fingers' become redundant and are replaced by (primarily male) skilled technicians and engineers. For example, as the technology advances in Malaysia and Latin America, men are replacing lower skilled women in the electronics industry resulting in an overall reduction in female employment. The need for specialist skills translates into a demand for male labour as firms are opting to employ younger, inexperienced men from technical schools rather than retrain their existing female workforce, often despite a history of long service. As work becomes more specialised and technological the labour force shows a trend towards defeminisation (Mehra and Gammage, 1999). Although conditions in manufacturing in the 1970s were far from ideal, nevertheless women do not want to be forced out of these jobs and have to return to their prior situations.   Any gains that women may have achieved through working in the manufacturing sector are now appearing to be short-lived as women are forced out or marginalised within the sector (Mehra and Gammage, 1999).

A Service Sector[3] Profile

The rapid formation of the female labour force across the globe has been tied, in particular, to the rapid shift from agriculture and to the growth of the service sector (Bernería, 2003; Mehra and Gammage, 1999).   The restructuring of the labour market and the labour process has seen moves to transfer some aspects of service sector work to less developed countries as firms search for cheaper and more flexible ways to accumulate capital.   The first wave of IT-enabled service sector jobs in developing countries was in online export-oriented information processing (especially medical transcription, banking, insurance and airline data entry) and these jobs were done almost entirely by women. For example, for the past 30 years, large numbers of female data entry workers have been employed in Barbados and Jamaica, and in the West Indies 99% of these workers are female (Hafkin and Taggert, 2001). More recently, female data entry workers have come to predominate in China, India, Singapore and Vietnam.

A popular example of this type of employment concerns call centres, particularly those based in India. These are subsumed within two broader categories of IT Enabled Services (ITES) and Business Process Outsourcing (BPO).   These centres are being globally located via outsourcing and offshoring in the hope of taking advantage of different time zones and lower wages. Without doubt, the overriding factor that is driving this migration of call centre work to developing countries is the promise of substantial cost savings. They combine front-office (voice) and back-office work, with the former carried out mainly at night and the latter during the day (Taylor and Bain, 2004). Much of the 'front-line work' (Frenkel et al., 1999) is carried out by women since their social and emotional skills are often designated as gender attributes (Belt et al., 2002) and women are often considered cheaper and more flexible. These skills are often unrecognised and unacknowledged, but they are arguably gendered and indeed perpetuate the 'gender ghetto of women's service work' (Webster, 2004).   In this context, gender becomes embedded in the restructuring of global service production and is mobilized as an economic resource for companies.

Within the workplace, technology is also used to automate and facilitate work restructuring, as service sector employees interact as advisors, assisters, carers or message-takers. There are contradictory pressures as much of the work process is standardised and routinized, yet at the same time employees are required to satisfy the customer. Many of the types of calls that are handled in India are low-level transactional enquiries, which are fairly repetitive, with short cycle times (between 30 and 180 seconds). This intense activity of call handling for overseas customers occurs at night, often during shifts of between 8-10 hours duration, six days a week (Taylor and Bain, 2004).

In addition to these difficulties associated with workforce performance, employers within the global service sector demand a constructed cultural identity, which may sit uneasily with cultural identity within the host location. A key challenge that call centre workers face in India is the neutralisation of their diction and the cultural assimilation that is assumed (Taylor and Bain, 2004), as they adopt anglicised names while 'smiling down the phone'. Mirchandani (2004) describes the psychological tensions that are experienced as workers adopt Western identities and are expected to conceal the location of the call centre. Despite the assembly-line nature of the work, employers try to instil the idea of professional status by enforcing 'pink collar' dress codes of skirts and high heels (Freeman, 2000). For many women workers within the service sector these local and global tensions become embedded

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[3] The service sector also includes prostitution and related services and domestic and day-care workers.   Given the focus of this paper is on gender and ICTs the focus will be on 'pink-collar' offices and work broadly defined as clerical, sales, and services.

within their everyday lived experience, varying between types of service work and across different locations, depending on the contextual specificity.

Although skill requirements in this aspect of service sector work are not especially high (keyboard and language skills), they are far higher than those required in the first phases of feminised manufacturing jobs. As women become increasingly displaced in traditional manufacturing jobs, it is unlikely that they are able to move to service industry jobs, especially as these jobs tend to be numerically fewer. Service sector employers prefer young, single women, with a good education (Hafkin and Taggert, 2001). Underlining the assembly-line nature of the work, employers require flexible working with shifts, which frequently prevents women with families from taking jobs during off-peak hours. So while globalization may have brought new opportunities to young women with familiarity in English in the new service sector jobs, it has imposed homogeneous and culturally specific work practices, and made large numbers of older women redundant in the manufacturing sector.

As the service sector generally offers higher wages and greater job security than the agricultural sector, these trends are seen to reflect broad improvements in the quality of women's employment (Mehra and Gammage, 1999). Yet, within the service industry itself, particularly banking, finance, and insurance, women are predominantly based at the lower paid and less skilled employment levels, with few occupying positions in management (Standing, 1999). If women enter the workplace at the level of clerk there are limited opportunities provided for training and career advancement (Hafkin and Taggert, 2001). However, as ITES jobs come to reflect the movement towards the so-called knowledge economy, skill requirements are advancing and demands on women workers will be higher. Women may have made notable progress into highly skilled work such as software programming in Brazil, India and Malaysia, yet nowhere are these jobs held by a majority of women; women working in these areas comprise a small, educated elite (Hafkin and Taggert, 2001).

An IT/ICT workforce Profile

The IT/ICT workforce is a fairly new professional sector, particularly in many developing countries, yet women occupy a minority of positions and gender inequalities that are well established in many other sectors are being replicated in the IT/ICT industries. In India women comprise 19% of the IT workforce and 37% of employees in ITES (www.hindubusinessline.com), while in Brazil, women make up 20% of the software industry. They tend to be concentrated in particular occupational areas, which are generally the lower skilled IT jobs related to data entry, and they comprise a small percentage of managerial, design, and software personnel (Hafkin and Taggert, 2001). Yet, as increasing numbers of women enter the IT or ICT professions, there is a drop in salaries, status and working conditions. The domain of masculinity becomes increasingly feminised.

The majority of the newly created technology and telecommunication jobs in developing countries are in the private sector, but the lack of benefits available means that women are unlikely to pursue these types of employment, instead having to opt for public sector work that is more likely to offer childcare provision, flexible hours and maternity leave. As some governments legislate for such benefits, the full responsibility for providing them often falls on private sector employers who are then inclined to discriminate against employing women in order to avoid the financial cost of providing these services and benefits. In a recent case study on network engineer training programmes in Britain running the Cisco Certified Network Associate (CCNA) module (Gillard, 2006), it was found that employment

opportunities commensurate with their expertise were considerably restricted for women in general, but particularly so for lone parents. Reiterated by Hafkin and Taggert (2001), CCNA programme managers, instructors and students found that employers were reluctant to recruit women, perceiving them as poorly qualified and lacking critical work experience. Employers frequently maintained that not only were the supposed physical and computational demands of the job too exacting, but also that it was too risky to permit inexperienced personnel to tinker with the vital network infrastructure. Preferring to hire men, this blatant stereotyped discrimination in skills recognition was also encountered by female instructors and students in the Philippines, Romania and Russia, with job ads for computer technicians frequently specifying male candidates (Hafkin and Taggert, 2001). In the training programme however, women performed as well as, if not better, than their male colleagues (Gillard, 2006).

A Spatial and Organizational Restructuring Profile

Increasing globalization and the pursuit of international competitiveness have made labour costs more important in determining changes in the geographical location of production and employment and also in determining which groups of people are employed (Standing, 1999). In the quest for increasing profit, new markets and new commodities are explored, labour is sought in cheaper localities, the labour process is intensified, and neo-liberal policies deregulate trade and financial transactions. Globalization has facilitated a reduction of the core size of the firm as the periphery is expanded to new outsourced sites in other countries (Bernería, 2001). The development of ICTs, dematerialised products, and the standardisation of work imply that service work operations can take place at any time, any place and anywhere. However, there are significant reasons for the clustering of economic activity, including cost advantage and incentives, the environmental infrastructure, and the availability and ease of retention of people and skills. For example, regarding ITES, there are significant city-based clusters with Manchester in the UK, Bangalore in India and Brno in the Czech Republic consistently appearing in the top 5 global locations (King 2006). In India call centres tend to be based in Delhi and in the largest city and principal commercial centre, Mumbai (Taylor and Bain, 2004). So, while some may claim that we are in a transformational and global knowledge economy, virtual work in services tends to be both location less (and global) and location specific (and local). While the increasing adoption of ICTs may appear to enable work to be conducted 'anytime anywhere' the reality is that key employers are still based in major capitals or large urban conglomerates. The geographical location has an influence on women's ability to participate in the workforce since their mobility is much more constrained due to familial obligations.

These politico-economic capitalist activities have social implications for both communities and people affected by the mobility of international companies seeking greater valorisation of their products and services, with ICT productivity often at the forefront of development and equalizing initiatives (Gillard et al., 2006). Narrated as improving global interconnectedness between geographically dispersed regions, ICTs may contribute toward degrees of cultural homogenization through technical standards and implementation processes for example, but as Perrons (2004) and D'Mello (2006) note, local variances exist and flourish. Yet these differences are often airbrushed by the discourse of globalization and alleged democratic opportunities offered through ICT's as the zones and countries targeted for development are highly regulated by the terms and conditions set by key international agencies such as the IMF and the World Bank. Tied into financial contracts which change production, trade and economic activity and thereby affect social relations, the power behind these agencies lies with key Western nation states and corporations. This multidimensional consortium of power has a vested interest in capitalizing on homogeneity; nevertheless our world is not the same.

An Informal Sector Profile

Two of the major changes to the spatial reorganization of women's work arising from the use of ICTs in developing countries are home-based work and teleworking, both of which are based on subcontracting arrangements. ICTs are used to enable distance working whereby employees or freelancers work either at a site that is geographically separated from corporate headquarters (often located in a developed country) or work from within the home. Many of these types of extended production networks, which emphasise 'flexible working', allow corporations to legitimately pay lower wages while bypassing the provision of benefits and protective legislation (Ward and Pyle, 2000).

A key feature of flexibilization has been a relative and absolute growth in non-regular and non-wage forms of employment. Homebased work provides an important source of employment throughout the world, especially for women, and homebased workers comprise a substantial proportion of the workforce in key export industries (Chen et al., 1999). Globally, the female work force is greater than the male work force in the informal sector (Chen et al., 1999) yet gender differences are often ignored (Standing, 1999). There is a considerable gap in the literature on women's employment in the informal sector (Chen et al., 1999; Elson, 1999; Standing, 1999) despite providing more employment more consistently for women than the formal sector. Almost all women workers in low-income countries such as Tanzania and Ghana are concentrated in informal sector employment, while in middle-income countries a large proportion of women are concentrated here, notably 76% in Thailand and 80% in Turkey (Standing, 1999).

Teleworking is one of the most rapidly growing forms of flexible labour which is absorbing far more women than men and involves less secure working conditions (Standing, 1999). Informal sector employment is assumed to be compatible with characteristics that are deemed stereotypical of women workers: irregular labour force participation, willingness to work for low wages, static jobs requiring little or no career advancement. By outsourcing work to the informal sector corporations reduce costs, as women are employed without fixed contracts and lack the rights and benefits associated with regular employment based on company premises: comparable pay, promotion, pensions, training, unionisation and paid leave. As noted, one of the paradoxes of industrialisation, is that homeworking flourishes (Hafkin and Taggert, 2001).

These types of informal economic activities have traditionally been seen as a strategy for economic survival for women and used in addition to formal labour and household activities. In the literature during the 1970s and 1980s the informal sector was seen as transitory (Bernería , 2001) but the reality for many women is that this type of employment is far from evanescent (Standing, 1999) and indications reveal that the informal sector is growing in magnitude and significance as the formal sector shrinks (Breman, 2006). Conceptually, the formal and informal sectors were viewed as highly separate, despite studies showing levels of interconnectedness, particularly through subcontracting (Bernería , 2001). There is an increasing trend whereby even large-scale enterprises have been informalising their labour process in the industrial and service sector in order to increase their competitiveness and profits (Bernería and Roldan, 1987). In this respect, these two key areas of employment are highly linked and connected as the formal sector intensify their involvement with informalised production through outsourcing and subcontracting (Bernería , 2001). Therefore, rather than be absorbed by the formal sector, informal economic activity is on the increase and is instrumental to global competitiveness and profit maximisation. The informal sector is an integral part of the global market economy (Steans, 2000), being both dependent upon and subordinate to the formal sector (Breman, 2006). Core firms engineer a principal

role in the generation of informality and poor working conditions, via chains of subcontracting and outsourcing. As Standing (2006) notes, a trend in many developing countries is that so-called 'formal' enterprises (modern, large) have been informalising their labour, by outsourcing, and by using more casual labour and contract labour. Consequently, it has become increasingly difficult to identify where the formal market ends and the informal begins. Given the feminization of the labour force over the last three decades, coupled with the drop in formal employment, women have been central to these informal activities.

THE HOUSEHOLD: THE NEGOTIATION OF DOMESTIC WORK

In order to have some understanding of the interconnectedness of gender, ICTs and development, the totality of women's working lives requires examination. Much of the gender and development research has emphasised the need to redefine work to incorporate paid labour in the formal sector, paid informal sector work, and unpaid labour in the household (Ward and Pyle 2000). Households take different forms in different societies, yet the majority of women in the world work in two to three of these categories, aptly called 'the triple shift' (Hossfield, 1990). Under researched outside of feminist scholarship, this public/private nexus of work organization often means that whether or not it is managed by family members or paid personnel, domestic chores generally remain the responsibility of women. Despite a common assumption that equalitarian households are on the rise, many women have to sacrifice their career or employment choice to manage these practical caring tasks. Whilst the heterosexual married couple format remains the homogenising norm in many societies, familial units are changing; partly in response to shifting social aspirations and greater acceptance of varied sexual identities, but also to absent parents. The male breadwinner assumption is turned around by the rise in dual-earning and single parent families, both in Europe and in many developing countries such as the African continent where HIV/AIDS related illnesses, for example, have decimated not only families but whole communities. This restructuring of the household has implications for not only employment patterns, but also mobility, opportunity and well being. As the intensification of work filters through to globalized local arenas, long and anti-social hours cut into private lives and whilst the affluent can afford to buy in, or contract out, domestic services to save time or effort (Wajcman, 1998), the poor can not do so. Drawn from the lower strata of societies, in the West this domestic labour profile increasingly reflects a high proportion of Eastern European, Central and South American or Asian women (Hafkin and Taggert, 2001).

The commodification or negotiation of domestic work presents a key site of tension for public roles and responsibilities (Wajcman, 1998; Perrons, 2004). Better paid men may abdicate commitment, perhaps believing their financial contribution is sufficient, or justifying ad hoc obligation to the household(s). Few women have such choice or flexibility, and only those with stronger bargaining positions, such as income or robust extended networks, are the ones who tend to have greater determination of their own and their children's interests (Perrons, 2004). However, whilst it may be possible to negotiate fallback strategies with the aid of these and other support mechanisms, it can not be assumed that women have complete control over their wage. Kinship ties and sexual politics may requisition all or part of their income, restricting their bargaining power and increasing their dependency on additional wages as public or private health, education and water services, for example, escalate in cost.

Domestic structures and practices are recalcitrant to change and considerably contribute toward unequal gender relations in the household and in employment, and their cultural variances affect women and men in very different ways. In the quest for economic survival, family members disperse to productive cities or countries and as the household fluidly adapts, it is women who bear the brunt. For, if patriarchal processes are challenged by the growing

globalization of the feminisation of employment in local market settings, women may be subject to stigmatisation as loose, neglectful of their domestic duties and too independent for their own good as they shape and negotiate their public employment (Perrons, 2004; D'Mello, 2006). These and other cultural practices not only weaken their economic power, but contour the diversity of their lives by influencing degrees of effort required to negotiate their tenuous social positioning and bargaining scope.

CONCLUSION

In this paper, we have attempted to show some tensions in the globalization discourse of democratic equality and opportunity through ICT production. We have built on the conceptual research framework put forward by Walsham and Sahay (2005) by highlighting the importance of gender. This is not simply to be considered as an additional dimension, which humanises mainstream development studies, but rather we hope that the centrality of gender as a universal organizing principle of all human activity is evident from our discussion. Our critical analysis is intended to expose the tensions and contradictions evident in the way in which ICTs are used to 'promote' development. Drawing on the gender and development literature, we have highlighted the neglected topics of gender, identity and the tensions between the home, work and community; the evident contradictions of global capital demanding feminization of work; the gendering of the knowledge economy and women's engagement with ICTs, alongside continued absence of women in the design and control of ICTs; and increasing standardization with de-personalization and 'cultural cleansing' of identity. By focusing on the push/pull dynamics of homogeneity and heterogeneity, we have flagged the strengths of feminist theorising and research. If the dichotomous conceptualisation of developed or undeveloped is viewed as two sides of the same coin, each co-dependent and mutually constitutive, then the capitalist quest for global unification risks imposing homogeneous values and practices, and distorting heterogeneous realities and experiences.

This political economy of development, where deregulation of markets, standardization of ICT employment activities and rigid classification of gendered social and economic relations are constituted and reconstituted to meet capitalist requirements and practices (Gillard, 2006), is not the only way forward to improve issues of poverty, disease, malnutrition and societal exclusion. Whilst attention should be drawn to the social implications of these neo-liberal policies, ideologies and practices and their offshoots such as gender mainstreaming or diversity initiatives, the absence of challenges to the political and economic status quo or the lack of tackling why and how it is that those who struggle to survive continue to be exploited and devalued, must also be addressed. Shifting the onus from requirements to fit into normative, homogenizing practices, and rethinking work and life from women's perspectives may offer alternatives for reorganizing and improving human existence and activity. Realigning public work to the 'rhythms and pulses' of private life may begin to provide concrete heterogeneous ways in which women are supported and empowered to engage more fluidly with their families, their locales, their employment, and their particular circumstances.

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OPEN SOURCE GIS APPLICATIONS FOR PUBLIC HEALTH IN DEVELOPING COUNTRIES: CHALLENGES AND APPROACHES

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Abstract: While it is widely acknowledged that the use of maps can play a crucial role in improving public health management in developing countries, the use of Geographical Information Systems (GIS) in this context remains an unrealized potential. Amongst various other conditions contributing to this is the cost and complexity of technology, and the existing ambiguity of both spatial and non spatial data. While Open Source GIS applications undoubtedly provide a key potential to at least address the technology related concerns, working business models are far from being established in this domain. Drawing from an empirical experience of establishing Health Information Systems (HIS) in India more generally, and the state of Gujarat more specifically, we describe the effective application of a "hybrid Open Source" GIS model which appears to be working well, at least in technical terms. Drawing from Actor Network Theory, three key conditions are identified to contribute to this success: *"map" culture: historically existing strong inscriptions; translation of interests: existing symmetry; hybrid OSS models: loose integration and strong inscriptions*. We believe that this hybrid approach has wider implications on how the potential of Open Source technologies can be more effectively realized in practice to support the needs of developing countries, especially in the social development sectors, such as public health.

Keywords: GIS, public health, OSS, India, Health Information Systems

OPEN SOURCE GIS APPLICATIONS FOR PUBLIC HEALTH IN DEVELOPING COUNTRIES: CHALLENGES AND APPROACHES

1. INTRODUCTION

The recent literature both in the IS and public health disciplines reflects the growing use of ICTs to improve the governance and delivery of community health programs in less developed countries (LDCs) (Miscione, 2007; Braa et al., 2004; Monteiro, 2003; Lippeveld et al., 2000; Ausse et al., 1995). However, the use of Geographic Information systems (GIS) for public health, which is the focus of this paper, is relatively more recent, although undoubtedly with tremendous potential that is currently unrealized. Researchers, for example, Sauerborn and Karam (2000) have argued that much of the data used in an HIS is spatial in nature (for example, catchment area of a primary health centre (PHC[1])), and its spatial analysis provides the potential to improve public health management (for example, mapping disease patterns, and creating health profiles of regions).

The full potential of many of the GIS endeavors for social development sectors including health generally remains unrealized due to typical contextual conditions obtaining in LDCs. For example, spatial data is difficult of access, verifying its quality is problematic, it is embedded in deep rooted political and security considerations, and there is lack of prior experience of meaningfully using spatial data (Mennecke & West, 2001; Ramasubramanian, 1999; Sahay & Walsham, 1996). These difficulties are further exacerbated due to the poor availability of trained (GIS) system developers to implement, operate and maintain GIS application software (Hall, 1999). The high cost of acquiring proprietary GIS software and its subsequent upkeep and maintenance is also a key bottleneck in LDCs (ibid.). Apart from being unaffordable, the imported proprietary software leads to a lock-in to vendors, inhibits improvisation and tends to mystify the technology already perceived to be inherently complex.

The success of a GIS-based HIS depends also to a very large degree on the timely availability of reliable routine non-spatial (for example, monthly data on particular disease incidence), besides the spatial data itself (Lewis, 2005). This crucial requirement has often been ignored or underplayed due to the inherent bias towards acquiring spatial data for an intended application, which, in any case, is in itself beset with several procedural and bureaucratic bottlenecks in LDCs (Fox, 1991; Georgiadou et al., 2005).

The above introductory discussion underscores at least two key problems that impede the meaningful use of GIS in the health domain (amongst others) in LDCs, viz., the black-boxing and the expensive nature of the technology itself, and the ambiguity of data – both spatial and non-spatial. The research aim of this paper is to examine these two issues within an empirical setting where the implementation of a routine HIS at district level is ongoing in certain states in India. We explore the potential and problems of using Open Source Software (OSS) as a possible alternative to the proprietary GIS regimes.

The rest of this paper is organized as follows. In the next section, we briefly revisit some key concepts of Actor-Network Theory (ANT), especially related to translation, and how it helps to explore multifarious and divergent interests that underlie the use of ICTs, particularly

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[1] A PHC (Primary Health Centre) in India exists at the lowest echelon of government's medical hierarchy, providing minimal though essential healthcare service to people inhabiting a cluster of villages a few kilometers around its location, including immunization to pregnant mothers and infants. These services are usually availed by the poorest of the poor.

(OSS) GIS, in primary health domains in India. A brief discussion around research methods employed for fieldwork and data analysis is then presented, followed by the case description, and then its analysis. Some summary conclusions are then presented.

2. THEORETICAL LENS

Two key concepts relating to translation and inscription from the domain of ANT are drawn upon for supporting our case analysis. The ontological basis of ANT is that the society is a seamless socio-technical web comprising of heterogeneous and dynamic actor-networks, work practices, and organizational arrangements (Hanseth & Monteiro, 1997; Walsham 1997). Two key notions of ANT relevant to our analysis are *translation* and *inscription* (Callon, 1986, 1991). Translation is the process of aligning interests in a network of different actors, while inscription explicates how viewpoints and meanings of behavior become embedded in actor-networks. These perspectives and intentions can be inscribed into technical artifacts that are designed to serve a particular purpose.

Initially used to investigate the networks of interdependent social practices, the analytical framework provided by ANT has also been applied to investigate together social and technology (and later information technology) developments. This is because the introduction of new ICT projects in organizations is a socio-technical process, usually entailing paradigmatic changes in the existing work routines and the traditional structures of an organization (Holmström & Stadler, 2001). These changes often meet with resistance, causes conflicts, lead to a realignment of prevalent power and political interests, restatement of organizational vision and strategy, and the emergence of new actors and networks. The underlying contradictory concerns and interests need to be transformed towards alignment by mobilizing and enrolling influential allies to ensure success of the new technological induction and innovation (Latour, 1987). Monteiro (2000. p. 246) has argued that the success or failure of IS in organizations may not be determined by adopting the "best technical approach," but "the solution with the "heaviest" backing wins out." The strength of ANT analysis lies in its ability to trace these processes of negotiations, how different actors are brought into play, what compromises lead to translation and inscription of interests, finally leading to the success or failure of the technology in question.

In summary, ANT, in particular the notions of translation and inscription help us to analyze how heterogeneous actor networks may be aligned or not to agree upon and use a technological innovation. Within a primary healthcare setting in LDCs where efforts to introduce ICTs like IS/GIS are often resisted due to bureaucratic apathy and diverging interests of actors involved (Sahay & Walsham, 1996; Braa & Hedberg, 2002), ANT provides a powerful theoretical lens to analyze the trajectory of these endeavors and their associated outcomes.

The analytical focus of the case presented in this paper concerns an OSS application with a focus on how the GIS functionality was developed. Traditionally in IS research, ANT has not been explicitly applied to this domain of OSS applications in public health in LDCs, but more so in Western business settings. For example, Hanseth and Braa (2001) used the ANT's framework to analyze the implementation of a proprietary ERP software in a large Norwegian manufacturing company. On the other hand, OSS applications and also the maps involved with GIS technology have unique characteristics as "public goods" (Georgiadou & Groot, 2002) where its application and use are not guided by motivations of a private sector inspired capitalistic logic, but of bringing benefits to society at large. The traditional mechanisms of inscription and translation as evidenced in commercial applications like ERP within Western organizations will arguably be different in the case presented. While Walsham and Sahay

(1999) have developed an ANT inspired analysis of GIS implementation in India, the specific software in question was a proprietary one, which has practically very different motivations for its adoption than those within the OSS framework.

The term OSS implies that the source code as well as its binary version is made freely available to potential users by Internet-based communities of developers (von Hippel & von Krogh, 2003). In LDCs, where the availability of Internet is not a given, especially within rural settings, OSS development efforts cannot rely on a purely Internet based sharing of code. Furthermore, unlike in the West, where a lot of the OSS development can be traced back to an ideological counter to the corporate ownership of packaged software (Raymond, 2004, Rosenberg, 2000, von Hippel & von Krogh, 2003; Hars & Ou, 2002), in LDCs, the motivation may be quite different than primarily ideological. The heightened current use of OSS in the West has been described as a "rising tide" (Massey, 2005) within various economic and social applications (Weber, 2004; Feller & Fitzgerald, 2002), and the reverberations of this tide are also to some extent being felt in developing countries (Weerawarana & Weeratunga, 2004; Raghavan et al., 2006). However, while various governments and researchers argue for the merits of using OSS in the context of LDCs, there are indeed very few practical examples of how to make these applications work within application settings such as public health.

Less has been written about the application of OSS based GIS technologies within the public sector in LDCs, even though many new OSS tools are at various stages of development in the West (Raghavan et al., 2006) (for example, Cartoweb, Kids etc). Arguably, these applications bring in further challenges to the plate because of the inherent complexity and novelty of the technology itself (Puri, 2003), and the various dynamics that surround the use of maps in LDCs, such as the paranoia surrounding security.

In summary, the domain of public health, in LDCs, OSS and GIS, taken together, provide a unique setting, which we argue have not been theoretically analyzed in prior research. We adopt an ANT based perspective to examine the context of the empirical case of introducing an OSS IS/GIS application for primary health care at a district level in India. After briefly outlining the research methods used, we describe the case study.

3. EMPIRICAL APPROACH AND METHOD

Broadly, the research approach is based on an action research framework, where the focus is on facilitating change within public health settings. Our approach can be best described as creating "networks of action" (Braa et al., 2004), where the focus is on creating actions that can help to share and learn between actors in a multi-node network. Within this perspective, OSS becomes a key actor, given that it can be circulated through the network without the baggage of licenses and vendor lock-ins.

The empirical setting for the research is the Health Information Systems Project (HISP) in India which has been ongoing since 2000. HISP, India, is established as an NGO, with support from the University of Oslo, establishing contracts with various state health departments to design, develop and implement DHIS (District Health Information Software) for public health. A team of more than 30 full time HISP staff are involved in various actions such as software customization and adaptation, capacity building, and gaining political endorsement for the project. The two authors of this paper are honorary members of HISP India, and also have faculty positions at Oslo. They are engaged to different degrees in the everyday practicalities of establishing and continuing the project, in addition to developing a research perspective and outputs.

4. THE CASE STUDY

The case relates to the design and implementation of GIS-based application and its integration with the open source DHIS currently being implemented by HISP[2]-India in 6 selected districts of the Gujarat state since April 2006. Prior to this, in India, HISP has worked in Andhra Pradesh (AP) from 2000 and the state of Kerala since 2004.

Historically, HISP was first introduced in post-apartheid South Africa in 1994 (Williamson et al., 2000), and. DHIS 1.3 (based on Microsoft Access but distributed free) was first developed in 1997 and subsequently accepted as the national standard for the South African health services. Over the years, HISP has evolved and been "translated" into applications deployed in various countries in Africa, and also in a few Indian states (Braa et al., 2005). Given the empirical focus of this paper, it is worthwhile to comment that DHIS 1.3 did not have significant GIS features, and used Arc Explorer (from the Arc/Info series), which could be downloaded free, and used primarily for displaying maps (and not for conducting spatial analysis such as overlays etc).

In 2005, based on various feedbacks received from the field, the DHIS was enhanced and translated into a Java/MySql based platform independent software that could run off the web and also offline. This application (called DHIS version 2) was first tried out in the state of Kerala in India, and thereafter it was customized and implemented in Gujarat state which is the empirical focus of this paper, especially its integration with GIS functionality.

4.1. HISP Implementation in Gujarat

The HISP initiative in India was first mooted in AP state in 2000, largely enabled through the personal interest in the project taken by the then Chief Minister (CM) of AP, the IT-savvy Chandrababu Naidu, who was the brain behind various innovative e-governance projects (Krishna & Walsham, 2005). It was within this context, HISP India started to work in selected clinics, which unfortunately at that time was also seen in competition to another World Bank funded project which had the state health department support. As a result, HISP was always battling against various attempts of the authorities to eject them from the state. In trying to counter these attempts, HISP India tried to develop and enhance their software application, such that it could be well differentiated from the competing application. One such component of this strategy was the development of the GIS application.

The Oslo faculty who was associated with HISP India had worked with GIS applications in India and other developing countries for more than 10 years, and realized both the strategic and political value that GIS could bring. One of the HISP's developers was assigned to acquire knowledge around GIS, and he really rose to the occasion and produced a very attractive application that could do various functions such as display, overlay, and correlate both health and infrastructure related datasets. Initially, through a donation from ESRI, we received two free Map Object licenses and training, which was sufficient for the development of the prototype, but was not amenable to scaling. We abandoned the scaling plans, but continued to use the prototype primarily for making presentations to various audiences. In the meanwhile, our GIS developer enrolled for Masters' degree in Oslo, and expanded significantly his GIS technical and implementation capabilities.

Going back to the AP story, after a change in political fortunes in 2004 when Naidu was voted out of power, HISP was also asked to leave the state in 2005. HISP, in anticipation, had in the

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[2] Health Information Systems Program (HISP) is a not-for-profit NGO, headquartered at Hyderabad, which is the independent Indian design and implementation node of, and linkages with, the international HISP research and development network.

meanwhile initiated the project in another southern state, Kerala. The government's insistence on a license free implementation also provided the impetus for the speedy rollout of DHIS 2.0 (a free and open source version of DHIS), and implementation was initiated in one pilot district in Trivandrum. Here, we learnt that the custodian of maps for the state was a quasi-government organization, and through a European Commission funding, were to be contracted to develop a state wide spatial database to be also used for public health. Since this organization was supposed to be the owner of the maps, we could not proceed without their collaboration, and with delays in the EU funding, the GIS effort was also delayed. We could not make headway there.

In the meanwhile in early 2006, an IT consultant working in the department of health, Gujarat, while making searches over the Internet for suitable HMIS software options for the state discovered the HISP India website (www.hispindia.org), and sent an email to the President of HISP India asking if they would be willing to explore the possibility of introducing HISP in Gujarat. After a preliminary exchange of information over email, she invited HISP to make a full-scale presentation to the Commissioner, the head of the state health services. Both the authors as well as the technical manager of HISP-India made this presentation in April 2006 at Gandhinagar (the state capital). Attending the presentation were about 50 health department staff representing *all* echelons of the health hierarchy in the state, and also the state IT agency, and representatives from BISAG (who were the formal providers of GIS services to various state departments). We made a rather detailed presentation including various functionalities of DHIS, with a special emphasis on its capability of integrating it with other applications such as GIS. The GIS-based visualization features of DHIS, which we demonstrated from the Andhra Pradesh module, impressed the audience. The HISP President also differentiated DHIS from other solutions by emphasizing the significant public health domain knowledge that was inscribed in the DHIS. He said:

> Right from its conceptualization in South Africa, the DHIS design has been based on the inputs given by public health specialists in various countries, including India. Thus, DHIS is probably the only system for computerizing primary healthcare domain in developing country settings that has been based on extensive "user participation," incorporating their domain knowledge. This is how DHIS has evolved, and would continue to do so by incorporating users' inputs. A striking illustration of the domain knowledge embedded in DHIS was its "indicator" functionality. The user could choose from the exiting indicators list, or add another as per an emerging need, to obtain a summary overview of a particular aspect either in textual form, and/or in bar/pie chart formats, or more graphical GIS displays by linking location and other spatial data.

At the end of the presentation, the Commissioner after directly seeking the opinions of his staff on HISP, decided to invite HISP to conduct a pilot project in a southern district from May 1. Within the scope of the project outlined, was included the need to integrate the HIS with GIS. However, this integration was to be carried out in collaboration with BISAG, since they were the custodians of the state spatial database, and had been already invited by the state health department to develop the GIS component of the public health HMIS.

On May 1, the implementation was initiated along two key lines. Firstly, system facilitators were hired in the pilot district to help the HISP developers to customize the application install it in the clinics, and start the process of populating the non-spatial database through training of the health staff. Secondly, the HISP technical lead started to sit with the BISAG development team in Gandhinagar (where their office was located) to start making the conceptual design for the integration. We will focus on the second stream of activities for this study.

It is worth noting that in Gujarat, unlike many other Indian states, there is a growing trend of using spatial information for planning and decision-making in the public sector. For example,

BISAG has developed several map-based systems for many government departments in Gujarat (disaster management, crime mapping, crop acreage and production estimation, watershed management, flood mapping are a few key application areas). At the initiative of the Chief Minister, considerable emphasis has been placed on actual use of these applications in the field, which are regularly monitored by the departmental heads, and even by the Chief Minister himself. This political and administrative support has led to this growing "map-culture" in the public sector's functioning. Also, BISAG's approach represents the creation of a spatial data infrastructure (SDI), shared by various user departments, and is a good example of the successful use of a user driven approach rather than a typical top-down process. (Georgiadou et al., 2005)

By coincidence, one of the authors of this paper, who had more than two decades of experience of working with GIS projects in the Indian government, was a close personal friend of the Director BISAG. In addition to the formal mandate for the development of the integration, there was also the social glue which helped to build trust and confidence in each other's capabilities and intentions. BISAG had built their own GIS package called *Pragati*[3], and was customizing it for the public health needs. HISP, because of their extensive prior experience in working with GIS for public health in AP, were able to provide the basic needs from a public health perspective.

The BISAG application was built on MYSql and Visual Basic, was desktop-based, and efforts were also simultaneously ongoing to develop the web-based version of the application. Furthermore, some very preliminary forays were also being made by them to explore various open source solutions. In contrast, the DHIS 2 application was completely on an OSS platform. The challenge of integrating these two platforms was addressed by the design that the integration will only be carried out at the level of the database (in both cases MySql), and the individual applications will not be affected by this integration, except when changes are made to the basic database structure. This form of "loose integration" provided relative autonomy to both groups, and once the integration was done, there was little maintenance required as the non-spatial data from DHIS 2 (collected on a monthly basis from the pilot district clinics) would automatically be updated and made available in the desired formats for the BISAG application. This represented a win-win situation for both groups, as BISAG could access the non-spatial data and keep ownership of the maps, while DHIS could access the spatial data. The entire application was deployed over the Gujarat server.

Within a short period, the two teams developed the integration module, with the HISP team providing the queries to BISAG so that the data could be pulled out from the DHIS database and be made available to BISAG in the desired formats. BISAG then started to make presentations of the prototype to various forums for obtaining feedback from us and also the user community to introduce further improvements. Two key areas for improvement were identified through a recent presentation by BISAG to the HISP team. One, to develop more user friendly interface relevant to user needs. Secondly, to categorize the output reports (such as by particular diseases and health programs), so that the application becomes more accessible to a range of different users. The HISP and BISAG teams are expected to work together to make these improvements. In the meanwhile, as a pilot, BISAG has also installed the GIS application in the different DHIS pilot sites, however, its meaningful use requires much more training and support, and also the resolution of initial teething technical issues.

In trying to take this OSS philosophy further, HISP has also invited BISAG to provide their application to two other nodes of the HISP network, namely the State of Jharkhand in India,

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[3] *Pragati* means Progress.

and for Ethiopia where HISP implementation is ongoing. This invitation has been accepted in principle by BISAG, as they see it as a way to extend their visibility to the national and international arenas. HISP and also Gujarat state will benefit as extending the user base will ensure a greater involvement of BISAG in the maintenance and upgrading of the software. Despite the philosophical agreements to collaborate on this extension, there are logistical issues still to be resolved since *Pragati* is essentially a proprietary application, and HISP is fundamentally committed to an OSS approach in which they have promised license free applications to the state.

5. CASE ANALYSIS: TOWARDS DEVELOPING HYBRID OSS PROPRIETARY MODELS

Key themes emerging from the case relate to: (i) map culture: historically existing strong inscriptions, (ii) translation of interests: existing symmetry, (iii) hybrid OSS models: loose integration and strong inscriptions. These are discussed.

5.1. "Map" culture: Historically existing strong inscriptions

Several past studies related to GIS in LDCs cite the lack of "map culture" in the Indian society as a key reason for their failures. For example, Sahay and Walsham (1997) in their detailed analysis of the application of GIS to land management in India found that the relevant spatial information generated by the GIS models was not used by land managers while planning land use. They attributed this disinclination to historical and cultural backdrop of colonial occupation of India, and how people related to geographical space and place. During the British occupation, for example, the use of maps was, by and large, through the government citing security reasons (Baber, 2001), tended to exclude the civil society from the use of maps, and a lack of impetus to universities to orient their curriculum accordingly. More recently, however, this deficiency is being gradually addressed with increased exposure of the populace to the Western value systems through the Internet (for example, Google Earth), electronic media, and the impact of globalization.

The people of Gujarat, for example, are reputed for their business skills and entrepreneurial acumen. To retain and improve their competitive edge, the adoption of new technologies is commonplace, the state being at the forefront of establishing e-governance as a matter of public policy. In this positive and facilitating environment, BISAG has played a key role to promote the use of map-based information in the field not only through promoting the large scale use of the spatial data infrastructure cultivated over the years, but also by becoming change agents. Through intensive educational programs, awareness campaigns, and workshops focusing on specific target groups within the government, BISAG has sought to demystify the GIS technology, and create increased user ownership of applications. This is a refreshing and welcome change as compared to the earlier focus of scientific institutions to engage with newer technologies like GIS largely from a research perspective and not placing enough emphasis on use and social development (Walsham & Sahay, 1999). BISAG has not diluted the research perspective, but has kept it in the background while creating for itself the image of a user-friendly agency that aims to empower the users.

As a result of the above efforts, the use of GIS has been gradually inscribed into the functioning of several government departments in Gujarat, their work routines having been accordingly modified over time, and GIS outputs being more routinely used for decision making. However, the use of GIS in primary healthcare settings is still at a nascent stage, and it needs to be carefully nurtured to embed it into the day-to-day functioning of the health services, especially sub-district levels.

5.2. Translation of Interests: existing symmetry

The strength of HISP lies in developing IS applications for primary health which can be used at the district, sub-district and PHC levels. HISP staff has long experience of normalizing existing data input formats by removing redundancies etc. to create the requisite essential datasets that are used as input to DHIS. With the accumulated knowledge of primary health embedded into the DHIS design, the HISP staff also has effectively incorporated emerging user needs into the system. While HISP's technical team has gained some experience of working with GIS technologies, it is prudent to claim that HISP's core expertise lies around the processes related to non-spatial data, rather than spatial.

On the other hand, BISAG's focus and expertise lies in collecting and analyzing spatial data, mainly derived from remote sensing satellites. It has to rely on secondary sources such as government's statistical bulletins for non-spatial data. BISAG also asks users to provide this data for developing their applications, but does not directly involve itself in this pursuit. Therefore, BISAG and HISP's expertise domains complemented each other, and provided the incentive to both sides to network together. Given this symmetry of interests (the required spatial and non-spatial data being provided by BISAG and HISP respectively), through mutual discussions and presentations, it was relatively easy to align the interests of these two agencies towards developing a reliable IS and GIS for the primary health domain of Gujarat. HISP also found influential spokespersons (for example, the Commissioner, the IT consultant and various medical doctors) who accepted and promoted the use of DHIS. Thus, a well-aligned actor-network comprising the above-mentioned key stakeholders, their work procedures/routines and professional interests, the HISP team, the technology itself (DHIS and *Pragati*), and BISAG was established with a clear-cut goal and mandate. BISAG constitutes the obligatory passage point (Latour, 1987) for this effort since they already had a mandate from the government to introduce spatial planning models in the health department, and were also the custodians of the spatial database. Thus, even if HISP had the right technical GIS solution, it could not have been implemented it by itself.

5.3. Hybrid OSS Models: loose integration and strong inscriptions

Pragati is not yet available as an open source product. However, its adaptation to DHIS was provided without cost to HISP. This constitutes a hybrid model in which one OSS-based application (DHIS) is integrated with another, which, although proprietary in nature, is made available freely. BISAG has the mandate to provide GIS support to development related applications in Gujarat, and is now veering around to the view that such support should not only be extended to other Indian states, but also to other LDCs. This expansion is enabled through the model which has a loose integration but strong inscription. *Pragati's* interface draws upon the DHIS's database to provide the GIS functionalities like the spatial query and visualization modules. Any change in the DHIS's database structure would, therefore, affect this system, requiring redesign and programming of *Pragati's* interface.

However, this enlarged mandate (expanding to other states and countries), institutionally requires due approval of the state government, and BISAG to view its spatial data holdings as public goods, and play down the proprietary perspective. One way forward is to adopt the above-mentioned hybrid model beyond Gujarat, for example in Jharkhand and Ethiopia. A potential advantage of adopting this approach is that the end product may become available to the end-users at no cost. On the flip side, the (spatial) data is not independently available to the users, but is embedded in the interface application. Also, it increases the software maintenance overheads since any change in the database structure at the user end would require BISAG's intervention to update the interface. However, BISAG could still exercise

proprietary ownership and continue to earn revenue by developing commercial applications.

6. CONCLUSIONS

In this paper, we have described the processes around the development of a hybrid OSS model, and the underlying conditions that are making it work. In LDCs, where the use of OSS is currently more of a hype than reality, such an approach can be a way forward to explore how the potential of OSS can be effectively realized in practice. Conventional models based on internet based sharing of code (as seen in the West) may not be a sufficient glue for developing this model, which may also need other social elements (like the personal relationship of senior HISP and BISAG staff). Such situational contingencies need to be taken into account, and taken advantage of, in the formulation and implementation of OSS models.

7. ACKNOWLEDGEMENTS

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NETWORKS FOR OPEN SOURCE SOFTWARE DEVELOPMENT: CASE STUDY OF ART SOFTWARE DEVELOPMENT IN ETHIOPIAN-VIETNAMESE-INDIAN NETWORKS[1]

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Abstract

 In this paper, we have focused on understanding the micro-level dynamics of a software development team working together largely within a south-south framework to develop a rather complex patient specific ART application. The learning by doing approach adopted for this development process, we argue helps to address some of the challenges of "design-reality" gaps that north-south models tend to magnify. More specifically, three key facets of the learning by doing approach are emphasized: rapid prototyping in close collaboration with users; creation of south-south networks, and, the creation of social glue

Key words: *free and open source software, network, learning by doing, medical health record, ART*

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NETWORKS FOR OPEN SOURCE SOFTWARE DEVELOPMENT: CASE STUDY OF ART SOFTWARE DEVELOPMENT IN ETHIOPIAN-VIETNAMESE-INDIAN NETWORKS[2]

1   INTRODUCTION: CHALLENGES   AND   OPPORTUNITIES   OF OPEN SOURCE SOFTWARE FOR DEVELOPING COUNTRIES.

Increasingly, information infrastructure of a country is seen as essential to economic growth. As UNCTAD Secretary-General Rubens Ricuperso recently stated: "*Among all the factors that can contribute to the competitiveness of developing countries, I can think of none more important than information technologies*" (http://www.iatp.org/tradeobservatory/headlines.cfm?refID=31781). However, while the potential of ICTs no doubt exists, in practice the benefits are not easily realized. Information Systems (IS) researchers empirically examining the implementation of ICTs (Information and Communication Technology) in different contexts have reported a wide range of cases where systems end up as total or partial failures. Major contributing reasons identified have been the structures (for example, funding mechanisms) and processes (for example, training and education methods) around the technology transfer projects. It has been argued by various quarters that the technological disparities between poor and rich countries have worsened as a consequence of the wide adoption of ICTs in developed countries, as evidenced in debates around the "digital divide." This gap proves a major barrier to battling ongoing problems such as poverty, health care (for example, the HIV/AIDS pandemic), environmental degradation etc.

Various arguments have been raised by IS and development studies researchers to establish "south-south" collaborative networks as contrasted with the traditional "north-south" networks. North-south projects, as Heeks (2003) argues often leads to the creation of design-reality gaps reflecting the chasm between the design assumptions inscribed in the technologies by the developers in the North and the practical realities of the ground where the technology is expected to be put in use. Heeks identified the following seven dimensions around which these gaps are prominent:

- **I**nformation

- **T**echnology

- **P**rocesses

- **O**bjectives and values

- **S**taffing and skills

- **M**anagement systems and structures

- **O**ther resources: time and money

(summarized by the ITPOSMO acronym)

A contrasting model, though not empirically tested in depth, can be south-south collaborative links, reflecting networks being constituted primarily by developers and institutions in the South. These networks can be further supported by taking on a structure of south-south-north,

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where the North playing a more enabling role rather than one of direct design, development and the control of implementation processes. These enabling roles can be in the form of providing specific technical guidance, provision of expertise and funding, and for supporting educational processes. These south-south linkages, also referred to as "counter-networks" (Mosse and Sahay, 2003) are seen to provide the potential to challenge technology imposition and unsustainable practices sometimes seen in north-south transfers, and allow the sharing of experiences, skills, products, and processes between similar contexts. These similarities in structures can thus help to close some of Heek's "design-reality" gaps, and potentially contribute to more effective applications of technology.

One important domain which should be the basis of such a counter-network involving south-south (-north) partnerships concerns Open Source Software (OSS), which provides the developing world with a powerful strategy to leverage the potential of ICTs for supporting local applications. OSS represents fundamentally a model of distributed, shared, open software development, and as a development philosophy gaining momentum in many developing countries. For example, a significant proportion of the Internet infrastructure is based on OSS products including send mail, BIND, Linux and Apache HTTPD, the latter running more than 69% of all active websites (approximately 15 millions) with Microsoft IIS coming a distant second with less than 23% share. OSS is arguably a cost effective and customizable alternative, potentially helping to prevent monopoly, and can be beneficial to the poor nations where software license costs accounts for a significant proportion of governments' budgets on ICT infrastructure. For example, Meystre and Muller (2005) use the example of Vietnam to argue that "*the cost of Microsoft Windows XP and Office is higher than the average annual income!* "

OSS offers a wide spectrum of software programs developed not under the lock and key of a single company but through communal efforts, and is increasingly becoming the foundation of the Internet economy, powering much of the global flow of email and more than 70% of all web servers. The OSS movement is helping to provide alternative models, technologies and processes to businesses and governments in developing countries to compete more significantly in the global marketplace, as well as to enhance service quality and efficiencies in the public sector. An example of this is the Linux operating system which has grabbed a significant chunk of the server business once held by Unix, and is increasingly also becoming a significant desktop contender, increasingly with the backing of influential companies. With the rapid spread of Internet access, OSS offers a great potential for significant commercial gains for industries in developing countries, `for example, in the domains of saving on licenses for standard business software, for specialized software serving a range of industries, and for contracts to do customizations and to add features. Provided the skills to exploit it are developed locally, OSS offers an excellent foundation for commercial software development serving local or global markets.`

Furthermore, OSS provides governments in Asia, Africa, and Latin America with freely available ICT-based tools to address chronic problems of poverty, low productivity, population growth, wide scale unemployment, primary product export dependence, epidemics, and illiteracy. Several European countries are now promoting OSS and setting up international networks and UNDP has established a network for the Asia-Pacific region (UNDP, http://www.apdip.net/). Developing countries are increasingly facing up to the potential of OSS. Examples include South Africa (South Africa OSS, http://www.oss.gov.za/docs/OSS_Strategy_v3.pdf) and Vietnam (Vietnam OSS, http://www.oss.gov.vn/index.php?SetLanguage=0&lang=en) making important policy

decisions, Brazil setting up a "Chamber for the Implementation of Software Libre" (Linux Today, http://www.linuxtoday.com/news_story.php3?ltsn=2003-06-13-009-26-OS-LL-PB), and Malaysia recently introducing a "Public Sector Open Source Software Master plan" (Malaysia OSS, http://opensource.mampu.gov.my). Arguments for OSS are also being made forcefully in India, both relating to rural e-governance and for commercial software development, with the Indian president Dr. Abdul Kalam a strong proponent and states forming OSS policies (Time India, http://timesofindia.indiatimes.com/cms.dll/html/uncomp/articleshow?msid=47799819).

This increasing momentum due to dynamics in the domains of the industry, markets and politics helps to make a compelling case for a developing country to adopt a OSS driven ICT strategy. OSS should not be viewed as a mere product choice, but more fundamentally as an alternative strategy for building, maintaining and changing the rules that govern information flows in the economy.

While OSS represents a real paradigm shift in how organizations approach ICTs (Meystre and Muller, 2005), there are several challenges in making them work effectively in practice, for example:

1. There are limited institutional mechanisms in place to support sharing of OSS both within and across countries.
2. OSS as an ideology, to be effectively implemented on the ground, needs to be supported by alternative organizational forms and business models, for example through pricing mechanisms for training and support.
3. The nuances of licensing arrangements are still poorly understood, and policies need to be established in this regard.
4. Technical capacity to deal with OSS development and support is still limited, and lies primarily in the domain of computer scientists working on closer to the machine applications (like operating systems and compilers). When we talk of applications within domains like health or education, there is very limited capacity to deal with OSS technologies.
5. Technical support mechanisms for OSS applications are a big issue as there are often no clear accountabilities within a community based development and support model.
6. The capacities of universities and technical institutions need to be strengthened in order to diffuse greater competence amongst the development community to effectively deal with OSS technology.
7. Language issues to enable transfer and use of OSS from one context to another are significant.

As the above list indicates, the opportunities and challenges of leveraging OSS applications for developing countries is tremendous, but so are the challenges. With the view that we know little of how these applications can be made to work in practice, we focus on trying to develop insights into the micro-level practices surrounding OSS software development process in a developing country context. These micro level processes concerns how learning takes place, how developer capacity is created, and how particular software choices are made. The empirical focus is Ethiopia, the development team consists of a Ethiopian-Vietnamese-Indian network, and the domain of application is HIV/AIDS management, specifically a patient specific system for monitoring ART (Anti Retroviral Therapy) treatment.

The rest of the paper is structured as follows. After a brief discussion of some related literature concerning OSS and health in the next section, we briefly outline the research

methods used in section 3. In section 4, in the case study we describe empirical attempts to create networks of expertise between three southern countries around application development of a ART system for Ethiopia. Finally, some analysis and overview conclusions are presented.

2   LITERATURE REVIEW

The key focus of this paper on the software development processes around a OSS application for health of a specific ART patient record system. Literature on this topic is relatively limited, especially around OSS EPR (Electronic Patient Record) kind of systems. Muller and Meystre (2005) also write: "The academic literature about OSS in health is very limited". They also present some examples of OSS in health care:

Carnall   (2000) published a letter advocating the use of OSS in health care, with a more complete electronic version also. Wright and Murray (2002) have also proposed the creation of the IMIA (International Medical Informatics Association) open source working group (Muller and Meystre, 2005).

Most of the published examples on this topic come from experiences based in developed, with literally nothing written about OSS in health care in developing countries. Another key theme in these published papers is the key argument being made to propose the use of OSS in health care to reduce costs and dependencies on vendors. The papers also discuss the barriers which prevent the dissemination of OSS in health care. While many of these barriers are generic in nature and apply to OSS in general, the health sector has certain particularities for example arising from the conservative nature of the health managers and also the heavy work burdens of the health workers. These particularities are magnified in the context of developing countries, because of further problems such as of fragmentation contributed by donor funding policies aimed at supporting specific health programs (Chilundo, 2004). From Mozambique, Mosse (2005) argues the need to take a broader view of infrastructure in the context of health information systems n Mozambique, because it is not only the constraints of hardware and software that serve as impediments, but also the related conditions of road transport and power supply. Furthermore, in the specific conctet of OSS development, infrastructure constraints, such as limited bandwidth and lack of capacity in Java based technologies pose serious challenges to develop and apply OSS.

Within the public health domain, Braa et al (1995) have discussed the problems of technology transfer between North-South countries, arising due to the lack of local capacity to adapt the technology, and the cross-cultural challenges that exist. They argue for the need for a paradigm shift from "technology transfer" to "technology learning" where the focus is on developing local mechanisms of learning rather trying to replicate models of the North in the South. A useful approach to this can be one of "learning by doing," as argued by von Hippel and Marcia (1995):

Although the economic significance of learning by doing and using has been made clear, the process by which these gains are achieved is still quite unclear. That is, we do not know the micro-level mechanisms by which learning by doing is actually done" (von Hippel and Tyre, 1995, p.2)

The OSS landscape is also extremely dynamic with various changes taking place in terms of technologies, application domains, and who is getting involved. For example, Fitzgerald (2006) has traced how the existing OSS arena is changing and is slowly becoming more professional and commercially driven in its approach. He uses the term OSS2.0 to distinguish it from the earlier OSS, arguing:

"*I contend that the open source software phenomenon has metamorphosed into a more mainstream and commercially viable form, which I label as OSS2.0*" *(Fitzgerald 2006, p.2)*

Drawing upon Tushman and Andersen's (1986) framework, Fitzgerald argues the reason for this metamorphosis in the OSS arena is due to radical changes in both the product and process related factors in OSS. In the product set, OSS2.0 works increasingly based on business strategies, support and licensing arrangements, which did not exist in the past. With respect to process, now OSS is based more on "purposive planning", is "less bazaar-like" and "developers are being paid".

Our research focus maybe seen as some kind of hybrid between Fitzgerald's "new" and "old." Working within a public sector framework of health in a project inspired by research and education, the developers are not paid. However, it is also not completely bazaar like, and a fair deal of purposive planning comes into play as the aim is not to create a product for only the sake of development, but to try and embed this product within the everyday working routines of the health department. We specifically focus on the development process, and how "learning by doing" processes be cultivated, primarily face to face, which stands in stark contrast to the Internet inspired OSS development projects originating in the West. Another point of departure concerns the development within primarily a south-south network, as we see this to be a potentially interesting alternative to try and develop the "design-reality" gaps which Heeks has described to contribute to failures in the South. We see this analysis to be having broader implications for approaching OSS based technology development projects more generally.

3   RESEARCH CONTEXT AND RESEARCH METHODS

3.1   Context

The HISP initiative has its origins in 1994, when the University of Oslo in collaboration with the University of Western Cape started the process of supporting the health sector reforms in post-apartheid South Africa. The HISP initiative is constituted of three key components: the design, development and implementation of Free and OSS called DHIS (District Health Information System); large scale capacity building efforts of health staff; and, research and education including doctoral and masters studies. For this paper, our empirical focus is on the software component, particularly on the process of its development. .

This study lasted 6 months from March to October, 2006, primarily based in Ethiopia. The researchers involved in the empirical component of this research include a Professor of the University in Oslo (UIO) who is also deeply engaged in the implementation of the projects through HISP India and HISP Ethiopia; 3 Informatics Masters student from UIO, 2 Ethiopian and 1 Vietnamese; and, other members of the HISP Ethiopian team. The Indian and Vietnamese researchers are the authors of this paper.

The context for this study was provided by the University of Oslo Masters program, as a part of which students spend one semester in Oslo, and the second taking courses at Addis Ababa University. This teaching took place in the Spring of 2006, and got together the staff and student as detailed above. The semester in Addis was spent both in teaching two courses (Health Information Systems and Geographic Information Systems), and the students identifying their thesis research topics, and initiating empirical work on them. Two pairs of students were created to work on these projects, one on the DHIS Version 2 customization for Ethiopia, and the second on the ART system (called IHAMS – Integrated HIV/AIDS Management System). Both these groups had relatively zero prior exposure on Java or PHP

technologies on which the DHIS 2 and the ART applications were based respectively. The focus of this case is primarily on the ART system development.

3.2   Methods

A case study based approach is used for the empirical work within an action research framework, where the aim was not only to describe but to also develop and implement the ART system within the regional health bureau at Addis. The case study approach, informed within an interpretive tradition, helped us to look at the problem of system implementation not only as a technical exercise of building the software, but also dealing with the politics such as the challenges from the American universities and the big money backing they had from agencies like Center for Disease Control (CDC), Atlanta. Given the extremely political nature of the HIV/AIDS problem, huge amounts of money are flowing into the development of systems to manage the epidemic, making the task of building such a system as much a political as a technical challenge. However, we focus primarily on the development process.

The actual working interactions amongst the team member involved in the system development was an important source of empirical data, since our focus was on understanding how team members could learn from each other. Other sources of data included some interviews with health workers and managers about the requirements of the ART system, and the prototyping process where intensive feedback and comments was elicited from the end-users. Then there were various chats (electronic and face to face), informal meetings and email discussions within the local and global HISP team members. Various secondary material was also used for systems analysis and design such as forms, reports and other artifacts gathered during the requirements phases. The prototyping approach used by us was a rich source of data as various versions of the application was placed in the user context, and their feedbacks helped to not only improve the system but also to gain an understanding of users' perspectives and concerns.

First, the Vietnamese student taught the Ethiopian students about the three key technology components used in the development of the ART applications: PHP, database, and web design. After the Ethiopians became familiar with the technology and were able to make some small examples (for example, data entry forms) that we had came to understand in the course of the ART requirement analysis.

After collecting the requirements needed for the first version, we tried to make a very quick demo of one data entry form and went back to the clinic in a short time. This prototyping strategy was to try and build trust of the health staff and to remind them that we were rapidly working on their requirements.

We continued to make speedy improvements and enhancements of the prototype every time we re-visited the clinic. This continuous and iterative process of system development and improvement formed the basis for our data collection and analysis. The analysis process involved the authors discussing amongst themselves the salient features of the development process, with a focus on the characteristics of how "learning took place by doing."

4   CASE STUDY: CULTIVATING NETWORKS OF (OSS) EXPERTISE THROUGH SOUTH-SOUTH NETWORKS

In Ethiopia, like in many other developing countries, there is an increasing need for patient-based health management systems, for example to monitor the progress of a patient over an extended cycle of a patient's treatment, such as for TB or HIV/AIDS. We started with

Care2x[3] and how it could be adapted to the context of the Ethiopian hospital, but very soon realized that it was not suitable for our needs One alternative approach suggested by the Oslo Professor was that we should focus on specific health programs such as HIV/AIDS or Tuberculosis or Malaria (all of which also require also patient specific data) rather than try to work with a complete hospital system which was extremely complex and the requirements unclear. The main argument was to narrow the scope and conditions of the work, and do something which is more practically feasible, and also fits into the framework of a Masters thesis. Furthermore, we decided that rather than work with Care2x as the starting point, we will build an application from scratch. Given the high need for a system for ART management in Ethiopia, which we recognized in discussions with the program manager in Addis, we decided to focus on it as a starting point. Even while realizing the limitations of a hard coded system, we decided to go that way given the expediency of the situation, where there was the need to quickly come up with a solution, as the Americans were also threatening to introduce their own system.

The choice of technologies

We decided to choose PHP instead of Java (the choice for the DHIS 2 platform), as we felt it was simpler and easier to learn and use. Therefore, it would potentially be more suitable in the context of developing countries like Ethiopia where Java capacity is limited. Developing effective knowledge sharing mechanisms could potentially provide the basis for making the project sustainable locally, and allow it to be further developed when the Vietnamese student left for this home country. Even in the architecture of the system, we selected a very simple structure comprised of many *.php files where we put all the user interface (html) and server scripting (PHP) and client scripting (JavaScript) together. We were subsequently criticized by the experts for this "simple" architecture, which made it difficult to maintain since there was no separation layer by layer (of the View from the Control etc). We defended our choice based on its appropriateness of the approach to the context given the simplicity, issues of available capacity and time constraints. And most importantly, through this approach the system should be under local control rather than create a dependency on Oslo expertise. In the words of one of the local team members: *"Why the question of PHP or Java is important? The most important concern is to have a system which works"*.

Learning by doing

The approach adopted to knowledge development can be called "learning by doing," in which the team members learnt by actually doing work. The Ethiopian members always had a lot of questions for their Vietnamese "teacher,", wanting to know about many issues before starting to write real code. For example, the first PHP page the Ethiopian team tried to create was simply to get a name filled in the text field and show a message: "Hello xxx " with xxx being the input name. The code for this was simply like this:

```
<?php
echo $_GET['txtName'];
?>
```

Immediately, the Ethiopian team asked to explain what *echo* means, what *$_GET* means etc. It could take the Vietnamese 15 minutes to explain them all and maybe other 15 minutes to write an actual example of the code including debugging. But he decided to cut that 15 minutes of explanation, and replaced it by letting the team write that code and run it. It

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[3]   The FOSS software for integrated hospital management system initiated in Germany (www.care2x.org)

worked and then he gave them other small exercises to gradually extend the coding expertise and skills. For example, he asked them to add one more combo box to select the gender of the person whose name was given. After it worked, the exercises for adding other types of controls such as list boxes, check boxes were assigned. As a result of this rapid learning by doing approach, in a very short time the team became increasingly confident in coding, and were motivated by seeing physically what they were able to create.

But it was not easy to convince the team to follow this approach. Used to a hierarchical system of instructors in college, they preferred the more academic approach which emphasized the understanding first. But we were keen on them to try and abandon some of this theoretical approach and adopt one that was more practice oriented. And when they could gain a lot of technical skills in a short time, they themselves became supporters and spokespersons of the "learning by doing" approach.

In addition to the working in the laboratory doing coding work, the team members also spent a lot of time socially in dinners and other settings. These interactions helped to develop a strong social glue amongst the team members, which contributed to an easy flow of questions and answers between them, breaking down some hierarchical structures that they were used to in the past, and this arguably contributed to the speedy development of capacity with various aspects of systems design and development.

After 2 weeks of intensive development, a first prototype of the ART system was released, including the implementation of the first form which was to keep track of the ART clients who were receiving treatment. This form (see figure below) allowed the addition, deletion and editing of ART clients, and was quite complex containing nearly 50 different data fields. :

Figure 1. The ART registration form in the first working prototype of ART module (We just show the top part of the form because of its length)

The above form was slowly improved in the subsequent versions. For example, in the above form the elements in the vertical layout allowed very little validation, which was subsequently improved. .

The successful implementation of this form gave the team a lot of boost and encouragement, and a sense of confidence that they could do the work. After that, the team started to work with reports, and also the forms for pre-ART and follow up. After 2 more intensive weeks, we had implemented three forms and one report, which formed the basis of the first version which was presented to the program manager who was supporting us. On his suggestion, we tried to get the first demo quickly installed in one clinic so that we could obtain user feedback which could be incorporated into making improvements on the system. The positive feedback received from the manager gave further confidence to the team, who started working on multiple tasks such as improving the: user interface, incorporating validation rules, and adding menus to facilitate data entry.

Continuing development in remote locations

After two months of intensive work, the Vietnamese student returned to his home country, and the Ethiopian team started to work alone. The support mechanism now needed to necessarily shift from a face-to-face to remote mode, including through the use of email and instant messenger services, and sometimes Skype was used. Unfortunately, SMS could not be used as that service is banned in Ethiopia. Despite these different tools being available, requests from the Ethiopian team to the Vietnamese were very few, which either could be interpreted as a good sign that they were becoming independent, or alternatively they did not prefer electronic means of communication. Also, some of the questions were difficult to formulate and express over the electronic medium. For example, user management function requires using sessions which was very difficult to the team to understand, and even more difficult to formulate as a question and transmit electronically. Maybe also contributing to this limited communication could have been the earlier period of face to face interaction, to which the members were now used to.

2nd chance of co-located work

In the end of May, the Indian coordinator and Vietnamese student went back to Addis to attend another conference on Africa e-learning. This provided another chance to further the face to face collaboration, and resolve issues which were not possible through the Internet, especially the integration of the ART and flexible system (for form generation) made by Vietnamese student while back in Vietnam. This flexible module allows to rapidly add new forms to the system. The first health program we tried to adapt using this flexible system was the VCT program (Voluntary Counseling and Testing). While the trial integration worked fine with respect to form generation, problems were experienced in generating reports because the database structure of the generic system was more abstract then for the fixed one. For example, the generic system used only one table called datavalue to store all data different forms, and values of fields in one form were stored as rows. In the ART system if the form had 3 elements such as patient name, birth date, address, ths data would be stored as 3 different rows in the datavalue table, which was very different from the structure of the flexible system. Thus serious difficulties in integration were experienced. The following figure shows the structure of the table datavalue as an example:

←丅→			ID	FormInstance	FormID	ElementID	Value	PatientID
☐	✎	✗	292	1	11	45	28/05/2006	479
☐	✎	✗	293	1	1	1	Nguyen Ngoc Thanh	479
☐	✎	✗	294	1	1	14	37/5B Trung My Tay, Ho Chi Minh city	479

Figure 2. Table structure to store values of one record. The one-step-more abstract layer made the generic system more complex to generate reports and integrate with ART module

After a very short time of one week, all left, and the Ethiopians were supposed to continue to try and make the integration work. Later, we were informed that they could not do that because of various technical problems such as report generation etc, and also because the field implementation of the ART was every day throwing up new requirements, and they had to focus their energies into making these improvements.

3rd chance of co-located work

In October 2006, there was another chance for the developers from Ethiopia and Vietnam to work together during the DHIS developers' workshop in South Africa. We brought to the conference the latest version of ART software with a lot of improvements as compared to the first prototype. The following figure shows the Intake data entry form used to register an ART client[4].

Figure 3. The latest version of ART module (as of October 2006).

One of the Ethiopian team members made a demonstration of this ART which really impressed the audience, who expressed surprise that the system had been developed in only 4-5 months by 2 students, and that it was practically working well in the real settings of the Ethiopian clinics.

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4   In Ethiopia, they call ART patients as clients

However, there was a flip side to the rapid development process adopted in Ethiopia. We realized the limits of this when we started to explore with a South African group who were interested in adapting the same system for a hospital in Pretoria. When our code was examined by a computer scientist there, who was both an expert in PHP and OSS technologies in general, he gave valuable feedback on the limits of the existing architecture, which he felt was like a "ball of mud" which was difficult to maintain and almost impossible to share.

His conclusion can be summarized in this excerpt from an email sent by him:

"*It (the ART module) may will not (as a software artifact) be suitable for use in SA or perhaps anywhere else*".

The suggestion from this expert to the Ethiopian team was to redevelop the system using Symphony framework. This process is currently ongoing, which for reasons of space limitations we do not discuss in this paper.

5 ANALYSIS

Four key analytical themes are synthesized from our empirical work, and these are now discussed.

5.1 Rapid prototyping strategy held in close collaboration with users

As we discussed earlier, the transformation of OSS into OSS2.0 implies a transformation of both the product and process (Fitzgerald 2006), which our case also reflects. Firstly, with respect to process, the different phases of planning, analysis-design, coding, and implementation all took place almost at the same time, with no clear boundaries between the phases. The communities of developers and users were separated in this process, which is not the case in traditional OSS projects, for example of operating systems, where the developers themselves are typically the users

The lack of technical capacity of the local team, the limits of time and the pressures of putting the system into work in the real situation made us adopt a "rapid prototyping model," differentiated from how conventional prototyping is used in typical software development projects. Our prototyping approach took place on site (in the clinics and the office of the manager) in very short and rapid cycles. This rapidity was necessitated due to political reasons of impending competition from the American system. In the window of time we had due to the delays in the American system, we were trying to quickly introduce a working system in the clinic. Traditionally, prototyping approaches take place in laboratory kinds of conditions, often very divorced from practical realities. This was not possible in our case. Furthermore, our design criteria was sometimes based on the most expedient solution depending on existing needs, rather than the most elegant solution based on computer science criteria. This of course created a "messiness" in the code, but nevertheless helped to establish a working system in the situation of real clinics.

5.2 Creation of south-south collaboration rather than north-south: learning by doing approach

Technology transfer in North-South networks have been criticized by various researchers, especially for its limits in transcending the design-reality gaps (Heeks 2003). We came from the normative standpoint that creating south-south links could potentially be more effective

than purely north-south links, as it would involve teams of developers working together who came from rather similar backgrounds (of pressures, infrastructures, disease burdens, and familiarity with how a bureaucracy worked). These similarities can potentially help in develop a stronger mutual understand and genuine sharing of knowledge, something often found lacking in traditional north-south outsourcing projects (Nicholson and Sahay 2005). Trying to use Care2X as a starting point for this exercise and its subsequent abandoning is a case in point, as the knowledge required to work with such a system is quite encrypted and tacit because of it being built primarily for the context of hospitals in Europe. Given that this was a OSS project, and not driven by contractual conditions and payments, the team in Ethiopia of course had the agency to abandon Care2X in favor of something else – building from scratch. But would this agency have been available to the local team if the software had been prescribed through donor funding? The answer is most probably not.

As a counter to this north-south effort, the team consciously took on a south-south team structure for various reasons, Firstly, there was a greater symmetry in capacity levels, and an understanding of each others' points of departure. As students, coming from similar backgrounds, experiencing similar everyday problems (such as waiting for a bus which may not come or trying to use an Internet connection which is very slow and subject to repeated power failures), there was greater empathy with each other's problems, and a strong sense of "my opinion is being heard," often not felt in the faceless world of the Internet. Coming from contexts where there was generally a weak Internet culture, and stronger interpersonal social ties, all the team members showed a stronger preference for face to face communication. While the Vietnamese student had the technical competence, he had no understanding of the local context, including how an ART clinic worked in Ethiopia. Besides being a foreigner, he would not have had access to the sensitive records of an ART clinic. The combination of local knowledge through the Ethiopian students and the technical competence of the Vietnamese contributed positively to the evolution of the project. In addition to the informatics competence, knowledge of the medical domain was injected into the team through the participation in the project of one Medical Doctor who was doing his Masters in informatics. He helped the informatics people to understand medical terminology specific to ART, and the working of the clinics, which was crucial for the understanding of requirements.

While often we don't think beyond north-south networks when we consider advanced technology, our case emphasizes how south-south networks can be equally or more effective if properly created and cultivated. The structuring of the network was important at two levels: the national and the local. The national level involved team members from 3 Southern countries (India, Ethiopia and Vietnam) working together, arguably sharing a common understanding of the problem and the way to approach the solution. At the local level, the network benefited from the combination of the informatics-public health background, as they effectively complement each other. The "learning by doing" approach helped to cultivate and grow the system and the network, as it grew from a vision, a form, to a relatively full scaled system for ART management. Sustainability, a key impediment to ICT projects in the South (Heeks 2002), was ensured by the involvement of Ethiopian nations, their taking ownership of the project from inception, and them having the capacity to sustain and grow the system over time.

5.3   Building of social glue

OSS communities in the Western world rely primarily on the Internet as a way to share and learn. In a country like Ethiopia where the Internet connectivity is painstakingly slow, such distributed development would never have been able to take off if solely reliant on the Internet medium. The Internet can be a necessary condition, but is surely not sufficient to

ensure the success of OSS projects, as may be possible in the West.. What makes it sufficient we argue, is the development of a social glue amongst the different developers wherever they are from or where they may be located. This social glue in our case came from the face to face contact, the informal discussions that took place, the ability to go out and have a drink together and more importantly, to be able to share a laugh together both at and after work. This social glue, we argue, helps to break down some of the traditionally existing hierarchies between the teacher and the student in the South, and thus allows for a freer and more horizontal circulation of knowledge.

Collocation, on three different occasions during the course of the development process, helped to foster both the social relationship, but also to provide the occasion for solving technical problems not possible to be dealt with over the Internet. In our case, opportunities for co-location came with the Masters program, and also through meetings in conferences. While opportunities were there, it was us who grabbed it with both hands, as we realized how important the building of social glue was to the overall system. In South Africa, when the audience applauded the ART system presentation by one of the Ethiopian team members, all shared a sense of pride.

6   CONCLUSIONS

In this paper, we have focused on understanding the micro-level dynamics of a software development team working together largely within a south-south framework to develop a rather complex patient specific ART application. The micro-level processes primarily concerned the learning by doing approach adopted for system development. We argue that this approach has helped to address some of the challenges of "design-reality" gaps that north-south models tend to magnify. This approach can be described as being "successful" as it has effectively fought away the American competition, and today the Ethiopian team are executing a MOU to implement the system in 42 facilities in the Addis Ababa Health Bureau.
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SCALING UP LOCAL LEARNING - EXPERIENCES FROM SOUTH-SOUTH-NORTH NETWORKS OF SHARED SOFTWARE DEVELOPMENT

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Abstract:

There is solid empirical and analytical evidence for the importance of localising ICT in the context of use. Through hands-on experiences, the inevitable source of local processes of learning, improvisation and tinkering, an information system is grounded in situated work routines. Building on this position, but ultimately moving beyond it, we discuss the challenge of balancing two competing demands. On the one hand, allowing the required local learning as indicated above, while, on the other hand, accommodating trans-local (or "global") knowledge flows to take place. These trans-local knowledge flows are required since reiterating the full process of local learning at each and every local site is prohibitively resource-consuming; it does not scale.

Scaling of local knowledge is explored using the case of open source software development for health care within the HISP network. From a start developing information systems to support the new decentralised health structures in post-apartheid South Africa, HISP now has more than ten years experience from building South-South-North networks for shared learning in this area. Attempting to do the 'same' in each of numerous sites in a number of countries in Africa and Asia, the network needs to balance contradictory demands for local learning (thus local flexibility) with enjoying economies of scale through harvesting from investments done at other sites.

Keywords: Capacity building, local vs. global, standards, improvisation.

SCALING UP LOCAL LEARNING - EXPERIENCES FROM SOUTH-SOUTH-NORTH NETWORKS OF SHARED SOFTWARE DEVELOPMENT

1. INTRODUCTION

The aim of this article is to explore how information systems development may be incorporated in global collaborative networks that enable sharing of both costs and knowledge, while still remaining sufficiently flexible to be developed further locally. Sharing of resources is one of the great promises of Free and Open Source Software (FOSS) approaches to software development – but it also puts demands on the local capacity in all parts of the network, ranging from software development to adapting the use context – capacity to *both* meet local needs and contribute to global development at the same time. This is a challenging combination, and there is a need to investigate the interconnections in more detail. A particular challenge is to balance the efforts going into developing the global core application (i.e. the global standard) with the efforts going into local customisation and add-ons. The more generic the global solution, the more it can be shared globally and reused, but also, the more resources will be required and the more complex the development – and vice versa. Furthermore, the more shared learning and "best practices" are incorporated in the "business logic" of the core software, the more it becomes a vehicle for shared learning – and, again, vice versa. We address these research aims through examining various processes around the design, development, and implementation of FOSS solutions in such a network.

The Health Information Systems Project (HISP) is an extensive South-South-North (SSN) network with a focus on information systems for public health care. Initiated by universities in Cape Town and Oslo, it is currently present in a number of African countries (South Africa, Tanzania (including Zanzibar), Ethiopia, Malawi, Botswana, Mozambique, Namibia, Zambia, and Nigeria), as well as in India and Vietnam. For analytical purposes, we distinguish between networks within a country (which we call "local" for the purposes of this paper), and across countries (which we call "SSN"). The local networks are comprised of various actors in the health administration (community, sub-district, district, provincial, and national), universities, NGOs, and funding providers. The global SSN network has over the last decade been engaged in developing and supporting two sets of processes. One, supporting local learning and sustainability around the application and use of computer based Health Information Systems (HIS) to address local public health challenges. Two, strengthening the overall SSN network to enable further sharing and learning across the various countries in the network. In this paper, we explain how these processes are mutually reinforcing, and that they cannot operate effectively without one another.

Given these research aims and backdrop, the rest of the paper is organized as follows. The next section discusses relevant literature, and presents key analytical concepts. Section 3 presents the research methods, followed by a description of the case itself in section 4. After presenting the case analysis in section 5, the final section summarises discussions and implications.

2. LITERATURE REVIEW

Sustainability and local improvisation

There are a number of reports on full or partial failure of information systems (IS) in developing countries (Heeks et al 1999). Lack of sustainability, defined as processes that are self-sufficient

(Reynolds and Stinson 1993), is often cited (e.g. Kimaro and Nhampossa 2005). However, the requirements of modern IS often mean that developing countries cannot be expected to be fully self-sufficient in this regard. As suggested by Korpela et al (1998), sustainability would imply that the user organisation is able to manage risks that threaten the long term viability of the IS. In the context of health information systems (HIS), long term viability will require sufficient flexibility for the IS to adapt to and encompass ever-changing needs for information caused by new and emerging health challenges, such as the HIV/AIDS pandemic (WHO 2000).

Inappropriate design as related to the needs and context of use represent a major reason for IS failures in developing countries. Design and development need to be grounded in the context of use, and the capability for local improvisation in IS development play a key role in order to close this "design–reality gap" which needs to be enabled along the following dimensions (Heeks 2002):

•   Technology; the IS applications need to be reality-supporting and enabling with high levels of "plasticity" and "shallow inscriptions" (Akrich 1992)

•   Nature of design; local design improvisation will rely upon modularity and increments

•   Local capacity; local improvisation will have to be carried out by local people understanding context , organisation and work processes, as well as the role of IS.

•   Improvisation-supporting IS development approaches, such as participative approaches.

The HISP project in South Africa is widely regarded as a success, mainly because of local improvisation applied to all the dimensions above; the enabling character of the District Health Information Software (DHIS) application, the incremental and modular design and participatory approaches applied, together with the capacity of the local team covering the range of aspects of both health and software (Braa and Hedberg 2002).The aim of this article is to explore how achievements such as these may be shared across countries and developed further locally in collaborative networks.

Standardisation – negotiating the local-global dichotomy

The difficult issue (analytic as well as practical) is where to draw the line between how much to keep constant (standard) across the different sites and what to open to localization. Dominant approaches to standardisation portray it as a top-down imposed 'iron grid' which subjects merely have to comply with (Schmidt and Werle 1998). Recent work on generic software packages have examined how to bridge the heterogeneity between different organizations and cultures, concluding that they are "brought into being through an intricately managed process, involving the broader extension of a particularized software application and, at the same time, the management of the user community attached to that solution" (Pollock et. al. 2007). We wish here to focus on the perspective of the developers and implementers. FOSS methodologies have a potential to empower local implementors to customize applications for "the very particular needs that often arise in different settings, and allows, through use, the natural evolution of information technologies and systems within unique and specific contexts" (Weber 2003).

The District Health Information System (DHIS) application software lies at the core of the HISP project. We explore the negotiations around striking a balance between the need for standards to adapt DHIS to various local contexts, while simultaneously coping with complexity by leaning towards universal solutions. Globally flexible solutions are often costly and intricate both to program and to configure as compared to "hard-coding" of bespoke

solutions closely tied to the present local situations. Local capacity, ranging from software to the context of use, needs to be developed through practical implementation efforts in each country. Sharing software raises the issue of balancing the set of standards being imposed through the software with the need for local flexibility and room for improvisation. Unless the common core is significant, the software becomes prone to fragmentation into mutually incompatible versions (a phenomenon known as "forking" in the context of FOSS), and ceases to be an effective *boundary object* allowing distributed communities of practitioners to collaborate and learn across contexts and borders (Pawlowski et al 2000). The case study explores how distributed and "shared" development of the software between different countries and contexts of use may help identifying areas of the software application that need to be open and flexible and what areas can be "fixed".

The way universal solutions, predominantly from the developed countries, need, but notoriously fail, to be negotiated against the needs of developing countries illustrates the problem (Braa, Monteiro and Reinert 1995; Ryckeghem 1996; Sahay 1998; Sahay and Walsham 1997). In essence, this amounts to exploring the tensions arising from two different strands of reasoning. The former, closely aligned with readily recognizable concerns for curbing complexity, reducing risk, and maintaining control, is the argument that the only viable way to establish a global information infrastructure is to adhere to uniform, standardized solutions (Weill and Broadbent, 1998). The latter, by now well iterated and largely internalized, argues for the necessity of adapting information systems to local, situated and contextual work settings (Ciborra 1994; Kyng and Mathiassen 1997; Suchman 1987).

In particular, scholars have pointed out how this needs to be conceptualized as negotiation processes involving elements of 'work arounds' (Gasser 1986), 'drift' (Ciborra 1996a), 'improvisation' (Orlikowski 1996), and 'situated actions' (Suchman 1987). Collectively, such surprising outcomes of technologies-in-use are often lumped together under the heading of 'unintended consequences' (Barley 1986, Robey and Boudreau 1999). The extent of improvisation, drift or unintended outcomes is of course strongly linked to the notion of intended action in the first place: if all deviation from the intended trajectory is 'drift', this will necessary be a significant category.

3. METHODOLOGY

This article draws on experiences from a continuous software development process in the HISP network over the last decade (Braa and Hedberg 2002, Braa et al. 2004). The authors of this paper have been engaged in different ways in various processes around in software design, implementation, political brokering, and obtaining funding, in both the SSN and the different local efforts.

The HISP initiative draws upon the so called Scandinavian action research tradition in IS development where user participation, evolutionary approaches, and prototyping are emphasized (Greenbaum and Kyng 1991, Baskerville 1999). This methodology has been further developed as part of HISP into a "networks of action" approach, emphasizing the need to go beyond learning in singular locations to the sharing of experiences and knowledge between various nodes in a network (Braa et al. 2004).

While one of the authors has been actively involved to different degrees in the process right from the start in 1994, the others have been active participants in subsequent phases, including the customization and adaptation of the DHIS software in various countries. Two of the authors are currently coordinating the global development of DHIS version 2. In addition, we build on results obtained by Masters and Doctoral students who have contributed to specific project activities such as software customization or capacity development in an action research mode

(e.g. Lewis 2005, Nordal 2006, Øverland 2006).

4. CASE STUDY

Centralized development and local improvisations of DHIS version 1

The first releases of the DHIS (referred to collectively as "version 1") were developed through numerous prototyping cycles over a decade, with extensive initial trials in pilot health districts. It was subsequently scaled up to two provinces, and then to the whole of South Africa. A major reason for its portability and eventual success came down to the system's flexibility with regard to the definition of what data items to collect, as well as a transparent and open database management system which meant that local managers and implementers could easily adapt it to the needs of any particular province *without* the need for programmers to be involved (Braa and Hedberg 2002). The ease of creating locally defined data sets combined with an emphasis on minimal national datasets to be reported upwards in the health system hierarchy. Another success factor was the strong involvement of public health professionals both in the design and use aspects. The technical team was composed of a main programmer actively engaged in the health domain together with a small private company, all working closely with public health specialists.

From 2000 onward, version 1 was adapted and applied in a number of countries in Africa and Asia. While data structures could be adapted to the context of other countries using the flexible GUI, language and special reporting requirements could not. For the first prototype in Mozambique the Portuguese translation was hard coded in the user interface. This did not work well, since it represented a "fork" of the DHIS, and the frequent new releases from South Africa could not be used in Mozambique. This sparked the development of an independent language module, where strings of text could be translated to – in principle - any language. This was the first example where specifications developed in other countries was fed back to South Africa, and contributed to south-south collaboration.

The Mozambique activities were tightly coupled with the development group in South Africa. In contrast, the team in Ethiopia worked relatively independently with one specific DHIS release, and developed a module based on local requirements for handling data based on ICDs (International Classification of Diseases), by adding both tables code to the DHIS core. This approach was effective locally, but again created a "fork". The code was not integrated with the core distribution from South Africa, and Ethiopia was stuck with one specific DHIS release, not able to enjoy the improved features of subsequent releases.

The use of Microsoft Office, (specifically MS Access) as the platform for development meant that the database structure was transparently available, and extensions could readily be made. The Indian team took advantage of this fact to employ local capacity to develop a range of add-on functionalities related to reporting, presentation, and use of the data collected in the system (Nhampossa and Sahay 2005). A GIS extension was also developed, and later translated into Portuguese and adapted for the Mozambique context in collaboration with local developers there (Lewis 2005). This was the first example of south-south collaboration without the involvement of the core development node (South Africa).

Global software development and local adaptation of DHIS version 2

In October 2003, a report distributed by the Ministry of Health in Mozambique critiqued version 1 as follows: "DHIS technology is outdated by a decade". It was recommend it to migrate to SQL server, tiers should be split, and it should be web-enabled. The content of the critique was in many ways already acknowledged by the HISP group, but the report provided

the impetus to initiate development of a Version 2 on a completely new platform. As the South African team was still hard at work with a final release on the previous platform, the development of version 2 became the responsibility of the Department of Informatics, University of Oslo. As no funding was available to hire professional developers, this was undertaken mainly as a research project involving PhD and master students, most of whom were relatively inexperienced with large scale software development. Also, no public health experts or local end users were involved.

The final major overhaul of version 1, which was still under development, was used as the functional design for version 2. A full stack of open source Java frameworks was eventually selected as the development platform, providing both flexibility and "industrial strength" capabilities and scalability. However, the combination of several such advanced frameworks proved complicated to master, and limitations in accessing the Internet in partner countries presented an additional deterrent to learning, as most of the documentation was available in dynamic forms online, as is typical of evolving FOSS frameworks.

Version 2 development was conceptualized under a model in which core development (of the database for example) would take place in Oslo along with a small number of Southern partners. In Vietnam, agreements on collaboration was signed between Oslo and a technical university, a software company, and the health authorities in two provinces in the South. However, results were not as expected, since the health services had no experience of applying IT in health, and the HISP technical team (IT students from Norway and Vietnam) knew nothing about health.

It was the development in India from late 2005 that led to the finalisation of a workable prototype of version 2. The Kerala government's informal (but often strongly articulated) policy to support FOSS served as a catalyst for the development processes. Establishing a stable local team proved challenging, given the great demand from the private sector for skilled Java developers. Through "learning by doing", the Indian developers learnt to deal with many local problems, requesting assistance from the SSN through the internet when stuck. Help was usually readily forthcoming (primarily from Oslo, but increasingly also from Vietnam). This ongoing development of capacity in the team has contributed to the scaling of version 2 to two more states.

Similarly, in Vietnam, the breakthrough came in June 2006, when version 2 was finally implemented in several locations in Ho Chi Minh City (HCMC). Rolling out the software on a large scale raised the need for both a customised reporting solution, a multi-language module with support for Vietnamese translations, as well as technical support to the health offices. These demands created the conditions for closer interaction between the local technical team and health staff, and with it the potential for mutual learning and increased technical capacity.

Flexibility and local improvisation

The flexibility of the new global platform (where the core has been mainly produced in Oslo) is pronounced on several levels, and goes well beyond the ability for users to create new data collection items without the intervention of a programmer. The very modular web interface framework employed by the project allows for easy incorporation of various modules. For example, both the Indian and Vietnam teams have created reporting modules able to replicate the sometimes fiendishly complex paper reporting formats. These modules integrate nicely with the web interface and show up as new menu items. The modular web portal allows the local teams to assemble selected modules into a running application. For example, to promote management control over the user management and the health hierarchy, the Indian team selected to build a slimmed down version for data entry clerks, which removed certain modules.

In the case of Ethiopia, there was a strong requirement to collect more fine grained information about each disease. Although not going all the way to a full patient data system, the health authorities wanted to add International Classification of Diseases (ICD) codes, and to break down the statistics collected by sex and age groups. Again, the modularity of the system allowed for increased detail at the data entry level in a separate input module, which could easily run alongside the global system, though the data were partially stored separately.

Yet another example of local variations in application of the general software stems from India, where the use of 16 official languages and almost as many different alphabets mean a strong emphasis on multi-language support. In general, Java is strong in this field, and this is also true for the Indic scripts. Thus internationalization of the user interface became. However, data clerks in clinics will often prefer all text to be entered and displayed in the local language, whereas managers at various levels often prefer to operate in English. Also, data will have to be reported in English to the federal level. This means that not only the user interface, but also all the names of districts and diseases, which constitute the data in the system, need to be available in multiple languages. Also, when expanding to several new states, the project soon faced the fact that IT and public health experts from one state often meet a language barrier when working in another state. Setting up the database and working with minimal datasets soon becomes unwieldy when working with foreign languages. Lacking a full blown internationalization of all aspects of the database, the Indian team made use of "shortnames" for English equivalents of the local Hindi or Gujarati script versions of diseases and clinics to enable the use of two languages in parallel. While the eventually successful generic solution providing full support for all elements in the database was being worked on in Vietnam and Oslo dragged on because of the intricacies involved, the local team found workable local solutions which fulfilled the needs of the users and decisionmakers.

The hundred flowers of reporting

The process of developing a reporting solution for DHIS 2 illustrates some of the local-global tensions in the SSN, and also consequences of design-reality gaps (Heeks et al 1999). Routine and ad-hoc reporting is one of the most context-specific parts of the software, with a wide range of local requirements within the SSN.

In January 2006, a technical team from Norway and Vietnam worked in HCMC on developing a global report solution that would serve both the apparently quite simple report demands of HCMC and the more general requirements of the global SSN. At the same time, there was immense pressure on the HISP India team to roll out DHIS 2 in Kerala state, and the most crucial missing part was the report module. The requirements from Kerala were too complex for the Norwegian/Vietnamese team to incorporate it into the global solution, and the Indian team lacked the necessary "DHIS 2 skills" to develop a generic and integrated solution. The combination of these constraints forced the India team to develop a local "quick fix", which in many ways was inconsistent with the core architecture and technology choices of DHIS 2. Even though the solution solved a critical problem in Kerala, the Norwegian core developers objected strongly to seeing that their global "best practices" standards for software development had been thoroughly disregarded. At a time when the core developers, lacking understanding of the use context, struggled to develop a generic solution for reports that could be shared across countries, the Indians developed a less general tool that lacked the necessary flexibility to be shared globally in the SSN.

The local solution to the Vietnamese reporting needs were somewhat hampered by the emphasis on also meeting the more complex and generalized global requirements defined by the coordinators in Norway. While the Vietnamese requirements at first seemed quite simple, the implementation process and the subsequent interaction with end users sparked a series of

new requirements and improvements to this module, a "discovery" of requirements quite similar to the complex ones initially elicited in Kerala. Given the increased technical skills of the developers in Vietnam, and more importantly their much improved knowledge gained through extensive user interaction, the local developers were able to handle these additional requirments. However, the coordinators and developers in Norway were frustrated to see that these improvements, of which many could benefit the whole SSN, were placed in a separate local Vietnamese module as a fork to the global solution. After strong pressure from Norway, these local improvements were finally incorporated as part of a global report module.

Based on the continuous Vietnamese improvements to the global report module, the Indian team has also started to use some of the functionality, such as flexible and rapid viewing of simple reports, a feature the more static "quick fix" did not support. This then lead to an unfortunate complex situation for the users, where two different report modules were in use at the same time. However, as the Vietnamese module becomes "globalised", the "quick fix", can be phased out and fully replaced – a year after being absolutely crucial to getting the system up and running in Kerala and the rest of India. This rather chaotic repository of report solutions also caused a lot of confusion and delay in making reports in Ethiopia, which, though an early pioneer in the use of Version 1, was less well integrated in the SSN when it came to developing Version 2, with the result being yet more local fixes to be able to meet the tough deadlines of the local health authorities.

5. ANALYSIS

In the initial development phases in South Africa, local learning came about through a merger between the technology and health knowledge domains. High levels of participation, involvement of public health specialists, and technology applied by people experiencing real problems served as important mechanisms to aid the learning process and avoid large design-reality gaps.

The role of the SSN was initially to create institutional structures of collaboration, which provided the framework for the merger of knowledge. As the system was ported to other settings, experiences from Mozambique, India and Ethiopia gave practical evidence of the limits of the existing architecture, and raised the need to de-concentrate the development from South Africa. However, the health-technology gaps in the other HISP countries remained an issue of concern.

The start of version 2 entailed a conscious effort to create learning within the SSN. Impediments to this learning process came from the high threshold level of knowledge required to master the full stack of Java frameworks, the lack of public health knowledge, and the geographical and cultural distance between Oslo and user sites. However, as we have seen from the development of a report solution in Vietnam, an incremental and participatory implementation process sparked local learning and a bridging of the initially wide design-reality gap. In the HISP India team, with many years of experience implementing DHIS version 1, the initial lack of technical skills to support the new platform and take part the global software development has been reduced as a result of the practical implementation process. This ongoing development of capacity in the team has contributed to the scaling of version 2 to two more states. Increased field level implementation creates a demand-push dynamic, helping to attract monetary resources, which can help to hire more skilled developers and also public health specialists.

Arguably, the most effective learning mechanism was through practical implementation of the DHIS application in the context of the health services, and processes to fit the technology to local needs. The participatory implementation process can be understood as a mutual learning

process bridging the design-reality gap (Heeks et al 1999). In South Africa, the basic functionalities of DHIS were developed over time in close collaboration with users. Similarly, the DHIS 2 development demonstrates that practical implementation involves social dynamics of reciprocal commitments and "push and demand". Only when the developers in Vietnam were "pushed" out in the field to implement the DHIS 2 did their contribution to the global software development take off - due to the increasing need for reciprocal commitments. Similarly, in India, the commitment to implement in Kerala sparked the finalization of the first DHIS 2 release, which helped create capacity in the HISP team to approach other states. This shows that learning cannot take place through simple diffusion, but requires a process of translation where the final essential piece of knowledge must be developed – innovated – close to the context of use.

Balancing the support of the global and the local

The DHIS addresses the critical need for computerised health information systems to be flexible in order to adapt to and encompass the ever changing needs for information. The core idea of the DHIS architecture is to provide this flexibility to the various local contexts in the SSN in a standardised way through a complex meta-design. Core elements of a HIS such as data collection sets and organisational structures can be set up generically in each context, and basic functionality to capture and analyse data is provided through standardised tools. The more advanced peripheral functionality such as tailored reporting, custom data capturing, and special analysis tools are kept as external modules that can be loosely-coupled to the standardised core to provide the user with an integrated user interface.

As we have seen from the case of developing a generic report solution, it is difficult to draw a line on where to standardise and where to allow for local improvisation. While this distinction might seem relatively clear from an architectural viewpoint, this case was influenced by many other factors such as lack of human resources with the right skills and extreme time-pressure in Kerala. While in Vietnam and India the need to meet local user requirements had top priority, the coordinators in Norway needed to balance the importance of local problem-solving and improvisation such as the "quick fix" in Kerala, with the more long term goal to build a SSN where software and best practices regarding implementation and use are shared among the nodes. Though the resource-constrained SSN would benefit from such a sharing of software and expertise on one standardised and generic reporting solution, this has proven very difficult to develop. Currently there are four different report solutions in use around the SSN, of which some are not even possible to share across countries. Table 1 serves to summarize the tensions inherent in the local-global dimension.

Modes of software development in the SSN:	Benefits	Challenges
Local improvisation	• System tailored to local context • Local flexibility enables learning • Rapid response to local demands	• Harder to integrate with the global modules especially in future releases • Often more static as it is targeted as solving one specific problem (that might change over time) • Limited support from the network
Global standardisation	• Generic solutions more adaptable to change • Easy integration also for future releases • Global support and documentation available • Likely to be maintained and improved	• Solving many problems in one solution is often complex and resource-demanding • Standard solutions to context-specific requirements are often difficult to maintain over time as the requirements keep changing and become even more diverse

Table 1. Benefits/Challenges with the local and global software development in the SSN.

6. CONCLUSION

Developing information systems for public organisations in developing countries is in many ways a thankless task – a bewilderingly complex tangle of local and national requirements combined with often dismal infrastructure, stifling bureaucratic inertia, limited local IS capacity, and severely scarce resources. One approach to these challenges is to collaborate on sharing development resources and experiences in mutually supportive "networks of action". HISP is an attempt at doing exactly this, in a way that involves countries both in the North and the South, in order to ensure broad contributions on both technology and actual implementation issues, aiming to make the contexts of use and development inextricably interlinked. However, such an effort will not succeed unless there is significant overlap between the solutions deployed in the various nodes in the network, i.e. a global standard. The extreme complexity and cost of supporting a large variety of local solutions would soon deprive the network of a sufficiently significant boundary object around which to collaborate and the various solutions would drift apart. On the other hand, for the global solution to be used locally, it must be fairly generic and flexible *in certain aspects* which are crucial in local contexts. The process of discovering what these aspects are unavoidable entails trying to come closer to the South and develop the application in close contact with the context of actual use.

Implementing more and more generic and flexible solutions in the global software will however require considerable resources and take time, that might be might be better used on local add-on solutions. In order not to lose momentum locally, or globally, it is important to continuously negotiate an "appropriate" balance between the local and global efforts. If momentum is lost locally, one risks that local learning processes come to an halt, and eventually that less local learning is shared in the global network and incorporated in the software. On the contrary, if one loses momentum in the global network, one risks that the global efforts are disintegrating into independent local projects with limited shared learning.

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TOWARD A MOBILE-GOVERNMENT MANIFESTO FOR DEVELOPING COUNTRIES: ISSUES AND RECOMMENDATIONS FOR FUTURE RESEARCH DIRECTIONS

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Abstract
Countries are rushing on to the e-government (e-gov) bandwagon as a means to improve government and governance, enhance citizen participation in governance, and improve public service delivery. Due to factors like low computer and information literacy levels, poor IT infrastructure, etc., mobile government (m-gov) has come to be viewed as the "way to go" for developing countries in implementing e-government. But these countries, in establishing m-gov initiatives, have to be clear as to what m-gov is. They have to be clear as to what qualifies an e-gov initiative as m-gov. They also have to be aware of and address a number of current issues in m-gov, while paying attention to future trends in m-gov. Based on the premise that m-government extends beyond just accessing government services through the use of mobile phones or PDAs, we are particularly interested in the end-users, or consumers, of m-government. In this paper, we make a start toward proposing a manifesto on m-gov. The literature is reviewed for the issues. We then outline a number of recommendations for future research directions in m-gov.

Keywords: Mobile Government, Manifesto, E-Government, Developing Countries

TOWARD A MOBILE-GOVERNMENT MANIFESTO FOR DEVELOPING COUNTRIES: ISSUES AND RECOMMENDATIONS FOR FUTURE RESEARCH DIRECTIONS

1.0 INTRODUCTION

Globally, mobile phone users are expected to surpass the one billion mark by 2005 (Repacholi, 2001). For example, Africa's use of mobile phones is said to be growing much faster than anywhere else in the world (FIN, 2005). The rate of growth of mobile phone use now exceeds that of fixed-line (CPSI, 2003). Consequently, the efficacy of using the Internet to close the digital divide in Africa and other developing countries has come under scrutiny. Growing concerns about the access inequality to e-government has led to consideration of mobile technology as an alternative service distribution channel. Most developing countries have low per capita telephone lines, and low Internet penetration vis-à-vis the rest of the world (see Figure 1) has fueled the need to leapfrog e-government through mobile technologies in these countries.
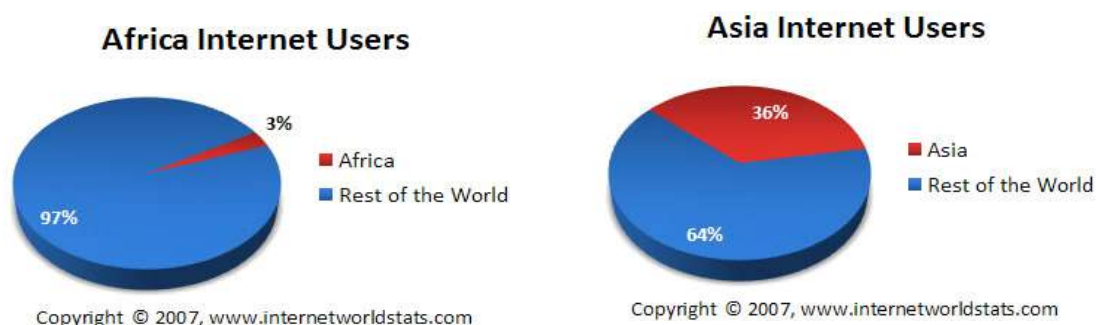
Figure 1: Internet Penetration for Africa and Asia

Difficult questions are, however, now being asked about the impact of e-government on public service delivery. Although countries have spent billions on e-government over the past decade, little organizational change has resulted. Millions of less privileged individuals without access to the Internet still have no realistic chance of accessing government services. M-government is now looked upon as a viable alternative solution. This trend and hope is driven as much by advances in mobile technology and mounting expectation on the part of citizen for better service provision by government. Kushchu and Kuscu, (2003) therefore argue that m-government is inevitable. As developing countries grapple with how to make e-government citizen-centric and widely available to all categories of citizens, m-government is emerging as the next logical extension of, or complement to, on-going e-government efforts.

For example, the Provincial Government of the Western Cape (PGWC) of South Africa has launched its "Cape Gateway Project" (CGP), which has as its primary aim the shift of government service delivery from traditional face-to-face towards more on-line provisioning of and access to provincial government information. And due to the problems such as government's growing concerns about the access inequality to e-government, low per capita telephone lines, and weak Internet penetration, the CGP relies on the extensive use of handheld digital devices like mobile phones by citizens to access electronic services offered by the PGWC.

From our experience and involvement with the Cape Gateway Project (CGP)[1] of the

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[1] Cape Gateway Policy, www.capegateway.gov.za/eng/copyright

Provincial Government of the Western Cape (PGWC)[2] of South Africa, our understanding of the e-government efforts in some other African countries, e.g., the Nigerian e-Government Strategy (NeGSt) project (Nigeria, 2004 and Nigeria, 2005), and an examination of some e-government initiatives in Asian countries, we obtained a glean of the typical issues and challenges confronting mobile government efforts in developing countries. Armed with this information, we performed a trawl of the literature on e-government for existing works that are pertinent to the efforts in developing countries. Based on our discovery and our experience with the CGP, we have pieced together a manifesto on m-government initiatives.

In view of the foregoing discussion on developing countries and e-government, the manifesto should be particularly valuable to m-government initiatives in these countries. Although the paper deals with developing countries in general, we are specifically more concerned with Africa, because, as can be seen from Figure 1 and later in the paper, Africa lags far behind other regions and is in a more dire situation with respect to access to information and communication technology (ICT). The manifesto is reported in this paper. The paper starts with a clarification of what m-government is and how it relates to e-government.

2.0 ARGUING FOR M-GOVERNMENT IN DEVELOPING COUNTRIES

So much has been said about what constitutes e-government and what the potential benefits are that it seems redundant to redefine and re-examine these fundamental concepts. Yet a brief glance at existing definitions indicates deep conceptual differences in the understanding of e-government. Since a shared understanding of these concepts is key to developing a shared vision of the appropriateness of various e-government initiatives in different contexts, we contribute to the existing discourse by presenting a view of e-government that is pertinent and slanted to developing countries.

We have found it useful to adopt a broad definition that recognises the potential of all ICTs as tools to improve government's citizen-facing and internal services and processes. Such a broad definition stands in contrast to the preponderance of definitions that tend to view e-government as the use of the Internet to transform and improve government. Our definition focuses attention not only on what e-government is, but also on what it is for. Consequently, we have defined e-Government as the use of any information and communications technology (ICT) tools to improve government's citizen-facing and internal services and processes.

Pressure on countries to prioritize e-government and speed up its implementation comes from a number of sources. Some of these include the need to apply various e-government models and conduct benchmark assessments (Anttiroiko, 2005). These various models and benchmarks often in the guise of e-readiness assessments (see Im and Seo, 2005, p. 190), may be aimed at helping countries identify the e-government path that they would like to follow and provide experience and advice from "best practice" scenarios. Unfortunately, the ways in which the models are phrased and applied often turns e-government into a race along a single path. Most of the models available (for example, Panagopoulos (2004), Layne and Lee (2001), Sood (reported in Stowers, 2004), Lam (2005)) appear to suggest that a systematic progression through various identified stages is "the most effective method for avoiding errors and preparing affected stakeholders … for change" (Stoltzfus, 2004).

Although the proliferation of different models suggests the lack of a universally accepted framework for e-government development, there are certain similarities between models. This

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[2] Initial research to inform the design and development of e-government services. E-Government Services Research Project Report PMO1035, Provincial Government of the Western Cape, South Africa, August 2003.

indicates that e-government development is predominantly seen as a linear process, starting with the electronic provision of rudimentary information and ending with a functionally rich system for government transformation.

A common thread across the various stages of e-government service delivery in the literature is the inherent assumption that an initial presence is followed automatically by subsequent stages characterised by increasing online service provision. Although most of the models closely match e-government growth phases in developed countries, their relevance to e-government trajectory for developing countries remains to be empirically verified.

A further commonality between the models is the tendency to focus on client-facing e-government programmes and emphasise internet-based initiatives. The models thus tend to neglect the many back-end improvements that could vastly improve government service delivery and reduce costs and also disregard other ICTs that could be used to improve government services, for example mobile technologies. Both these factors are of particular importance to developing countries. Back-end improvements can bring significant improvements to government in areas where Internet uptake is too low to justify client-facing e-government initiatives. On the other hand, alternative technologies offer means by which e-government programmes can be made broadly accessible without relying on increased Internet access. In a developing country context, where relatively few people have access to the Internet, an e-government portal could easily become a white elephant that is used and appreciated by the elite few, but does little to forward a developmental e-government agenda. Such a portal can be a 'success' from the point of view of government officials and politicians (who are then able to feel that they are 'keeping up' with developed countries), while making little difference to the lives of ordinary citizens.

The rising expectations of citizens, businesses and public administrators for better government service delivery has led to a serious policy debate on alternative delivery channels to meet the rapidly changing needs of the population. Although the Internet has been the main channel for traditional e-government service delivery, access cost considerations, low e-literacy rates, and poor infrastructure to support the e-government architecture, especially in remote locations, has fuelled the debate supporting the need for developing countries to seriously explore alternative methods of service delivery. Some of the leading contenders behind the alternative government service delivery revolution are mobile and wireless based technologies (collectively referred to as m-government)

M-Government, according to Rao, et al. (2006) is a "multi-faceted approach for efficient utilization of all wireless devices (mobile phones, handhelds, personal digital assistants, wearable PCs) with maximal added value to all involved parties - government on one side and citizens and business on the other hand, justifying extra spending on new technologies and mobilized processes." It is emerging as the next generation of e-government evolution. And as noted by the e-Gov team (2006), many countries are beginning to develop systems that will enable their citizens to benefit from public services via mobile phones. Application examples cited include security alerts, reminders to renew licenses, delivery of the results of medical examinations, emergency announcements, SMS text message confirmation of tax returns accuracy; and purchase of event tickets via mobile phones.

Table 1 shows access to ICT in the developing block of countries vis-à-vis the developed block of countries. The penetration rates for mobile technologies (i.e., a key medium for m-government) in selected African countries are shown in Table 2. It is seen that the mobile phone penetration rate far exceeds that of fixed lines and Internet usage for developing countries. (The difference is especially pronounced in the case of Africa, as Table 2

indicates.) A major reason for this is that the cost of adopting a cell-phone is relatively much lower than that for computers in the developing countries. The majority of poor people who, for this reason, lack ready access to the Internet have a greater chance of owning or at least of having access to a family member with a mobile phone. The pattern is similar even for China, with its booming economy and massive human population (BMBS, 2005, CNNIC, 2005 and MII, 2005 (cited in Song, 2005)).

	Telephone lines and cellular subscribers per 100 population		Personal computers in use per 100 population		Internet users per 100 population	
	1990	*2004*	*1990*	*2004*	*1990*	*2004*
World	**10.1**	**46.42**	**2.5**	**12.96**	**0.3**	**13.65**
Developed	**45.4**	**130.06**	**11.1**	**55.9**	**0.3**	**51.42**
CIS	12.5	57.05	0.3	9.63	0.0	8.85
Developing	**2.3**	**31.66**	**0.3**	**4.85**	**0.0**	**6.96**
Northern Africa	2.9	27.58	0.1	2.58	0.0	6.28
SSA	**1.0**	**8.19**	**0.3**	**1.55**	**0.0**	**1.83**
LAC	6.4	50.03	0.6	8.97	0.0	11.87
Eastern Asia	2.4	54.13	0.3	6.94	0.0	10.26
South Asia	0.7	8.42	0.0	1.7	0.0	3.39
SEA	1.4	27.44	0.3	3.5	0.0	7.39
Western Asia	10.0	52.48	1.2	10.83	0.0	10.46
Oceania	3.4	10.09	0.0	6.51	0.0	4.69

Note: SSA=Sub-Saharan Africa; LAC=Latin America and the Caribbean; SEA=South-eastern Asia
Source: ITU

Table 1: Access to ICT in Select Regions

Country	PC density per 100 people	Fixed lines per 100 people	% population with Internet access	Mobile phones per 100 people	Mobile users as % of total telephone users
South Africa	9.97	9.97	10.75	71.6	87.8
Nigeria	0.93	0.93	3.80	14.13	93.8
Tanzania	0.39	0.39	0.89	5.16	92.9

Table 2: Phones, PCs, and Internet access in selected countries[3]

Kushchu and Kuscu, (2003) reports that even in the developed countries of Europe, the penetration of mobile phones is well above that of home PCs. The pattern, therefore, does not seem unique to developing countries. However, what differentiates the two blocks of countries (in this context) is that developed countries are not characterised by extremely low, and in some cases near-absent, Internet and PC penetration. We, therefore, find the option of m-government useful for developing countries where Internet penetration is low but other ICTs are relatively prevalent. In these countries, use of the alternative channels offered by mobile technologies may be a more appropriate and effective implementation of e-government. For example, Song (2005) and Song and Cornford (2005) report that, as a result of the relatively higher penetration of mobile phones in Beijing, many government departments attempt to leverage this to deliver better services of varying kinds. A similar argument is proffered in Anttiroiko (2005), Goldstuck (2004) (cited in Anttiroiko, 2005) and Lallana (2004) (cited in Anttiroiko, 2005) for developing countries where Internet access rates are low but mobile phone penetration is high or growing rapidly.

However, Governments contemplating m-government cannot rush to adopt the innovation without a thorough understanding of what it means. Based on the premise that m-government extends beyond just accessing government services through the use of mobile phones or

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[3] International Telecommunication Union, March 2002. See http://www.itu.int/ITU-D/ict/statistics/index.html (accessed 11/14/06).

PDAs, an important issue that should be of particular interest to policy makers are the end-users, or consumers, of e-services and the level or degree of cognitive demand the delivery system imposes on them. We take 'cognitive demand' here to mean what the user is expected to know and do in order to use the system to fulfil a task. This suggests the need for: (1) a thorough understanding of the various types of e-government services that can be offered through mobile technologies; (2) understanding the different categories of consumers in terms of their ability to use different digital devices to express service requests and; (3) understanding users cognitive capabilities, in order to have an effective m-governmnet policy. Hitherto, not much research attention has been paid to these aspects of m-government in Africa, although leading studies in the field have identified them as among the ultimate goals of government service delivery through digital technologies (Brussels 2005 and Irani 2006). This is understandable, given that m-government is a newly emerging aspect of e-government. However, this is now changing, as the pervasive use of mobile technologies forces researchers to start focusing on the application of mobile systems to government and governance. Our manifesto on m-government attempts to shed some light on a number of essential issues in m-government deployment. Given this focus on the end-users of electronic services and the level of cognitive demand the system imposes on them, we next present a phase model (also referred to as a staged model) of m-government development, which emphasises the degree of cognitive burden on users.

2.1. Functional Phase Model of M-Government

In modelling the development or maturity stages of m-government, we follow the aproach adopted by Antttiroiko (2005) to model the development stages of u-government (ubiquitous government). Arguing that u-government is a subset extension of generic e-government, the author then complements the stage model of e-government development with additional elements and aspects that express the attributes of ubiquity. In a similar fashion, we see m-government as a subset that extends traditional e-government with mobile computing features. Consequently, four actual evolutionary stages can be broadly identified in our categorization. (See Figure 2). These four stages are preceded by a pre-entry phase (stage 0 in Figure 2) that accounts for the presence and penetration of mobile technology-based communication devices.

Stage 0 (Pre-Entry) is characterised by the following:
- The availability of handheld digital communication devices, primarily mobile phones, and their underlying supporting infracture.
- The presence of a critical population mass that owns and uses handheld digital communication devices for basic personal or business communication.

In stage 1, the informational phase, government information is simply posted on the Internet for consumption by users. Research and usage problems at this level are mainly those dealing with information-seeking (Chen, 2002). In the sense of interactivity, this is the most rudimentary stage, with no support for two-way communication between users and service providers. The richness of posted information also tends to be fairly low. These two factors tend to combine to render the cognitive burden on the user to be basic.

The next stage, the communication phase, provide support for two-way communication and hence for increased levels of interactivity. Users are enabled to communicate their needs and other messages to the government through Web forms, emails, and other Internet means (Chen, 2002). Additionally, the functionality includes basic search, downloads, and linkages with other sites (Baum and Di Maio, 2000)

Stage 3, the transactional phase, supports transaction services. More complex types of interaction can be performed by users, and the content is typically more rich. Typical transactions at this level include self-service functions like tax-filing, local government service requests, license application and payments, etc., (Chen, 2002). Inter-governmental agency services are also conducted (Baum and Di Maio, 2000). The more complex nature of the transactions conducted clearly contribute to increasing the cognitive demand imposed on users at this stage.

Stage 4, transformational phase, is arguably the ultimate aim of e-government initiatives. Support is provide for very high interactivity and content richness. It here that true transformation of services and practices and of governance and the government function can take place. Government-to-citizen interactions, such as e-voting, e-participation, e-politics, etc., are enabled at this stage. As a result, true transformation of the democratic process through digital means can take place here. The ideal of a transparent or seamless single-point of contact for government services and function, with its support for one-stop shopping, can also be realized at this level. Extensive support for law enforcement and litigation in the form of newer and complex databases and powerful data mining operations can be provided at this level (Hauch et al., 2002). In the arena of intra- and inter-agency cooperation for crime-fighting, homeland security, terrorism, etc., this level should also be able to support complex pattern recognition and trend analysis functions. The richest contents and the most extensive interactivity occur here. Consequently, the burden on users, from the cognitive point of view, can be expected to be the most intense at this stage.

The segment of our "Reverse Cascade Functional Model" containing stage 1 to stage 4 is consistent with the evolutionary model in Alexander et al. (2006), the "information-communication-transaction-transformation continuum" of Chen (2002) and the four phases model of Baum and Di Maio (2000). The classifications in the existing works cited in Alexander et al. (2006) can also be fitted to our staged model.
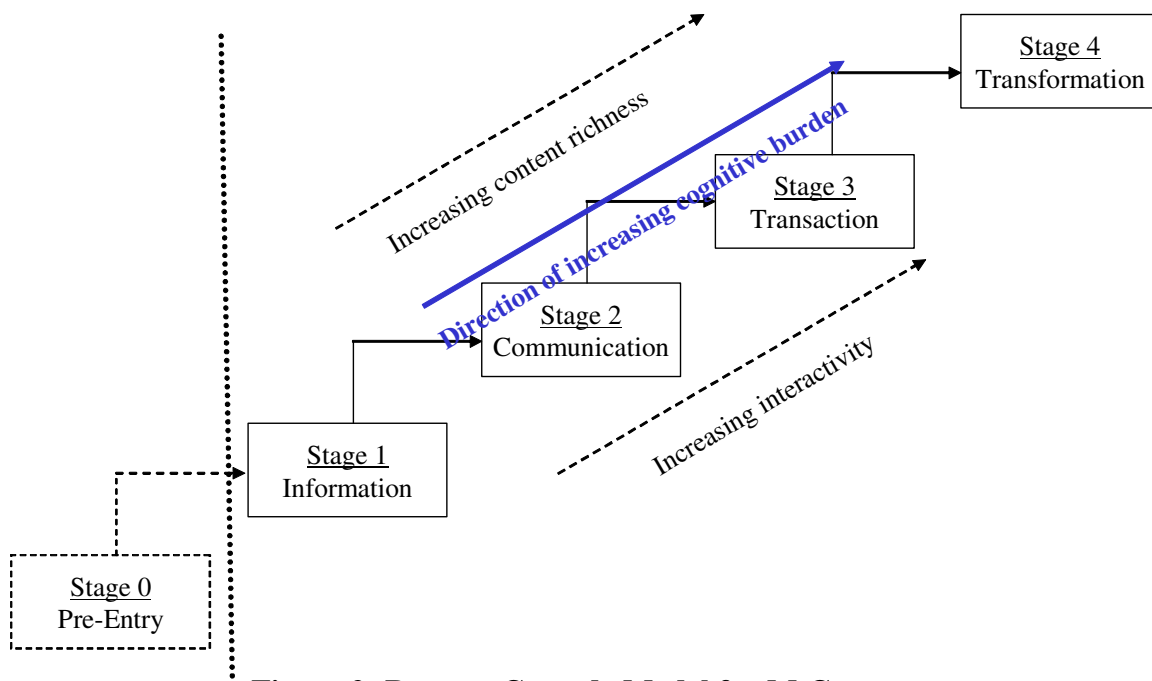

Figure 2: Reverse Cascade Model for M-Government

E-service delivery initiatives within and between countries can be grouped or classified into the stages of the model, according to to the maturity of the initiative, i.e., according to the

type of services being provided. The model can also be used to delineate how e-service delivery initiatives should progress. Knowledge of the profiles of consumers helps e-service and m-Gov providers develop request specification interfaces that assist consumers in specifying their requests as well as employ distribution, access and awareness generation approaches that are aligned with their profiles. In addition, specific training and skills development initiative can be embarked upon by policy makers to assist in effective deployment and use of m-government. These and other essential issues are now highlighted further in our manifesto on m-government.

3.0 AN M-GOVERNMENT MANIFESTO (M-GM)

From the synthesis of issues in m-gov, we propose answers to the question: What does it mean to say a system is an m-gov system? The question and answer address the issue of qualification criteria. We refer to the set of criteria provided by the answer as the "Mobile Government Manifesto", or m-gov Manifesto, (M-GM). The M-GM serves a number of purposes:

1. Research: It defines a framework that identifies important research issues in m-gov initiatives.
2. Development: It provides a guideline for developing m-gov projects.
3. Benchmarking: It serves a common basis for benchmarking m-gov efforts.
4. Comparative studies: It enables comparative analysis of different m-gov projects.
5. Impact analysis: It provides the bases for studies on effectiveness and success of either an entire m-gov services delivery system or of individual components or aspects.
6. Readiness: It can be used to ascertain if governments are strategically prepared for m-government.

Oyawoye, (2006) states six questions that can be used to determine if a developing country is ready for e-governance, and views them as critical to the success of e-government initiative. The questions are subsumed by our manifesto. The manifesto is presented as a set of concepts that are classified into two categories: mandatory and optional. The mandatory concepts are those that any m-gov initiative must satisfy. They specify the "must haves" for m-gov systems. The

optional conditions define non-mandatory conditions. They provide added values to the system. They are the "nice-to-have-but-not-essential" for m-government systems. In this sense, the manifesto can be viewed as helpful advice and condensed recommendation, and used as a guide.

3.1. Mandatory Concept

Strategic framework: *M-gov initiatives must be developed according to a national strategy*
Governments must see m-gov initiatives as strategic. Their development and rollout must be done only according to strategic plans. While it can be said that this is true (or should hold) for any national development initiative, it is not necessarily adhered to in all developing countries.

Policy Framework: *M-gov initiatives must be policy-guided.*
A conducive policy environment is essential to getting m-gov initiatives right. Each country must craft policies that are tailored to its needs. Essentially, the framework shows the different issues that an m-government development and deployment policy must address.

Government institutions: *M-gov initiatives by different tiers of government must be harmonized.* The typical constitutional division of the government function into a tiered system (National, Provincial/Regional/State and Local Governments) is likely to make itself felt as each of these attempts to provide e-services. A crucial issue to be addressed by policy is, therefore, that of cooperation and collaboration among all three, as well as the harmonization of their efforts.

Regulatory institutions: *M-gov initiatives must be controlled by regulation*
A major development in the regulatory arena was the establishment of the Telecommunication Act in 1996. Regulation promotes universal access and affordable telecom services, customer centeredness, and fair-trading practices (Barendse, 2004). National regulatory acts have the aim of controlling collusion and other exploitative tendencies by firms. Although they typically do not have prosecuting authority, regulatory bodies usually have the power to recommend actions that could result in heavy fines for violators. They are responsible for licensing requirements and other access related services. Regulation therefore serves a crucial role in promoting and enhancing the deployment of m-government services, especially into rural and underserved areas.

Research support: *M-gov initiatives must be supported by extensive research and development.* Research and development drives the evidence-based technology development choices for m-government. Government agency should partner with private sector, other research bodies and academic institutions to provide objective diagnosis of requirements for the m-government infrastructure landscaping.

Service providers: *M-gov service providers must provide quality service.*
The mobile phone industry in many countries is dominated by a cartel of few service providers. In order not to stifle growth and the provision of quality service, the firms must be motivated and controlled through regulation and the de-regulation of the industry.

Delivery mechanisms: *M-gov initiatives must support multimedia data.*
A wide range of technology platform to support m-government will be needed. Given high levels of illiteracy in many developing countries (UNESCO, 2004), policy makers working in m-government should consider the use of text (email and SMS), voice, and multimedia (MMS) to ensure that as many users as possible are comfortable with this new service delivery format. Without flexibility in technology platform, access equality will not be achieved making the goal of closing the digital divide through inclusive information society unattainable.

Infrastructure: *M-gov initiatives must reach remote and rural communities.*
The physical telecommunication infrastructure is usually dominated by a very small number of operators. In many cases, a government-owned monopoly is the sole player. The growth of digital government in remote rural areas is strongly supported by Multipurpose Community Centers (MPCC). They provide improved access to both e-and m-government services. From a policy perspective, issues that address infrastructure availability, reliability, expansion, modernization, sharing, etc., have to be formulated to force these firms to extend services to rural and remote areas through some form of universal access program.

Technology: *M-gov initiatives must pay special attention to wireless access issues.*
End-user interface devices include landline phones, cell-phones, smart phones, personal digital assistants (PDAs), and laptops with wireless infrastructure. Policies here must address wireless interface issues, such as bandwidth limitations, micro-browser and micro-screen

restrictions, memory and storage capacities, usability, etc. This is especially important in the typical developing country where the generality of users are not computer literate.

Mobile channels: M-gov initiatives must tract the modes of interactions found in traditional e-government
Traditionally, the development of e-government interactions has led to four basic avenues of collaboration between parties involved. These are government-to-citizen (G2C), government-to-employee (G2E), government-to-government (G2G) and government-to-business (G2B) interface.   These operations occur at three levels of government, as already mentioned. A straight extension of these to m-government suggests the following: mobile government-to-citizen (mG2C), mobile government-to-employee (mG2E), mobile government-to-mobile government (mG2G), and mobile government-to-business (mG2B) linkages.

End-users: M-gov initiatives must assess impact on users and society.
Policies are needed to address the impact of m-government services on the different types of users and, by extension, society as a whole. In developing countries, with diverse linguistic and cultural groups of citizens, support for different languages is a crucial issue. Also, human factor issues have to be taken into consideration in the design of human-computer interfaces on mobile devices used by consumers to access e-services.

Awareness generation: M-gov initiatives must include awareness generation
The delivery of quality e-government information and services on an equitable and sustainable basis remains a huge challenge for the governments of many developing countries. Inherent difficulties lie on the road to universal access to digital government in these countries, and in order to stimulate widespread adoption of e-government service, effective communication strategies are needed (Eechambadi, 1994; Galbi, 2001). Such strategies are essential to generating awareness about services provided by government.

Security and privacy: M-gov initiatives cannot afford to overlook security and privacy issues
Data security and information privacy are sensitive issues with governments. Successful m-government endeavors must ensure the inviolability of the security and privacy of user data and information.

Finance: M-gov initiatives must operate on sound financial bases
This is especially important because governments normally operate under tight budgetary constraints and m-government projects are usually very expensive. Issues of charging for use must be carefully thought-out to avoid discouraging users from using the system.

Human resource: M-gov initiatives must have the appropriate types and levels of human skills.
M-government projects usually call for a wide range of expertise in technical and non-technical fields. Governments must therefore ensure the availability of essential skills before initiating the projects.

Leadership: M-gov initiatives must have a champion
An individual with the requisite clout, vision and interest is needed to champion the initiative and carry it forward to fruition in the typical political minefield that government projects are usually embedded in.

Politics: M-gov initiatives require the "right" political environment.

A political environment that is favorable to m-gov initiatives can help to promote general acceptance by users and decision-makers in government.

User-valued information and services: *M-gov initiatives must provide information and services that are perceived as valuable by users*
Nath (2006) argues that the key issue in e-governance initiatives is whether information that is of value to the public is being provided: "Is Electronic Governance providing me with information which is of 'value' to me and that I can use for my private benefit?" We subscribe strongly to this view, but extend it by adding that users must also perceive the services provided as "valuable".

Provision for tutorials, demos and walkthroughs: *M-gov initiatives must provide for user training.*
For illiterate communities, it is essential to provide this support to encourage usage and adoption.

It is clear from the foregoing that m-government architectures must comprise of multi-stakeholder partnerships in such areas as policy development, service provision, infrastructure, research and development, and technology, with a diverse range of potential beneficiaries including both civil society and businesses.

3.2. Optional Concepts

Government agency users: *M-gov initiatives may be used for internal government operations*
Although the public and businesses are the primary users, adoption and use by government for internal operations could render government functions more cost-effective, efficient and transparent. It could also enhance accountability and encourage widespread adoption of the innovation.

Agency skill: *M-gov initiatives may still proceed without in-house skills in certain areas*
The lack of IT skills within a government agency should not prevent it from providing m-government services. Outsourcing can be used where needed ICT skills are lacking.

Multi-language support: *M-gov initiatives may proceed without multi-language support in certain cases*
In those cases where the greater proportion of the population is fluent in and use a national lingua franca, the necessity to provide multi-language support falls away. Providing this support adds value to the project, but it loses its essential quality.

Adoption of "best practice" and "best of breed" principles: *M-gov initiatives may adopt successful approaches.*
Best practices and best of breed principles could contribute to improvements in the development and provision of service, especially in the areas of modeling, design, and awareness generation.

4.0 EMERGING ISSUES AND CHALLENGES

A number of issues in m-government require research in the future. In this section, we discuss only a few:
It is expected that m-government will offer the promise to improve internal performance, enhance efficiency, and above all enable broad-based inclusion of citizens in the Information

Society. M-government solutions are not standalone solutions. To achieve higher levels of performance and efficiency, policy makers need to identify the link between e-government and m-government. Services can then be streamlined in such a way that those that cannot be offered via e-government are routed through mobile technology options and vice versa. Understanding those services is one way of optimizing both e-government and m-government service-delivery.

There are limitations posed by the technology in terms of content delivery: most cell phones allow for 160 characters, making descriptive information such as is currently published on e-government portals unsuitable for delivery by SMS. It is anticipated, however, that SMS could be a suitable vehicle for delivering alerts, for instance when new job and tender ads are published on government portals. Alerts could also be used to inform parents of temporary school closures, or to tell subscribers about road closures. On a one-to-one level, SMS could be used by clinics to remind patients about doctors' appointments, or to remind drivers to renew their vehicle licenses. These applications of cellular technology are, at this phase, in the very early stages of being explored, however. In this context, as the penetration of mobile technologies into remote and rural communities in developing countries increases, the issue of support for indigenous characters on hand-held devices needs to be addressed by governments and ICT manufacturers.

One caveat has thus far been identified, which is that of cost. Anecdotal evidence from our research suggests that while many people own cell phones, few can afford airtime and thus reserve their phones for incoming calls only. Given current pricing of cell phone calls and SMS, there may be limitations to the implementation and sustainability of m-government initiatives, particularly where they are introducing new channels of communication with government, as opposed to replacing old, costly ones. An examination of cell phone costs and telecommunications market regulation and practices will necessarily have to form part of m-government exploration and implementation.

In this paper, we are concerned primarily with the end-users, or consumers, of mobile services. Consequently, our manifesto is primarily defined by the level or degree of cognitive burden the delivery system imposes on users. We have taken "cognitive burden" to mean what the user is expected to know and do in order to use the system to fulfil a task. Consequently, research will need to be conducted to identify different groups of service consmers and classify them into categories according to technology literacy and cognitive abilities. This taxonomy will then form the basis for designing and developing appropriate consumer request specification interfaces.

In addition to the above issues that apply to a larger degree to developing countries, there are a number of issues that are universal. These include small displays, inconvenient input, battery life, secure and stable connection (Song and Cornford, 2005), as well as low memory and speed (Kushchu and Kuscu, 2003).

5.0 CONCLUSION

As countries rush on to the e-government bandwagon to improve government and governance, enhance citizen participation in governance, and improve public service delivery, it is important that they pay attention to key issues in e-government. In this paper, we proposed a manifesto on m-gov and outlined a number of recommendations for future research directions in m-gov. The manifesto should be of value to m-gov initiatives, particularly those in the developing countries.

In concluding, we, however, sound a note of caution that pertains to national development policies in developing countries: If it is taken that e-government needs to support the development objectives of a country, is putting services online necessarily the next step? Will this have the necessary development impacts? This is a key question, given that in most developing countries only a few citizens have access to the Internet. Secondly, given the high failure rates of e-government projects (Stoltzfus, 2004), developing countries should be particularly careful not to 'put the cart before the horse'. Putting services online, in a country faced with problems such as the HIV/Aids pandemic, high levels of income inequality and lack of housing needs to be carefully thought out in terms of appropriateness. Thirdly, developing countries present particular constraints, such as the high cost of connectivity and relatively low levels of computer usage. Resources might be better spent on alternative technologies (e.g. SMS), or on development efforts that create a climate more conducive to putting services online at a later date (e.g. increasing public access to ICTs, or skills development).   Governments in developing countries would do well to apply the same consideration to m-government before rushing on to it.

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Minimum Critical Technical Success Factors for e-development projects: A Maturity Model.

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Abstract: Much has been said about the socio-economic aspects of e-development. In particular many projects focus on ensuring a participatory style of development is used, with conscious effort to ensure the prominence of human issues. While the need for focus on human issues is a central of e-development, there is a danger of neglecting the basic technical issues during the development process. With the development of a project or system, for e-development, comes not only a responsibility to ensure a societal impact, there is also a responsibility to ensure that the system that is developed is of a certain technical quality and excellence. Unfortunately there has been a tendency for e-development projects to fail and thus not to live up to this social responsibility. This paper looks at this issue, using the author's own experiences on Open Source development for Health Informatics Systems, as a basis for a discussion on what the Critical Technical Success Factors are for an e-development project.

Minimum Critical Technical Success Factors for e-development projects: A Maturity Model.

INTRODUCTION

E-development, or the process of developing ICT (Information and Communication Technology) systems for the express purpose of providing some kind of socio-economic or human development, is a growing and fast developing field. ICT projects, especially those targeted at small communities often only require an investment of skills and expertise, and very little in the way of capital, equipment or infrastructure and are thus ideal for socio-economic development.

It is this ease with which an ICT project for development can be set up that has resulted in e-development being one of the primary vehicles through which various organisations and agencies are attempting to perform socio-economic development.

This wide spread acceptance of e-development, has resulted in its very own challenges due to the very socio-political nature of e-development projects. Getting political support or community buy-in are just some of the issues that can hamper the success of an e-development project.

Unfortunately, due to all these socio-political issues that can influence the success of an e-development project, the underlying technical issues that are critical for the success of any ICT project, e-development included, are often marginalised. Ballantyne (Ballantyne: 2002), provides a list of general recommendations made concerning e-development projects, none or very few of which concentrate on technical issues at all. Further more, Montealegre (Montealegre: 1999), in a review of development literature depicts the following theme, as discovered in the research:

> "The studies emphasize the potential use and the content of IT for solving problems confronting LDCs. However, *substantive issues regarding the process of developing and implementing IT*, and the effects it has on the processes through which people were working, are generally ignored." (Montealegre: 1999) (Author's emphasis)

This article looks at the phenomenon of e-development failure and then tries to provide a scale or model which can be used to judge the technical maturity of an e-development project, where the technical maturity refers both to the level of technical skills of the project and the ability of the project team to perform systems development project management.

This model will then be used to attempt to answer the question of how much technical expertise and skill is needed for an e-development project and what the critical success factors are for a successful e-development project.

LITERATURE REVIEW OF E-DEVELOPMENT AND E-DEVELOPMENT FAILURES

E-development, is described by Heeks (2002a) as the "use of ICTs like the internet to support development…" (Heeks: 2002a)

This use of e-development, has seen a large surge in acceptance in the development communities in the last decade or two. There was a substantial influx of money, time and

expertise in developing ICT systems for development, especially focusing on developing countries. International organisations were formed to address issues arising around ICTs for development and a lot of hype and attention was giving to e-development. In fact, it was a very similar reaction happening in the field of e-development as what was happening in the so-called dot com boom. Heeks describes this period as follows:

> "Donors, attracted by a combination of hype and hope generated by ICTs, have altered their funding priorities and pushed ICTs up the development agenda." (Heeks: 2002a)

Unfortunately, similarly to the dot com boom, there has been a significant degree of failure of ICTs for development. While the actual statistics are difficult to measure, as the failure of an ICT system is largely subjective and can range from an acceptance failure to a total technical failure, nevertheless, as echoed by Heeks, there has been a marked level of ICT failure, especially in developing countries:

> "In summary, the evidence base is not strong - and it urgently needs strengthening – but it all points in one direction: toward high rates of IS failure in developing countries." (Heeks:2002b)

A more concrete example of ICT for development failure is given by Wade, detailing the example of the failure rate in multi-purpose communality telecenters in Mexico:

> "Buried at the end of the thirty-page World Bank paper is an account of multipurpose community telecenters (MCTs) in rural Mexico. (MCTs are facilities that provide public access to a variety of information and communication services.) It turns out that of twenty-three MCTs built recently in rural Mexico, only five were working two years later. This is a failure rate of 80 percent." (Wade: 2002)

A broader summary of ICTs and failure, by Beynon-Davies, suggests the following:

> "Available literature suggests that failure is a ubiquitous feature of both the UK and International experience of IS engineering." (Beynon Davies: 2002)

While Davies' summary relates to the whole of IS (Information Systems) development as a whole, it supports the overall picture that there is a tendency for IS and ICT projects to fail, and ICT systems for development, as a subset of ICT systems, are prone to this tendency as well.

There appears, from a brief study of the literature, to be an indication that ICT systems do fail, ICT systems for development also fail, and that the failure rate is significant enough to be the subject of serious concern. The issue of failure of ICT systems, especially when used for development, is one that requires study, and much of the study that has been directed in this area of research has been on why ICT systems fail.

Beynon-Davies, quotes Winograd and Flores, summing up the causes of ICT failure:

> "Most of the well-publicised failures of large computer systems have not been cause by simple breakdowns in their functioning, but by breakdowns in the larger web of computing in which the equipment resides." (Beynon-Davies: 2002)

All-in-all the consensus appears to be that the failure of ICT systems for development is not the result of one single factor but is due to a myriad of issues. ICT systems are a complex mix

of technical, social and political (on a national or organization scale) factors, and the incorrect handling or management of one of theses factors can jeopardise the success of the entire system.

This is even more true for ICT systems for development, as a host of cultural and social issues, which are generally not present or not as prominent in commercial development, become increasingly critical to the success of the ICT system. In a commercial system it is easy (or easier) to force user acceptance of a large company wide information system. This user acceptance is less easy to obtain in a rural African village that has few or none IT skills, as well as a significantly different culture to that of the developing agency.

Heeks offers the ITPOSMO framework to classify the failure of ICT systems according to the following seven dimensions:

> "Combined with the more descriptive material on information systems, these theoretical ideas build to create seven dimensions of relevance to design-actuality gaps: information (data stores, data flows, etc.); technology (both hardware and software); processes (the activities of the users and others); objectives and values (the key dimension, through which factors such as culture and politics are manifest); staffing and skills (both the quantitative and qualitative aspects of competencies); management systems and structures; and other resources (particularly time and money)." (Heeks: 2002)

This framework ties in with the idea that the failure of an ICT system is a multi-dimensional problem, which requires success in many different areas and aspects to achieve overall success.

The purpose of this article is to show that while each of these seven dimensions are important to the success of an ICT for development project, there are certain basic technical requirements that are non-negotiable. It is the author's contention it is more important to have an "adequately" working ICT system that does not achieve cultural or social acceptance, than to have an ICT system that is accepted by the community in question but is a technical failure.

The rationale behind this is not a blind return to a focus primarily on the technical aspect of an e-development system but the need for the technical aspects of such a system to be, in a sense, taken for granted. The technical maturity of an e-development system should not even been an issue, and should not affect the e-development process as a whole, instead time should be taken to tackle the more difficult, and more important, social, cultural and political issues.

This author's perception is that as e-developers we have a moral obligation to provide working, secure and mature systems to the communities or organisations that the e-development is focusing on. The danger we face is that through providing an e-development system that is a technical failure (or a social or cultural failure), we do more harm than good, and eventually increase the likelihood of future e-development projects being rejected by the communities they are aimed at.

In terms of this contention the article will focus on the Technology, Staffing and Skills and Management structures dimensions of Heeks' framework, as the critical basis on which any ICT project needs to be built. To explore the level at which these factors become important the article will use the Capability Maturity Model or CMM to devise a framework that can be used to gauge the level of technical maturity that an ICT for development project or system has.

Overview of the CMM (Capability Maturity Model)

The Capability Maturity model is a model or scale on which the maturity of an organisation, in terms of its use and application of ICT and ICT systems can be measured. It defines certain levels at which an organisation can be, as well as defining the criteria (and characteristics) of a typical organisation at that level. The following tables, adapted from Herbsleb et. al, describes the different levels of the CMM and their characteristics:

CMM Level	Characteristics
1) Initial	The software process is characterised as ad hoc, and occasionally even chaotic. Few processes are defined and success depends on individual effort and heroics.
2) Repeatable	Basic project management processes are established to track costs, schedule and functionality. The necessary process discipline is in place to repeat earlier successes on projects with similar applications.
3) Defined	The software process for both management and engineering actives is documented, standardised and integrated into a standard software process for the organisation. Projects use an approved, tailored version of the organisations standard software process(es) for developing and maintaining software.
4) Managed	Detailed measures of the software process and product quality are collected. Both the software process and products are quantitatively understood and controlled.
5) Optimized	Continuous process improvement is facilitated by quantitative feedback from the process and from piloting innovative ideas and technologies.

Table 1. The CMM

This model is designed to be used primarily to assess commercial organisations that perform ICT development projects on a regular basis and that have a certain amount of resources to spend on managing these projects. For this reason the CMM cannot be used as-is to determine the maturity level of an e-development team or an ICT for development system and requires a certain amount of adaptation.

Framework of Technical Maturity in an e-development project.

Taking the CMM as basic layout for the different levels of maturity that an organisation can be at concerning its software development processes, we can adapt it for use for e-development projects. E-development projects are generally different in nature to the projects that are performed by commercial organisations and it is according to these distinctions that the adaptations to the CMM need to be made.

Many of these observations are based on the author's own experience working with e-development projects, especially in the Health Informatics field and are thus based on both the literature as well as empirical observations. The specific circumstances of this e-development project will be elaborated on in the next section.

The following is a list of the general type of differences that one finds between ICT systems of development and commercial development projects. These serve as indicators of a trend

and thus reveal more of the tenor of the differences instead of being specific examples that will be addressed by the adapted model:

The technical side of E-development projects are generally once-off affairs

The CMM is designed to measure the maturity of an organisation and how well they can handle development projects over a protracted period of the organisation's life time. For this reason mention is made of previous projects that the organisation has performed in different levels of the CMM. On the other hand the development of an e-development project is usually a once-off affair, with the various parties consisting of different individuals and agencies that have come together to work on this specific project. It is unlikely that exactly the same individuals and agencies will work on a new project in the future or have worked together in the past and it is thus difficult to measure the protracted maturity of an e-development project.

E-development projects tend to have diverse budgets and project scopes

E-development projects range from small pilot projects running on a single computer in a single community, to massive country-spanning networks. For this reason it is difficult to pigeonhole e-development projects as having specific criteria in terms of budget or scope. While this facet does not uniquely differentiate e-development projects from commercial ICT projects, the nature of the funding, i.e. generally government or donor based-funding, differs from commercial projects. The fact that the funding comes from donor agencies or government, in turn means that the goals and targets for an e-development project are often more complex as the agendas and cultures of the funding organisations can and do have an impact on the e-development project as a whole.

Skill sets are often disparate to the problem in question in e-development projects

A commercial organisation hires people who can perform a certain task in the organisation. In an organisation that is producing ICT systems the skills of those people hired often relate directly to the system that is being developed, especially in terms of technical competence.

In e-development projects, the members of the team are often chosen not for their technical competence but for their knowledge of the domain in which the e-development project resides or their socio-political standings that can influence the project.

Similarly members of e-development teams are often researchers and domain specialist first and technical practitioners second. As Walsham and Sahay report on research in the field of e-development:

> "The use of the term *information infrastructure*, rather than information system, reflects the authors' view that such highly complex networks of actors, including technologies, need different methods of development and management."
> (WALSHAM, SAHAY: 2006)

Taking the abovementioned factors into consideration and combining it with the CMM, it becomes apparent that defining the technical maturity of an e-development project cannot be done merely on one dimension. Technical maturity for a project is not just the skills of the project members nor the level of project management that the project has but a combination of both, also as posited by Heeks as a level (staffing and skills) in his ITPOSMO framework. For this reason the model in Figure 1. attempts to define technical maturity, for a development

project, according to these two criteria of the technical skill set of the project members as well as systems development project management.

This model differentiates between systems development project management and other types of project management, because there are certain design and planning issues that are unique to systems development project management. Generally project management might have more to do with getting the funding, or political support or finding the right domain experts while systems development project management focuses more on managing the actual development of the system that the project will use.

SYSTEMS DEVELOPENT PROJECT MANAGEMNT MATURITY	**Integrated** Technical and development project management fully integrated				
	Organised Extensive systems development project management but not integrated with overall	**ORGANISATION-LED**		**COMBINED**	
	Individual Project management done on an individual or ad hoc basis			**INDIVIDUAL-LED**	
	Limited None or limited	**LIMITED**			
		Non-existant and is often acquired during the project	Individual Project Members have some technical skills	Individuals are hired for their specific skills	Individuals have extensive technical and e-development experience
		Limited	**Individual**	**Organised**	**Integrated**
		TECHNICAL SKILLSET			

Figure 1. E-development Technical Maturity Model

The E-development Technical Maturity Model covers the different stages in which each of the dimensions can be, starting with a very limited inclusion of this dimension in the project and ending with the full integration of this dimension into the e-development project as a whole. The model adapts the CMM in terms of the broad outline of levels of maturity but simplifies the number of levels into four per dimension. Because the CMM is designed to be used with organisations that are involved in many systems development projects it makes sense to have the 5th level, Optimized, while e-development project teams are often only together for the duration of the project and thus have little opportunity or inclination to enter this 5th level.

Each column or row, depicting a stage per dimension is discussed below:

The Technical Skillset Dimension

Technical Skillset: Limited

This level of maturity in a e-development project refers to projects that are small in size and focused primarily on the development aspect of the project not the technical side. The members of the project often believe that they will be able to obtain the necessary skills themselves during the evolution of the project, but there are practically no technical skills in the project group at the start of the project.

Technical Skillset: Individual

At this level the project members are aware for the need for se technical expertise in the completion of the project, but feel that the skills that are available within the project group, however diverse, would be appropriate for completing the project. It is at this stage of maturity that one often finds project members with development skills and expertise that overshadow their technical skills or abilities.

Technical Skillset: Organised

At this maturity level there is a concerted effort by the project members to include technically skilled people in the project group, often from the initiation of the project. There is a clear focus on providing a project that is technically sound.

Technical Skillset: Integrated

The final level of maturity is one where the technical skills of the project members are synchronised with the development skills of the project team, thus resulting in the technical aspect of the project being well aligned with the development aspect. These kind of development projects are characterised by a high level of cohesion between the technical and development sections of the project team.

The Systems Development Project Management Maturity Dimension

Systems Development Project Management: Limited

At this level of maturity the Project Management of the Technical side of the development project is generally completely absent or extremely limited. The focus of the entire project at this level of maturity is on the development issues without regarding the systems development project management at all.

Systems Development Project Management: Individual

At this level of maturity, project management process and standards are implemented on an individual basis, each person involved with the technical aspect of the project using their best knowledge of design and architecture without an overriding view or cohesion.

Systems Development Project Management: Organised
A well documented, well understood process of Technical Project Management is in place, guiding the technical aspect of the project, but without fully integrating with the development side of the project.

Systems Development Project Management: Integrated

At this final level of maturity the Management of the Technical aspects of the project are fully integrated with the Management of the development aspects of the project. Standards and documented procedures are not only used to ensure technical success but also to underpin the success from a development aspect.

Obviously, this model gauges the maturity of a project based on two dimensions so the possibility to having a project with a high level of technical skill but low systems development project management is highly possibly. Similarly it is important to note that while each dimension has been divided into four separate sections, each dimension is still a continuum. A project can fall on the border of two sections and two projects that fall within the same section can be at different levels of maturity within that section.

It is also important to note that the levels of Limited and Individual and also Organised and Integrated can be combined into a super-set. This in turn simplifies the model into the four quadrants that can be seen superimposed over the framework: the Limited quadrant, the Individual-Led quadrant, the Organisation-Led quadrant and the combined quadrant. These quadrants are useful when determining what the broad maturity of an e-development project is and what the Critical Success Factors for that project is. These factors will be discussed in the next section:

Minimum required levels of technical maturity for an e-development project

Obviously one can attempt an e-development project with a technical maturity at any point on the model, it is merely that the success of such a project might be in doubt. For each one of the quadrants there is a typical solution that can assist the e-development project from growing from this stage to a more mature stage. The discussion of the quadrants will start with the Individual-Led and Organisation Led quadrants, seeing as there typical problems and solutions found in them individually are usually found together in the limited stage.

Individual-Led Quadrant

A project in this stage of maturity is characterised by string individual leadership and expertise within the project. This stage can also be classified as a *guru-led* stage, seeing as it is usually the skill or expertise of one person (or rarely a group of persons) that is the driving force behind the success of the project.

A typical problem with this quadrant is the force of personality of one person overshadowing the rest of the project team. There is also a great dependence on the skills and expertise of this one person and their loss to the project can lead to the wholesale failure of the project.

To move from this level of maturity to a higher level of maturity it is important to consider a higher level of Systems Development Project Management. With more structured Systems Development Project Management one person cannot overshadow the rest of the project team and the skills and knowledge of each group member is captured and accessible to others through the process of Project Management.

To achieve a higher level of Systems Development Project Management, it is possible to look at implementing an existing (or creating your own) System Development Life Cycle or Methodology in the project.

Organisation-Led Quadrant

At this stage of maturity an e-development project is most likely following some kind of Methodology or Life Cycle, producing some amount of process focused documentation. Generally the project follows some kind of recipe or guideline to achieve completion. What is lacking is the technical skills of the individuals following the guidelines laid out by the Methodology or Life Cycle. This can be a lack of skills to carry out the guidelines or a lack of skills to properly understand and implement the Methodology or Life Cycle.

The typical problem of this level of maturity is one of much work getting done but little getting achieved. Developers in the project team follow the guidelines but aren't capable of producing a working system and thus it often appears as if much progress is being made but little real work is done.

To move from this level to a higher of maturity it is important to increase the level of technical expertise within the project team. This will ensure that the actual work of development gets done as well as preventing the team from focusing on unnecessary steps of the Methodology or Life Cycle due to ignorance of the Methodology or Life Cycle itself.

To achieve a higher level of Technical Skills in the project team, one can either train the existing members of the project team to higher levels of expertise or hire (or outsource to) outside experts who have the requisite skills and expertise. The exact approach chosen will depend on the budget and scope of the project

Limited Quadrant

A project at this level exhibits no or little technical expertise and no or little Systems Development Project Management. This means that the problems that are associated with both an Organisation-Led and Individual-Led e-development project are combined in a Limited Quadrant project. In turn this means that there will be no overall plan or structure to the project and no skills or expertise to implement any of the ideas into working systems.

This level of maturity is essentially inadequate for successfully developing an e-development system. If a project team finds themselves in this position they should immediately attempt to improve their level of maturity, either by increasing the level of Technical Skills or increasing the Systems Development Project Management Maturity. Ways to achieve this are given in the sections above.

Furthermore if, at the outset of a project, a project team finds themselves at this level of maturity, it is critical that they address this issue before continuing with the project.

Combined Quadrant

At this stage the Technical Skill as well as the Systems Development Project Management Maturity is at an appropriately high level for the project to be a technical success. It is important at this stage to explore ways of improving both dimensions as well as considering issues of maintenance and sustainability. While often the issues of maintenance and sustainability have more to do with the socio-political environment of the project, it is important to ensure that the technical maturity of the project allows for maintenance and sustainability.

EXAMPLE CASE STUDY

To further explore the applicability of this framework as well as to show its practical application the framework will be applied to a case study with which the author was involved.

The case study concerned the development of a HIS (Health Informatics Systems) for a small clinics in a developing country. The development of the system was done by a group of post-graduate students. The author was involved when the group of students, as well as their supervisors, visited the author's University for the purpose of demonstrating their system to the Health Informatics Research group in the author's department. For purposes of confidentiality the exact details of the project will be omitted.

The project was approached from a socio-economic perspective, focusing primarily on building up the necessary social and political networks that would be required to ensure the success of the project. A detailed understanding of the socio-political situation surrounding the project, especially as it pertained to its specific locality, was one of the goals of the project.

The political situation surrounding the project necessitated the speedy development of a prototype by the members of the project, some who had little development experience. A working prototype was produced and implemented in several clinics.

At this stage the project would fall under the Limited stage when measured along the Technical Skillset dimension. The various members of the project had limited technical skills and acquired many of these skills during the project. The systems development project management, at this point of the project, would fall under either the Limited or Individual Stage, as there was little design and architecture involved. Collectively this would place the project in the Limited Quadrant.

The members of the project then decided to partner with other individuals and agencies in developing countries who needed to implement similar systems in their own locations. Certain of the members of the new project teams were included specifically for their technical skills. Their additional skills helped improve the quality of the project as well as assist in redesign the architecture of the project in terms of security and flexibility.

Also at this time a more formal approach to systems development was implemented, using standard development and design practise and standards.

These to changes to the project helped move it from Limited/Individual on both dimensions to Individual/Organised on both the dimensions as well. Especially in terms of the Technical Skills the maturity of the project was improved, moving it into the Individual-Led Quadrant.

While this example (devoid of specifics as it is) does illustrate the application of the framework to a real e-development project, it is important to note some limitations or generalisations that the framework has and makes.

Firstly, it is interesting to note that even though the project was in the lowest level of maturity, it had a functional system that was being used by the target community. Sometimes the necessity of a project is so great that issues of technical maturity are left to be finalised at a later stage.

Secondly, this example reiterates the notion of each dimension of the framework as a continuum and not as separate divisions. It is often difficult to place the project squarely in a section and the overlapping of sections is an adequate solution to this indivisibility of each of the dimensions.

Thirdly there is a need for the movement of a project from a less mature state to a more mature state. As the needs and requirements, as well as the impact of the system or project grows, so too does the need for mature technical skills and systems development project management to ensure a mature project or system. Partially the role of this model is to chart and assist in the growth of technical maturity of an e-development project, by providing a mechanism to measure this technical maturity.

CONCLUSION

The process of e-development is one that is inherently complex, with a multitude of factors influencing the project and its chances of success. The need for technical maturity should not be one of these issues. Within the domain of systems development there is a large body of knowledge and expertise, not purely on the technical side of systems development but also on the management of development projects. It is vital that e-development projects incorporate the standards, techniques and methodologies that are found in this body of knowledge to ensure their success.

The model posited in this paper defines a way of measuring the technical maturity of an e-development project. By being able to measure this maturity one is able to estimate the need for greater focus on the technical aspects of the project as well as define a minimum level of competency and management required for the success of the project.

It is important to realise, that for better or worse, e-development projects are at their core information systems development projects. If we then focus too much on the social and cultural issues, we run the risk of neglecting the technical issues, indeed throwing the baby out with the bathwater, at the definite detriment of all issues, technical and social.

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IT INNOVATIONS AND E-SERVICE DELIVERY: AN EXPLORATORY STUDY

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Abstract: This study investigates the process through which new innovation is adopted in the service sector in developing countries. Studies have investigated factors which contribute both to delays in the adoption of a new information technology (IT) innovation and to delays in the realization of its potentials. However, issues involved when organizations add layers of new IT innovations have not been adequately examined. Such issues include factors that influence an organization to incrementally add a new IT, the process through which the increment is accomplished and the corresponding adaptation of associated service innovation. Organizations in developing countries (DCs) have over the past decade or so invested in and implemented series of IT and service innovations with varying degrees of success. In this study we propose a framework to help take stock of the various innovations that have been implemented and to understand the myriad of issues involved in the process of implementing these technologies and service innovations – especially when transiting from one innovation to another. As this study aims to examine the patterns of adopting new IT and service innovations in DCs, we would argue that such a study would enable us to understand how services can be better delivered with newer technologies, by learning from comparison of past experiences and present situations.

Keywords: innovations, e-service, diffusion of innovations, adoption of innovations, information technology, Nigeria, developing countries.

IT INNOVATIONS AND E-SERVICE DELIVERY: AN EXPLORATORY STUDY

1. INTRODUCTION

> *"As the importance of innovation in developing countries increases, so does the need for research on the subject. There is need to understand the mechanisms and approaches that may characterize innovation and technical change in developing countries, … … … so far research on the subject has been mostly focused on gathering evidence from the developed economies and building theories based on that evidence." (Da Silveira 2001)*

Existing discourse on diffusion of IT innovation has failed to focus much attention on rapid changes in IT development and its corresponding effect on service provision. What makes an organization adopt a new IT for service provision? What are the processes involved in implementing a newer technology in addition to existing ones? Answering these questions would require a more complete view of the diffusion of IT innovation that encompasses both the supply of a new technology and the demand for ad application of that technology by its users and adopters (Barras 1986). However, there has been very little consideration of these issues in diffusion of IT innovation literature. In order to take stock of IT innovations in developing countries (DCs), we proposed a framework which forms the basis of an empirical study to investigate the diffusion of IT innovations and ensuing service innovations within the banking sector in Nigeria.

While the applications of IT in services have been significant, the transition from one technology to a more advanced one is usually unnoticeable and occurs over a long period of time (e.g. mainframe computers had been in the back office for years before the PC appeared in the front office and before the processes were adjusted accordingly to utilize these new technologies). Telephone banking and ATMs were around for a long time before Internet banking and e-commerce began taking place. Thus, it is difficult to study how services are repackaged or redesigned to take advantage of new technologies in these types of settings.

However, in organizations where the gap in the utilization of a new technology has been rapid and occurs within few years, the process could still be studied and the immediate changes in services noticed and analyzed. For example, commercialization of the Internet and other advances in computing enabled an IT innovation called e-commerce and many organizations adopted this innovation. Advances in mobile telecommunications and computing is currently enabling a new innovation called m-commerce and organizations have also begun to adopt this. Within the banking sector, mobile banking is gaining increasing acceptance in addition to Internet banking. Some of the pertinent questions that need exploring include: How do banks already engaged in Internet Banking transit to Mobile Banking? What are the factors that influenced their decision to adopt m-commerce as an innovation and through what process do banks accept the new IT innovation? How are services rendered with existing technology repackaged to take advantage of the new technology? These are some of the important questions this paper aims to focus our minds on.

1.1.   Goals and Research Questions

The understanding of the relationship between different paradigms in IT and service delivery could assist organizations in preparing for changes. This process could also explain the patterns of adoption and diffusion of IT innovation and what drives some organizations to utilize new technology earlier and sometimes better than others. We expect that our findings will contribute additional knowledge to the diffusion of innovation theory. The study will examine how organizations respond to changes in IT and the advantages offered. Technologically, understanding these phenomena could also drive innovation in information technology by encouraging designers to direct the system to the specific need of users. To achieve these goals, the following questions will be addressed in the study:

- What makes an organization adopt a new information technology for service provision?
- What are the processes involved in implementing a newer technology in addition to the existing technology? This will attempt to explain how an organization arrive at the decision to adopt a new(er) technology and how associated services are repackaged or redesigned to take advantage of the newer technology.
- What are the factors responsible for the incremental adoption of a new innovation? For instance, what role (if any) did the existing innovation play in the adoption and subsequent implementation of the new innovation?
- What are the main barriers that could hinder incremental adoption of IT innovations?

The rest of the paper is organized as follows. In the next section we present a discussion of the theoretical perspectives underlying this research as well as the proposed framework. This is followed by a brief review of the methodology, including the criteria for the selection of case organizations and data collection. We conclude with a discussion of the relevance of the proposed framework and a brief overview of the preliminary findings.

2. THEORETICAL PERSPECTIVES: DIFFUSION OF INNOVATION

An innovation is an idea, practice, or object that is perceived to be new by a person or adopting entity. When an innovation emerges, diffusion unfolds which entails communicating or spreading of the news of the innovation to the group for which it is intended (Rogers, 1995). Adoption however is the commitment to and continued use of the innovation. The diffusion of innovations theory provide explanations for when and how a new idea, practice or newly introduced information and communication medium is adopted or rejected over time in a given society (Rogers, 1995).

Diffusion of innovations theory postulate that diffusion of innovation occur as potential users become aware of the innovation, judge its relative value and make a decision based on their judgment, implement or reject the innovation, and seek confirmation of the adoption or rejection decision (Roger, 1995). These processes take place through a channel over a period of time among people (users) within a social system. Diffusion of innovation recognizes individual as well as social factors that can influence the decision to adopt or reject a given innovation. Rogers concludes that diffusion of innovation could be affected by psychological and behavioral as well as external and environmental factors. He identifies factors like perceived characteristics of the innovation and the type of individual decision involved in the adoption process, size of the organization and socio economic status of the users of the innovation.

According to Rogers (1995), diffusion of an innovation gradually occurs over a time frame, which is categorized into two periods. The first period covers the availability of the information technology and its acquisition by the potential users (diffusion delay) and the second period covers the period between acquisition and installation to the application and realization of potential benefits of technology (realization delay) (see figure 1).
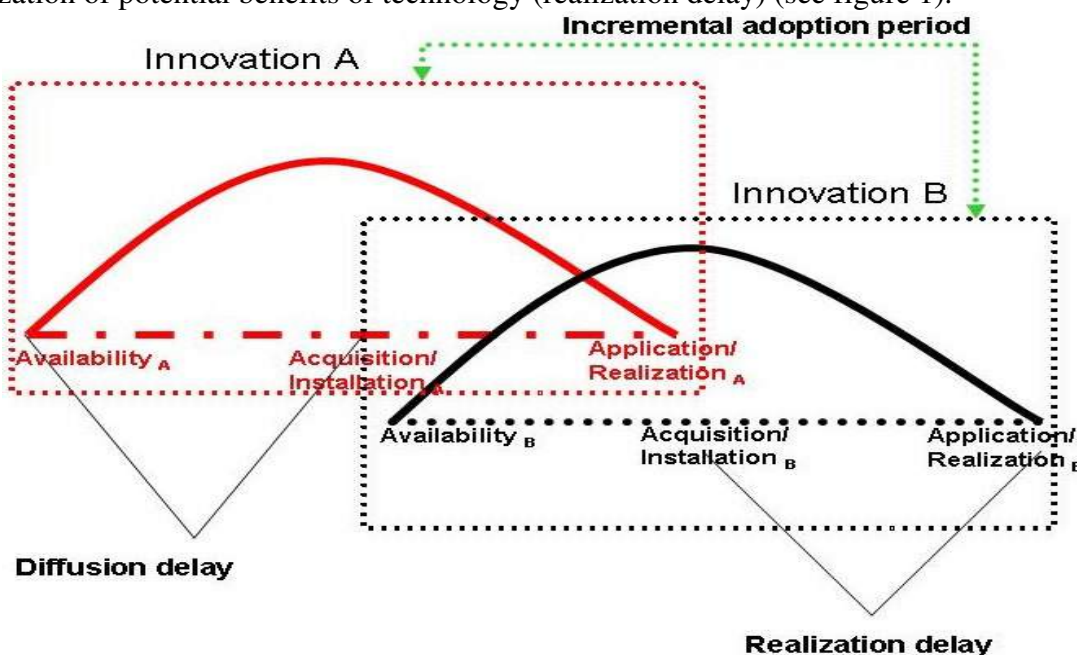

Figure 1. Diffusion/Realization Delays and the Incremental Adoption Period

Markus (1987) also proposed a critical mass theory in the diffusion of interactive media. The theory suggests that the more people on the network, the more the diffusion and adoption. For example, based on this theory the diffusion and adoption of IT innovation like internet banking could be explained that as more people have access to computers and mobile devices through which they can connect to their bank, the more the banks would want to provide services that can be delivered through those devices. Several studies have investigated factors that influence banks, especially in developing countries (DCs), to acquire and implement new technologies but most of these studies have only examined each innovation era or, to use Rogers (1995) terms - the diffusion and realization delays - in isolation. Few have specifically focused on the period of transiting from the realization delay of innovation A to the realization delay of innovation B and the accompanying changes in service provision.

Barras (1986) identified three main factors affecting the rate of realizing the potentials of a new technology. The first factor is "opportunity", defined as the suitability of the activities carried out within the user sector for applications of the new technology. This of course affects the rate at which the technology is initially adopted within an industry, but more important in the longer term, it affects the rate at which process and product innovations can be generated once the technology has been introduced. The second factor Barras (1986) discussed is the "usability" of the technology. Usability is defined to cover both the availability and quality of software, which provides the direct embodiment of the service sector applications of the technology, and the "user friendliness" of the system's basic operating procedures. The final factor identified affecting the realization of the potential of a technology is the "adaptability" of the organization installing the equipment: this includes workforce or managerial resistance to the introduction of new technology: the extent to which working procedures can be adjusted; and the rate at which the workforce can be trained in the necessary skills to use the technology.

In order to assist organizations in DCs, especially banks to critically assess their IT innovations experience, this period of transitioning from one innovation to another, which we refer to as the incremental adoption period, needs to be carefully analyzed. In figure 1, the period between innovation A (red dotted box) and innovation B (black dotted box) is the incremental adoption period (green dotted line). This incremental adoption period and the issues surrounding it are the focus of this present study. We argue that a focus on this transition period and allowing decision makers to reflect on 'opportunity', 'usability' and 'adaptability' issues (Barras, 1986) between the 'old' and 'new' IT innovations will offer DCs organizations a valuable tool to assess and critically evaluate some of the assumptions and initiatives that go into acquiring and implementing new IT innovations.

While factors have been identified for diffusion delay and realization delay, we are not aware of any empirical study and subsequent theory that explains how an organization arrives at the decision to adopt a new(er) technology to the extent of repackaging/redesigning a given service to take advantage of a newer innovation (incremental adoption). This study has a unique opportunity to examine how a service has been supported with different phases of development in IT. Applications of IT affect all sphere of human endeavor - from manufacturing to agriculture. It is thus significant for us to understand how services can be better delivered with new technologies, by learning from comparison of the past experiences and present situations. The outcome of this study could present a knowledge base for late adopters and facilitate learning from innovators' mistakes. We can theorize about patterns of adopting newer information technology innovation through a better understanding of the adoption process.

3. METHODOLOGY

3.1.   Description of the methodology

In this section, the purpose of the exploratory case study and the methodology to answer the study questions are reviewed. The methodological procedures are also described. Data analysis procedures are reviewed with expected results as a representation of the study. The relationship between dynamism in IT and service delivery was examined through an exploratory case study and analysis (Yin, 1994) of different organizations.

Case study is typically qualitative in nature and focus upon behavioral documentation and explanation. In a case study, the researcher does not, or cannot control or manipulate the situation. This exploratory case study constitutes an in-depth study of 8 banks in Nigeria in an attempt to answer the research questions stated above. The qualitative nature of the study is established on the analysis and interpretation of qualitative data: transcribed audiotapes of the interviews that were not controlled and a review of historical documents and observations. In support of case studies, Yin (1994), considered the case study method appropriate to investigate a contemporary phenomenon (or event) within its real-life context, especially when the boundaries between the phenomenon and the context are not clearly evident. On this note, this study relies on multiple sources of evidence and data gathering is based on prior development of theories in technology diffusion and concept of service and service delivery.

This exploratory case study investigates the phenomenon of dynamism of information technology and how it affects service delivery in Nigerian banks. Yin (1994) also supported the capabilities of multiple case study research in provision of scientific generalization. Yin observed that the triangulation of multiple sources of evidence permits convergence and corroboration of findings and build a stronger, more convincing basis for conclusions. While the conduct of multiple-case study can require extensive resources and time, the evidence

from multiple cases is often considered more compelling. This research design has been used extensively to conduct research in information systems and organizational sciences (Orlikowski and Baroudi 1991) and has been extensively used to examine IT issues in developing countries (Krishna and Madon, 2003; Bada and Madon, 2006). The exploratory case study is appropriate for answering research questions that seek to establish how an outcome can be derived. The view of the participants in all the organizations was captured through interviews and recorded on audiotapes with field notes as a guide. Relevant questionnaire (Weill and Vitale, 2002) was used to assess the infrastructures that are required to implement IT-enabled services.

3.2.   Selection of case organizations and Data collection

According to Stake (1998), the most unique aspect of the case study methodology is the selection of the cases to study. It was recognized that understanding of the phenomena depends on the appropriate choice of the cases. In alignment with the research design advice of Yin (1994) Merriam (1988), sixteen banks were selected on the basis of the track record in IT based service delivery and the e-banking awards. The banking industry in Nigeria was chosen due to its leadership role in the utilization of information and communications technology (ICT) compared to other sectors (Woherem 2000). According to a report by the Central Bank of Nigeria (2003), banks and financial institutions play an important role in Nigerian economy through gathering of deposits, repackaging of those deposits into a variety of financial products and services for customers and the public. In the process of delivery of these products and services, the use of ICTs has been identified to provide improved efficiency and effectiveness. It has also been recognized that advancements in ICTs have impacted positively on service delivery in the financial sector of the Nigerian economy.

All the banks included are engaged in electronic banking and IT is heavily used in their primary banking service delivery. Access and cultural proximity were among the criteria for choosing these particular organizations. According to Taylor and Bogdan (1998), an ideal research setting is one where the observer has easy access, is able to establish immediate rapport with participants, and can gather data that is directly related to the research interests. The researchers also have previous experience in working and conducting research in Nigeria banks.

The study uses several methods of data gathering: semi-structured interviews, which was complemented with short time on-site observations and surveys with quantified responses. Organizational documentation and presentations by senior management about their IT enabled services and initiatives was collected and analyzed. Multiple respondents was sought in each organization to achieve triangulation of data and insights. The issue of under-reporting or over-reporting that could result from imbalanced selection of the informants (Gold, Malhotra, and Segars, 2001) was addressed by including people at various cadres. We spent part of the summer of 2004 visiting eight banks in Nigeria for preliminary data collection and to lay the groundwork for a longitudinal study. The project was originally introduced to sixteen banks of which eight agreed to be partners on the project. A detailed proposal was then sent to them with a tentative 5 year plan. One of the banks could not participate at data collection stage due to some changes in the management structure. Visits were again made to some of the banks again in the summer of 2005 for clarification of some issues in the preliminary findings.

4. CONCLUSION

Based on the preliminary analysis of the data, we found that the banks are being driven by customer's need, availability of technology, competition to adopt a new information

technology and subsequently apply it to service provision. Most of these banks consider IT based service innovation as part of their strategic plan and not a technology issue on its own. Most of the services are championed by the customer care unit business improvement unit and tied closely to retail banking services that traditionally deal with customers. Customers of 21st century are more knowledgeable and demand high service qualities.

In this study we propose a framework that can assist service organizations, especially in DCs, in taking stock of their IT investments by understanding the myriad of issues involved in the process of transiting from one innovation to another and in the corresponding change in service provisions. Information technology (IT) has had significant impact on every stage of service provision, production, delivery, and quality. Today, the increased use of IT by service providers has in many ways changed the nature of service delivery. The dynamism and rapid changes in IT, which progresses from traditional business IT to mobile and pervasive IT, have posed serious challenges to service globally. Dynamism in the production and application of IT also requires corresponding dynamism in its applications to service provision. *However, there is lack of adequate attention to these issues in information systems research and practice. There is little understanding of how the rapid changes and developments in IT affect service provision in DCs.*

Although there have been several efforts to study how IT affects organizations in general (i.e. in organization design, organization strategy, organization and human resources development, organization communication etc). However, there has not been any detailed systematic study of the actual process of how (and why) organizations repackage their services each time there is a change in the capability of supporting IT. There has not been a clear understanding of theories that explain the ways service provision respond to the dynamism in information technology, specifically what happens during the incremental adoption period. Therefore, an understanding (taking stock) of the relationship between different paradigms in information technology and innovations in service delivery could assist organizations in preparing for changes. This process could also explain the patterns of adoption and diffusion of IT innovation and what drives some organizations to utilize new technology earlier and sometimes better than others.

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ANALYZING THE LINK BETWEEN DATA QUALITY, STANDARDS AND USE OF INFORMATION FOR ACTION: EXPERIENCES FROM THE PUBLIC HEALTH SYSTEMS IN INDIA

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Abstract: The aim of this paper is to make a contribution to the debates on creating 'usable' Health   Information Systems (HIS) in developing countries. The empirical material for this analysis is drawn from an action research project called HISP – (Health Information Systems Program) implementing ICT based HIS in collaboration with the governments of several Indian states. The gaps between the representation of data such as immunization and interpretation assumptions in the design and implementation of the existing paper based reporting systems are explored to make visible data quality problems. The paper argues that identifying these gaps and addressing them with adequate management and personnel strategies for the definition and implementation of standards, helps to generate quality data that can be used for informed action. The paper also attempts to draw some practical implications for developing and implementing HIS in developing countries.

ANALYZING THE LINK BETWEEN DATA QUALITY, STANDARDS AND USE OF INFORMATION FOR ACTION: EXPERIENCES FROM THE PUBLIC HEALTH SYSTEMS IN INDIA

1. INTRODUCTION

Health Information Systems (HIS) across the developing world, have been recognized as being 'data led' with little emphasis on data use for supporting action (Sauerborn and Lippevald, 2000, Sandiford, et al, 1992) and making them 'action led'. HIS that can link information with health services management requires data of good quality to support decision making. A fundamental criterion to convert health data into 'usable' information for policy making and to also support field operations is for it to meet 'usable' standards of quality. It has generally been recognized that the quality of data, including its completeness, accuracy and timeliness, is problematic in the context of HIS in developing countries (Sauerborn and Lippevald, 2000). Understanding the underlying reasons for this and what action can be taken to redress these problems is the focus of this paper. The empirical basis for this analysis is provided by an ongoing longitudinal study of implementing HIS in various states in India.

The aim of this paper is to make a theoretical and practical contribution to the debates on creating 'usable' HIS in developing countries by highlighting the issues of data quality, specifically the gaps between health related events (for example, of immunization) and its representation and interpretation, and the implications that has, for the use of this information for action. Standards are argued as being an important mediating condition between data quality and its use, This paper also attempts to develop some implications for making improvements in this regard.

The rest of the paper is organized as follows. In the next section, we review literature on data quality and standards and discuss the theoretical relationship between representation and interpretation assumptions around data, data quality, standards and information use. In Section 3, we discuss the research methodology adopted of action research. Section 4 gives a description of the research context and the empirical observations from our work in the Indian states of Andhra Pradesh, Karnataka, Gujarat, Jharkhand, and some field visits to Uttaranchal. We continue with the analysis of our empirical data in Sections 5 and in Section 6, we discuss our findings in the larger context of 'usable' HIS. In the final section, some brief conclusions are presented.

2. LITERATURE REVIEW AND THEORETICAL CONCEPTS

In this section, we briefly review literature from the domain of public health, specifically focusing on the issues of data quality and standards. This review has helped us to propose a conceptual framework linking data quality, standards and use of information.

'Quality of data refers to the degree to which the data measures what it was intended to measure when the data collection system was designed' (Shreshta and Bodart 2000, p 137). This definition refers to both the aspects of representation and interpretation of data which shape the level of data quality. Data quality of routine HIS in developing countries has been criticized by many researchers to be suspect, but 'perfect data' are difficult to achieve and expensive to maintain (Tayi and Ballou 1998).

A report on the state of data quality for Ontario's health care sector cites the lack of standards and education of staff in registering data as contributing to the overall poor quality of clinical data. A task force set up for analyzing this problem recommended a reduction of errors in data through making improvements in data quality by the development of standards, identifying best practices in health departments for better data production and use, and making the data more credible through continuous monitoring (HRT-IM, MOH, and Canada 2005). A study of maternity data from the NHS Trusts (UK) concluded that once a minimum set of maternity data is implemented, it should be ensured that data are collected according to agreed definitions to achieve consistency (Kenney and Macfarlane, 1999). Poor design of health records can be another deterrent to data quality (Allottey and Reidpath, 2000), as they often do not match with the existing work practices around how data is collected, validated and used.

Standardizing data is an important mechanism to improve quality by decreasing the fragmentation of systems and information channels (Jacucci, et al. 2006). This is particularly important in the context of countries like India where the health programs are vertically driven and data is often fragmented across programs. The vertical and horizontal interdependencies that mandate the flow of health information across boundaries (in health systems), and the need for integration across geographically dispersed health information systems, necessitates the use of standardized forms, terminology, policies and procedures.

Standardization has various facets including uniform definitions, data collection formats, interoperatability across standards, and also uniformity in work practices. Accurately defined operational concepts and their uniform application are the foundation for standards since. 'Imprecise definition of terms and lack of standardization… inaccurate translation of material adopted from other contexts' can lead to various errors (Shreshta and Bodart 2000.p.138). When there is a multiplicity of systems, as is the case in the domain of public health, poor interoperability between existing systems resulting from a lack of standards creates a barrier to implementation. Interoperability could be improved by providing standardized communication protocols and vocabulary. (Poon, et al, 2004). In the context of HIS in developing countries, Braa, et al make a similar comment that 'the lack of shared standards for data collection means that the same data are often reported many times through different structures, while at the same time there are gaps where important data do not get reported. Inconsistencies in definitions and procedures create further fragmentation' (Braa, et al, 2007, forthcoming). Standardizing not only requires a clear definition of terms, but also making uniform surrounding work practices (for example, how data is collected, by whom and when), which is difficult to do since practices are deeply embedded in social, political, institutional and historical contexts (Shidende, 2005).

 A data manufacturing system can be considered analogous to a product manufacturing system while developing a framework for analyzing data quality, comprising various facets of data quality policy, data quality management, data quality system, data quality control and quality assurance.   Development of data quality policies requires a clear recognition of the criticality of quality data, and to develop methodologies to identify factors influencing data quality. Standard data quality metrics, processes, data flow, human and automated procedures, and 'control' of poor quality data are some of the parameters to be addressed. Data quality policies and systems need to be developed by management. Personnel management including the development of incentive plans and measures to monitor data quality and feedback need to be also addressed. Other important measures include the assessment of the costs for data quality assurance and failure, and the technical support mechanisms required for implementing a data quality metric system (Wang, et al, 1995).

Wand and Wang describe two important facets of data quality – representation and interpretation. An IS has to make available a 'representation' of the 'real world system', or the domain as seen by the user. While directly observing a real world system, a gap is often seen between the users' views and that depicted through the IS. While the 'representation transformation' creates this IS representation, the 'interpretation transformation' happens when this IS system is actually used and meanings are ascribed to the data. But besides what the IS is capable of creating, it is also assumed that the user 'can infer a view of the real-world system as represented in the IS. By analyzing the gap, the authors generate four data quality dimensions, that is, complete, unambiguous, meaningful and correct that can be used to study data quality practices. (Wand and Wang, 1996).

Based on this review of literature on data quality and our own empirical experiences, we propose a conceptual framework for analyzing data quality issues. Good quality data that is accurate and complete is a prerequisite for effective use of health information for action. Standards act as the mediators between data and information use to help generate quality data that can be used for informed action. Within a HIS, standards need to focus on a range of diverse structural and process conditions ranging from definition of data elements, interoperatibility, reporting formats, reporting frequency to work practices. Good data quality and effective information use are mutually reinforcing and feed off each other in an iterative process needed to strengthen the use of information. However, while designing and implementing standards, representation and interpretation gaps need to be considered and addressed while trying to produce quality data that is usable. Figure 1 below summarizes this conceptual framework.
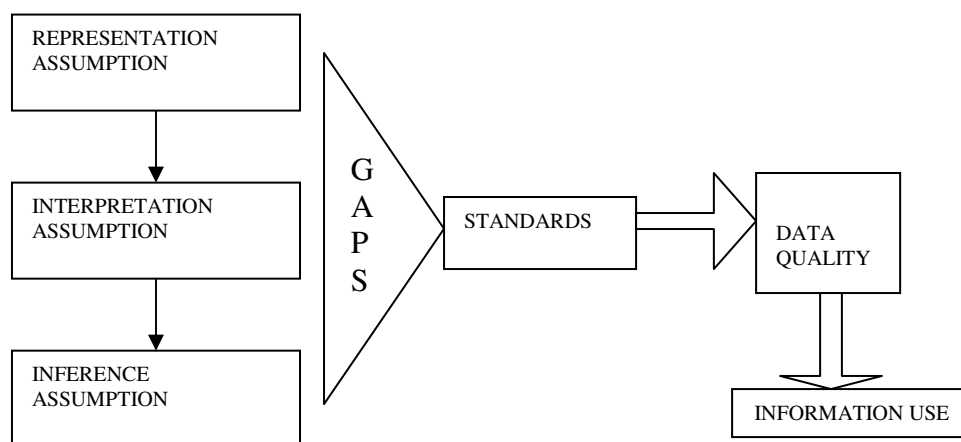
Figure 1: Conceptual framework showing the link between representation, interpretation and inference assumptions and its effect on data quality and information use.

To illustrate this framework with an example, data on immunization status in infants is commonly represented by a data element 'children fully immunized below the age of one year'. The health worker should be able to interpret this representation in order to perform the inference, to collect the correct data for this data element. Here there is an inference assumption that the health worker is aware of the significance of the term 'fully immunized'. In the Indian context, this represents a child below the age of one year who has received 3 doses of polio vaccine and triple antigen and one dose of measles vaccine before reaching the

age of one year. If, for whatever reason, she is not aware of this, or in other words, she is not well trained in the work practices represented in this term, a gap occurs between this representation and her interpretation resulting in incomplete or inaccurate data being collected for this data element. The work practice here includes understanding, besides the types of vaccine, the frequency of their administration, and the frequency of reporting. In real world practice, the health worker often writes down the same number for 'fully immunized' as for 'children immunized against measles'. As measles is the last vaccine given in the series, she often makes a faulty assumption that immunizing against measles is equal to full immunization.

By illustrating this theoretical linkage through our empirical evidence, we also seek to develop practical improvements to data quality. We now discuss our research methodology.

3. METHODOLOGY

Health Information Systems Program, India (HISP India) is a non profit society engaged in the implementation of public HIS in several states and at local level (sub districts) health departments since 2000 in India. This initiative is part of the larger HISP global R&D network around HIS initiated by the Department of Informatics, University of Oslo since 1994 and currently ongoing in various other countries in Africa and Asia. (for further details about the HISP initiative refers to Braa et al 2004).

The empirical basis for this paper is drawn from various action research projects where the authors work 'with and for' the state governments in developing and implementing HIS. The action research approach adopted helped us to engage with local users and acted as a means to generate knowledge, including around issues of data quality such as creating standards for what data and how should they be collected. Action research necessarily involves continuous negotiations with the participants and their 'competing agendas,' and tries to address the 'theory-practice' gap by finding useful and meaningful solutions for the practitioners (Meyer, 2000). This research approach helped us to build relationships at different levels of the health system, and gain access while simultaneously enrolling the participants into taking ownership of the systems.

The empirical material is taken from case study sites located in the 5 Indian states listed above. HISP India started with a pilot implementation in Chittoor district of Andhra Pradesh in December 2000 and later at the district level in all the 21 districts of the state for over 5 years. In 2003, a sub district level pilot was also run in Bangalore district in Karnataka state. In 2004, a pilot implementation was started in Trivandrum district in Kerala and now that work has been expanded to also include the district hospitals. In early 2006, we started a pilot in the districts of Valsad in Gujarat and Lohardaga in Jharkhand. On successful implementation of both these pilots, HISP India has since scaled up to 4 more districts in Gujarat and 11 districts in Jharkhand. Uttaranchal state is not currently in the action research group, but in 2005, the authors had the opportunity for doing a situational analysis of the HIS in that state as a part of a study for the Health Metrics Network.
The authors are fully involved in the process of implementation of various HISP processes including developing minimum data sets, customizing software to local needs, conducting capacity building activities, and engaging in gaining political support for the efforts. The authors have thus taken on multiple roles in various states to different degrees such as of political brokers, software developers, trainers, and informatics and public health experts. These roles have together contributed to the customization of the generic software District Health Information Systems (DHIS) for the local situation, and to embed in the local context. As a result of this depth and breadth of involvement over the last 6 years, the authors

have access to officers at all levels of the health system from the Health Commissioner who is the head of the health services, to the state and district administrators, medical officers, and grass root level health workers. The authors thus become both insiders and participant observers in this process, both understanding the problems (such as relating to data quality) as external researchers, and also responsible as part of an internal departmental team to make improvements to these problems.

4. RESEARCH CONTEXT

4.1. Health sector context in India

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	State/Nation	Health Sector context
1	India	Population 1 billion plus Per capita income: Rs. 25,716 (2005-06)[1] 26% population below poverty line Birth Rate: 23.8 per 1000 population Infant Mortality Rate: 58 per 1000 live births
2	Andhra Pradesh	Population: 75 million Birth Rate 19.1 Infant Mortality Rate: 57 23 districts
3	Jharkhand	Population 21.8 million Birth Rate 26.8 Infant Mortality Rate 50
4	Gujarat	Population 50 million Birth Rate 23.7 Infant Mortality Rate 54
5	Kerala	Population 30 million Birth Rate15 Infant Mortality Rate14
6	Karnataka	Population 45 million Birth Rate 20.6 Infant Mortality Rate 50

Table 1: Health sector context in the case study sites[2]

Though there have been impressive public health gains in India, mortality and morbidity is still unacceptably high. Some of the health problems are (re)emergent malaria, tuberculosis, HIV/AIDS, water borne diseases, nutritional deficiencies and other non communicable diseases such as diabetes, cancer and cardiovascular diseases. The per capita public health expenditure is about Rs.200 (USD 5). Another problem peculiar to the Indian system, is the inequity in health parameters between rural and urban areas and also between the better and lower performing states (Indian National Health Policy, 2002). Table 1 above summarizes the health sector context in the 5 states where HISP is operating. Infant Mortality Rate points to the health and development levels of a country. In 2004, UNICEF has calculated the IMR as

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[1] Ministry of statistics, Government of India, http://www.mospi.nic.in/stat_pr.htm

[2] Birth Rate and IMR from SRS (Sample Registration System) Bulletin October 2006 Vol 41 No.4 from http://www.censusindia.net

5 in industrialized countries and 62 in developing countries[3]. The birth rate in developed countries is in the range to 8-11 births per 1000 population.

The population figures depicted above are representative of the massive scale of implementation in each of these states, including the efforts in trying to make improvements in data quality, for example, the implementation of data standards.

4.2. Public Health Systems in India

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                    ┌──────────────────────────────┐
                    │   Central Health Directorate  │
                    └──────────────────────────────┘

                       ┌──────────────────────┐
                       │ State Health Directorate │
                       └──────────────────────┘

         ┌──────────┐  ┌──────────────────────┐        ┌──────────────┐
         │ Supervision │  │  District Health Office │     │ Information  │
         │             │  └──────────────────────┘     │ Flows Up –   │
         │ Top Down    │                                │ Little       │
         └──────────┘      ┌──────────────────┐         │ Feedback     │
                           │  Primary Health   │        └──────────────┘
                           │     Center        │
                           └──────────────────┘

                        ┌──────────────┐
                        │   Subcentre   │
                        └──────────────┘
```
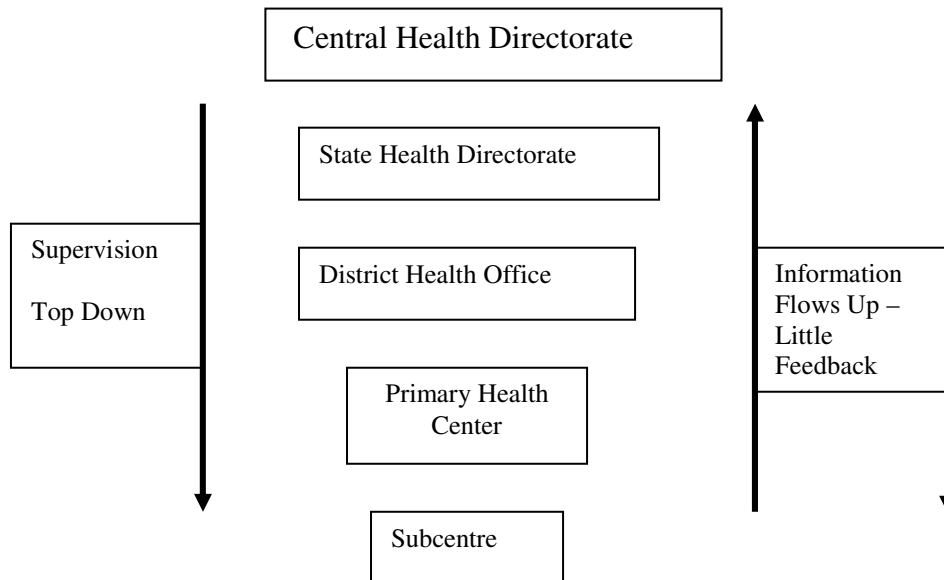
Figure 2: Supervisory levels of the health system and information flows in the system

In India, the public health care system is organized with a focus on the health district and is reportable to the state (provincial) and central (federal) governments. Figure 2 above shows a schematic representation of a typical supervisory level within the state health system and the corresponding information flows. The health workers work with the community at the village level covering an agglomeration of villages with a total population of about 5000. The health stations of these health workers are referred to as sub centres (SC). In turn, a cluster of SCs (typically 5-7) is monitored by and report to one mother primary health centre (PHC), which in turn reports to the district health office. The district health office reports to the state health department which in turn reports to the central health department. In general, the systems are directed top down, and information flows through bottom-up with limited feedback cycles.

5. EMPIRICAL OBSERVATIONS

5.1. Fragmentation of health data
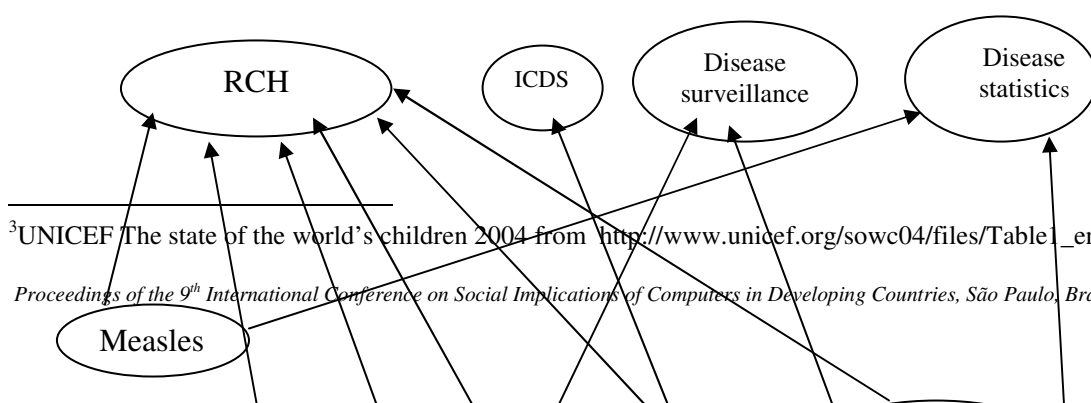
Figure 3. Fragmentation of child health information flows (ICDS: Integrated Child Development Services. ARI: Acute Respiratory Infections).

As with health systems all over the developing world, India too has several vertically driven health programs, including Reproductive Child Health (RCH), vector borne disease control (malaria, filaria and others), tuberculosis control, etc. Each of these programs thus 'stand alone' at higher management levels such as of the centre and state, and start to converge to a certain degree at the sub district levels where the health workers by default become a single point for data collection and service delivery for a whole set of health programs. The health staff at the SCs tends to be burdened by a large number of data collection tools serving different masters, often resulting in a situation of fragmentation and redundancies. To illustrate this with an example, we pick some parameters of child health information flows. Figure 3 above schematically depicts the fragmentation of child health information flows over different programs.

5.2. Report making or decision making?
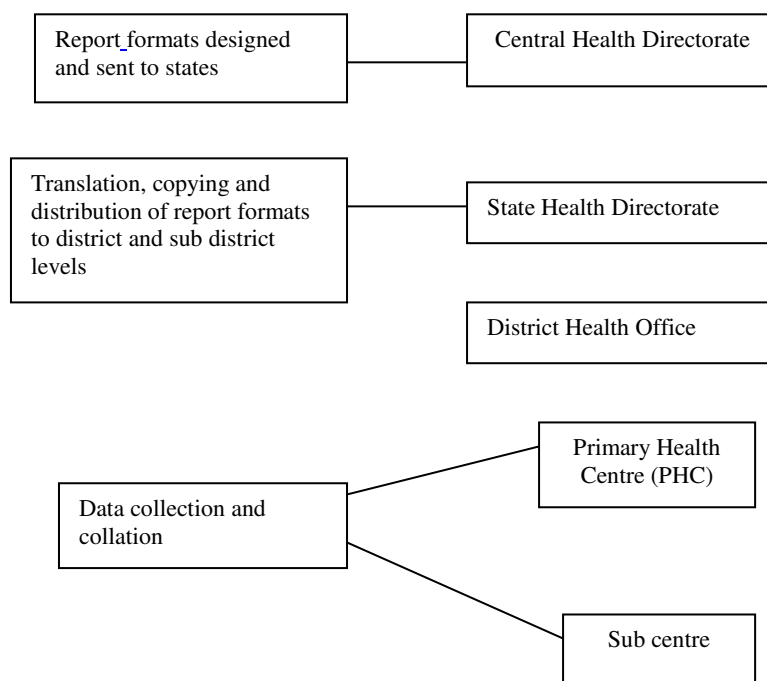
Figure 4. Work flow pattern across different levels of the health system for creation and use of reporting formats

As the health workers also have the responsibility for hands on health care delivery in addition to their significant data collection routines arising from the multiple programs they serve, it gives them little 'real time' or incentives for bothering about data quality issues. The lesser they use the data, the less is the meaning and relevance of these reports to them, with significant adverse implications on data quality. Despite this, due to the structures of bureaucracy, the reports themselves have a sacrosanct status, emphasizing aspects of form and ritual over content. Quality is undoubtedly a sufferer in this process, both with respect to its contents and also timeliness, with significant implications on its usability for action at all levels. The central health departments direct the states on what data needs to be collected and how much. Standardized printed formats for data collection are also given to the states by the central government for this purpose.

The typical reporting formats are printed based on national templates which are handed over to the states by the managers of various national programs. These in turn are translated, copied and distributed to the sub district levels where the data collected is filled in by hand for upward transmission again. To the health workers at the field level, this can translate to over twenty reports every month (for example Form 6 for mother and child health, reports for TB, malaria, communicable diseases etc). With the introduction of ICTs, attempts are being made by several governments with varying degrees of success to replicate the existing systems *in toto*, with little emphasis on creating information structures for effective data analysis and use. Figure 4 above shows the work flow pattern for reporting formats within the health system, and the two photographs (Photographs 1 and 2) below depict typical outputs, the first a paper format and the second its transformation through computerization.
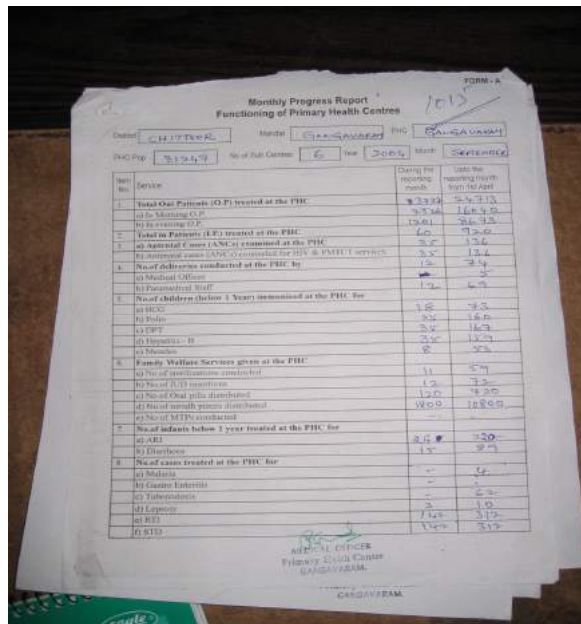
Photograph 1. Printed monthly progress report format filled by hand
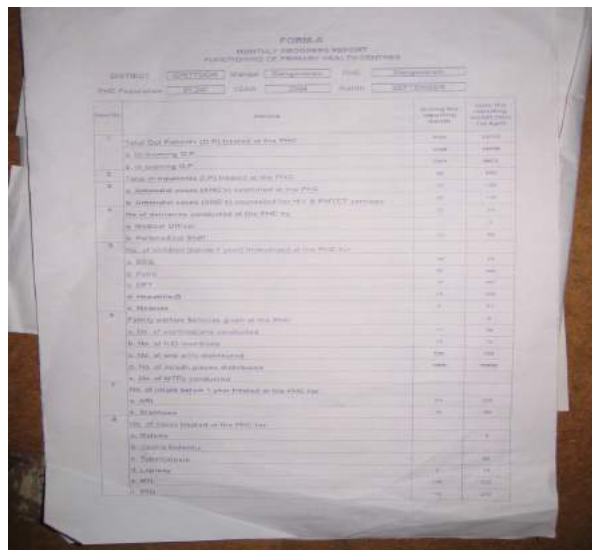
Photograph 2. The replicated computerized output of the same monthly progress report format.

The extent to which these types of outputs from the routine health reporting systems are made use of for policy making, planning and assessment is a moot point. Surveys such as Sample Registration System (SRS) and National Family Health Survey (NFHS) are conducted whenever there is a need for actionable data, disregarding and often replicating the data from the routine information systems. For example, the national health policy 2002[4] published by the department of health and family welfare, Government of India, uses SRS data for the assessment of Crude Birth Rate and Infant Mortality Rate bypassing the routine health data.

5.3. Data, data elements and data quality

Health data pertaining to women and child health is collected within the framework of the Reproductive Child Health program (RCH). Two of the data elements collected for managing

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[4] Available from http://mohfw.nic.in/np2002.htm

the RCH program are for prevention and treatment of anemia in pregnant women. The normal practice in antenatal clinics is to provide Iron and Folic Acid tablets (IFA) in packs of 100 tablets to every woman attending the antenatal clinic to prevent anemia of pregnancy and packs of 200 tablets to only such women attending antenatal clinics who have been diagnosed with anemia. Table 2 below shows the data collected under each of the columns in Figures 5 and 6. Figure 5 below shows part of Form 6 sent from the SC to the PHC levels. Figure 6 below shows part of Form 7 sent from the PHC to the district levels with aggregated data for the RCH program. The data elements in Figures 5 and 6 pertain to the data for prevention and treatment of anemia in pregnant women.

S. no	Description of Data element	Performance during same month Last year	Performance during the reporting month	Cumulative performance unto same month last year	Cumulative performance unto reporting month	Targets for current year

Table 2: Data collected under each column in Figures 5 and 6

| 1.5 | उन गर्भिणी महिलाओं की संख्या जिनका रक्त की कमी का उपचार किया जा रहा है | 0 | 2 | 0 | 2 | | |
| 1.6 | उन गर्भिणी महिलाओं की संख्या जिनका रक्त की कमी का उपचार के लिए रोग आई एफ ए दी गई | 0 | 21 | 0 | 21 | | |

Figure 5. Part of Form 6 from the RCH Program: Transmits data from sub center to PHC.

| 1.5 | उन गर्भिणी महिलाओं की संख्या जिनका रक्त की कमी का उपचार किया गया | 0 | 85 | 0 | 85 | | |
| 1.6 | उन गर्भिणी महिलाओं की संख्या जिन्हे रक्त की कमी के लिए आई एफ ए दी गई | 0 | 98 | 0 | 98 | | |

Figure 6. Part of Form 7 from the RCH Program: Transmits data from PHC to district (aggregated data from all sub centers under this PHC).

The above form, a data collection tool provided by the state RCH office says '*un garbhini mahilaaon ki sankhya jinkaa rakt ki kami kaa upachar 'kiya gaya' (row 1.5).* This translates to: number of those pregnant women who have (already) been treated for anemia. Now the next row 1.6 says *'un garbhini mahilaaon ki sankhya jinhe rakt ki kami ke liye IFA di gayi'* which translates as 'number of those pregnant women who have received IFA tablets for treatment of anemia.' The second data element is inherently ambiguous as it does not differentiate whether it refers to 100 or 200 IFA tablets or to prevention of anemia. When we explored further, the corresponding data elements sent in English by the centre were 'Pregnant women given prophylaxis (prevention) for anemia'(corresponding to row 1.5) and 'Pregnant women given treatment for anemia' (row 1.6). In the Hindi translation, both data elements used the phrase 'treatment of anemia' while the second data element also used 'IFA tablets' without differentiating between 100 or 200 tablets. The translation of these sentences into Hindi results in a lack of clarity as to which of these refer to prevention and which to the treatment of anemia.

As a part of our empirical observations, these two data elements were presented to a health worker who actually collected the data. He replied that since the reading was not clear, he just

decided to fill the first one with the data for treating anemia and the second one for prevention. A district RCH officer who was presented with this conundrum interpreted the first data element as prevention and the second for the treatment of anemia. The state RCH officer did not seem to have the concept of treatment and prevention of anemia and asked her assistants to explain it to her. This was not followed by any decision on the action to be taken at the state level for correcting this anomaly, as it was seen to be the mandate of the national government and not theirs.

6. ANALYSIS

In this section, based on our empirical experiences, we develop some analytical themes around data quality issues.

6.1. Lost in translation

India has 23 official languages with each state having its own distinct official language. Communications from the central government are sent in Hindi and/or English, while English tends to be the de facto standard for communicating between several non Hindi speaking states and the centre. New data collection tools created by the central Ministry of Health are typically sent to the states in English where they are translated locally into the state's official.

language for subsequent distribution within the state health systems. The degree of comfort with the English language varies from rural to urban areas, from state to state and with different levels of formal education. Further analysis of the empirical data using the example of pregnant women treated for anemia showed a wide range of translations. While the meaning of the two data elements were completely "lost in translation" in one of the states, there was varying degrees of ambiguity in meaning in several other states. Table 3 below gives a detailed comparison of the variations in translations of the two data elements pertaining to anemia of pregnancy in different states.

Agency (States named in random order)	Data element for anemia prevention in ANCs*	Data element for anemia treatment in ANCs	Degree of ambiguity	Comment
Central government	ANCs given prophylaxis for anemia	ANCs given treatment for anemia	Clear Assumes reasonable knowledge of English	The two data elements are almost identically worded except for the concepts of 'prophylaxis' and 'treatment'.
State A		1.number of those pregnant women who have (already) been treated for anemia 2. number of those pregnant women who have received IFA tablets for treatment of anemia'	High Ambiguity – difficult to decide which data element goes to column 2 and which to column 3	

State				
State B	Number of pregnant women given 100 IFA tablets	Total number of ANCs under treatment for anemia	Less ambiguous Assumes tacit knowledge of treatment and prevention work practices	Non standard terminology First data element refers to number of tablets Second data element refers to treatment of anemia
State C	Number of pregnant women given prophylaxis for anemia	Number of pregnant women under treatment for anemia	Clear Assumes reasonable knowledge of English	This state has the highest literacy rates in the country. Health workers comfortable with English Original data elements retained unchanged.
State D	Pregnant and lactating women who have been given iron folic acid tablets for preventing anemia	Number of pregnant women who are treated for anemia	Less ambiguous	Non standard terminology First data element refers to Iron Folic Acid tablets. Addition of lactating women Second data element does not.
State E	Antenatal cases receiving Iron and Folic Acid tablets for preventing anemia	Antenatal clients under treatment for anemia	Less Ambiguous	Non standard terminology First refers to type of tablets Second data element refers to treatment of anemia

Table 3: Comparison between the data elements referring to prevention and treatment of anemia in ANCs in several Indian states. (ANC: Antenatal Client)

6.2. Multiple terminologies

Continuing with the same example, we decided to examine in detail the terminology used for the data elements for the prevention and treatment of anemia in the 5 states. In the format sent by the Government of India in English, the first data element refers to pregnant women who are given IFA tablets to prevent the onset of anemia and it is worded as 'Pregnant women given prophylaxis for anemia'. The subsequent data element refers to those pregnant women who have been detected with anemia and are being treated for it with a higher dose of IFA tablets. This is worded as 'Pregnant women given treatment for anemia'. The terms used here assumes a level of tacit knowledge in the users by equating 'prophylaxis' with lower dose and 'treatment' with higher dose. We also noticed that the order of these two data elements also varied from state to state, with one or the other of them being placed first. While some states used the words prevention and treatment, others used the number or type of tablets given for preventing (prophylaxis) or treating anemia. Quite often it was a mix of both. The data element also assumes that 'treatment' is given to women with established anemia of pregnancy, at the same time not making clear the definitive standard for diagnosing anemia in these women such as whether it is a clinical diagnosis, or based on the levels of Hemoglobin for defining anemia and the trimester of pregnancy in which it was detected. This can result in either under or over diagnosis of anemia and consequently data collected on anemia of pregnancy can be unreliable. When these defective data are analyzed to make actionable decisions, it can also lead to the larger problem of inadequate management of the anemia of pregnancy in the community.

6.3. Too many bosses

The multiple vertical programs directed by the central government, converge at the point of data collection placing a large burden on the health workers at the local levels, contributing to redundancies and to data fragmentation. Following up on our earlier observations, we analyzed how the same data elements pertaining to anemia were represented in different reporting formats across programs in *one* state. It was not a surprise to find that the same data element being collected across programs within the same state also used varying terminologies. While 'treatment' and 'therapeutic' were used interchangeably, an additional condition of preventing malnutrition was brought into one of the forms. While some forms mentioned 'big' and 'small' tablets, others did not mention the size or number at all. In some feedback meetings attended by the authors, it was observed that several health workers, who are primarily responsible for registering such data, did not clearly understand the meaning of many of these terms and were using them interchangeably or randomly. The presentation of these data elements in these multiple guises and the ambiguities in meaning resulting there from can result in wrong data being entered against these data elements. Table 4 compares the data elements used for anemia across different reporting formats within the same state.

Name of the form	Data element 1 for treatment/prevention of anemia	Data element 2 for treatment/prevention of anemia	Comment
Form 7 (RCH)	Pregnant and lactating women who have been given iron folic acid tablets for preventing anemia	Number of pregnant women who are treated for anemia	Less ambiguous Key words 'prevention' and 'treatment' used
Maternal and Child Welfare Progress Report	Details of beneficiaries who have received big tablets of iron and folic acid for preventing malnutrition and anemia a. pregnant women .		Contradictory terminology? 'Big' iron and folic acid tablets usually given for treatment of anemia New word 'malnutrition' introduced
Stock report	IFA Big Tablet	IFA small tablet	
National Child Survival and Safe Motherhood programme monthly district report	IFA tablets Prophylaxis	IFA tablets therapeutic	New word 'therapeutic' introduced Form in English
RCH outreach services progress report	Women receiving IFA tablets		Ambiguous

Table 4: Comparison between the data elements of anemia across reporting formats within the same state.

6.4. How does the data speak?

In Figure 5 which shows the data being sent from a single SC, the number of ANCs given treatment for anemia forms roughly 10% of the number of ANCs treated for anemia (2/21). Paradoxically, in Figure 6, showing the collated data from all the SCs under the PHC, the number of ANCs given treatment for anemia constitutes almost 85% of the ANCs (85/98). From a public health perspective, if we assume that the aggregated data at the PHC level is valid, then it appears that some of the SCs under the PHC must have a high number of ANCs

with anemia and would require investigations into its causes and for planning actions to address the same. It is however, difficult to assume this as the inherent ambiguity in the terminology of the data elements (as described in Table 5) could mean that the data could have been interchanged at several SCs resulting in an unusually high proportion of ANCs with anemia. Also these data elements do not define clearly the cut off point for diagnosing anemia in ANCs and this could again result in the entry of non valid data. If data of such poor quality is used for decision making, it can impede health care delivery at local levels as it provides misleading information. Since these data are aggregated for use at higher levels of the health systems, they also hamper policy making at the national and state levels.

As illustrated in the empirical work above, while health data is visible and 'in your face', it cannot really serve the purpose for which it is meant, that of producing 'usable' information unless it is of a quality that merits use. In the last section, we draw upon our theoretical framework presented earlier to discuss the link between data quality and usable information, and the role of standards.

7. DISCUSSION

7.1. Closing the gap

Our empirical experience led us to see many gaps between representation and interpretation in the design and implementation of standards that affected data quality. In trying to address these gaps in our empirical setting, the actions of championing the importance of data quality by the management and managing people stood out as being particularly relevant. Though the end product of a data element or a data set that is used for data collection looks simple, the underlying processes and work practices are complex, requiring high levels of commitment to address them in terms of management responsibilities such as policies for data quality, and personnel management including training and motivation (Wang et al, 1995). In the hierarchical Indian setting, a mandate received from above to manage data quality was seen as unassailable and resulted in quick action from health managers at all levels of the system. The recognized action was to train and motivate the data producers on data quality and on the impact of poor quality data on information use.

For the purpose of this discussion, we therefore modify the conceptual framework described above (see Figure 1) by including these two elements. Figure 7 shows the redefined framework. In addition, we also suggest some practical steps that can be taken to improve data quality.
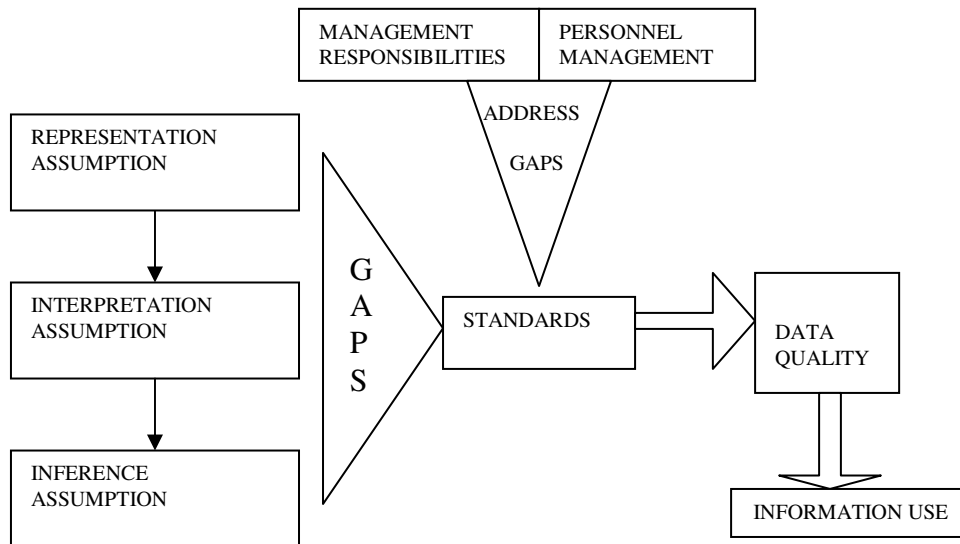
Fig 7: Improving data quality by addressing gaps in the assumptions

The reporting formats designed by the central government assumes a certain representation transformation of the real world system starting from the use of English language as the communication medium, and the assumption that it is in an usable form for the states for data collection. These formats however at the state level undergo an interpretation transformation, making many issues to be "lost in translation". An example is discussed above, where the central government sent (what they thought) clear representative data elements for prevention and treatment of anemia in English to the states, where they were interpreted in varying ways. With little support from the center to enable an effective interpretation translation, and almost no mechanism to promote local use of data, ineffective inference translations were made at various levels. Ambiguities in definitions, the use of multiple terminologies, errors in translation, limited field application and thus few attempts at "ground truthing," all contribute to the complex set of problems around issues of data quality.

Further magnifying these problems is the hierarchical structure of the Indian bureaucracy, where decisions of superior officers tend to be accepted without question. The metaphorical and physical distance between Delhi (where standards are formulated) and the field arena, where they need to be implemented, is too huge, creating large gaps between representation and interpretation.

Clear data definitions, to enable both effective representation and interpretation, well structured work practices with clear responsibilities and accountabilities, are basic ingredients we argue to develop workable standards that can potentially lead to good quality data and improvements in information use. Table 5 below illustrates this process using the example of the data element 'children fully immunized'.

Representation	Children fully immunized below the age of one year
Interpretation	Number of children below the age of one year who have received one dose of BCG at birth, 3 doses of OPV and DPT and one dose of measles before the age of 12 months at intervals of not less than one month.
Inference	The user is aware of the above description and sees that all these criteria are met before the number is counted for data entry
	Work practices:
	The data is collected every month
	The data is analyzed every month to assess her own progress
	Cold chain maintenance for preserving polio vaccine
	Maintaining tools such as immunization card
Gap	Health worker is often not aware of the interpretation or the work practices.
Address Gap	Management driven training

Table 5. Representation, interpretation and inference assumptions of a data element and its management.

7.2. Practical implications

In this section, we discuss some practical implications arising from this study, specifically around the issues of management responsibilities and personnel management.

Currently all the state governments use a large number of data elements, sometimes up to a thousand, making it cumbersome to bring improvements. Ideally these numbers should be reduced to a 'minimum data set' by restricting them to only those that are usable at each level, for example, those used for the calculation of indicators. However, making such changes is a highly political process, requiring continuous negotiations between the "owners" of the different data sets and data elements. However, as the case of South Africa illustrates (Braa and Hedberg 2002), with a strong political will, this can be achieved, but not in the short term. In addition to the political will, there are mechanisms that can be put in place such as the creation of a data dictionary, with standardized terminologies, and concepts carefully defined in operational terms and consistently applied'(Shrestha and Bodart 2000, p.138). The meta data articulated in the data dictionary becomes a powerful mechanism to align the data used in

the different formats, and also provides an evaluation framework while discussing the introduction of new data items. The description of the data element 'children fully immunized' in the Table above gives an example of how a data dictionary can be developed.

The national and state health management needs to put a clear data quality policy in place, where protocols are set up for managing data quality at all levels of the health system. Another key facet of this policy is personnel management.

The case studies described above raise the important question of whether the health workers are able to clearly understand the data that they are expected to collect. The processes supporting standardization have to be reinforced through extensive and continuous training and education efforts. The health workers and the medical officers of the PHCs who are the primary data collectors, have to be trained in identifying and correcting poor quality data, in the use of the data dictionary and in developing uniform work practices around data registration, conducting validation checks, and steps to be taken when data quality violations are identified. Finally, incentives need to be established to promote the local use of information.

In Gujarat state, as the HIS reform process threw up the gaps in assumptions, the Commissioner of health requested that training and education efforts for the medical officers and health workers be put in place to try to build up awareness of data quality issues. Currently these programs are being successfully implemented and are being enthusiastically received by the health personnel. Policies that set up protocols for monitoring data quality on a regular basis are also being designed and implemented. Photographs 3 and 4 show the medical officers being trained on data quality at Gujarat.

In summary, HIS reforms in developing countries currently tend to focus on computerized replications of existing 'bad' systems. Instead, we argue the system should focus on issues of usability, keeping the link of data quality, standards, and use of information as the center of the design and implementation efforts of these systems. The concepts of representation, interpretation and inference translations are important mechanisms to achieving these efforts.

Exploring the gaps between the representation and interpretation in the design and implementation of the existing HIS during HIS reforms will help to strengthen them by formulating strategies to address them. Strengthening these processes at the earliest stages of a ICT based HIS reform enables the development of an action led HIS rather than perpetuate a data led one. This can also support optimal utilization of scarce resources in these countries.

Photograph 3. Medical Officers being trained in recognizing data quality problems with their own data
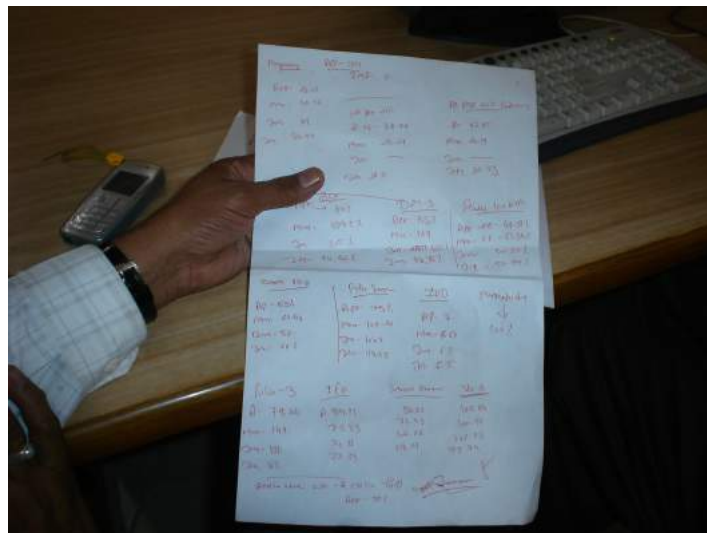
Photograph 4. Data quality errors detected and tabulated by a trainee working with his own data

Acknowledgements

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Social Inclusion and Sociability: Egypt and the Digital Divide (Exploratory study)

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Abstract:

The paper discusses the assumptions underpinning the twin notions of digital and social inclusion in relation to the Egyptian ICT for Development Initiative and specifically the Information Technology (IT) clubs programme and its predecessor the Technology Access Community Centers (TACC). It is argued in the paper that simply providing access to the internet and information and communication technologies (ICTs) to bridge the digital divide and realise social inclusion for the marginalized and under-served communities in developing countries in spite of its importance is insufficient. It is concluded that the notion of the digital divide is informed more by economic paradigms than the social reality within communities and that issues of sociality do not necessarily coincide with increasing flows of information as described in the existing literature.

Keywords: Digital divide, social inclusion, social capital, IT clubs, Egypt

Social Inclusion and Sociability: Egypt and the Digital Divide (Exploratory study)

1. Introduction

For many, the rise of information and communication technologies heralds the advent of an information and, more recently, a knowledge society. What such a society might mean remains unclear, but the promise of ICTs brings with it a concern about those who are not included. That disquiet has been expressed as an emerging digital divide though how such a divide is recognised has shifted both in terms of which technologies are involved and in who are seen as excluded. For developing countries, these issues are even more salient. The information qua knowledge society is presented as a mode of development in which the abilities of ICTs are married to an educated population to produce new forms of economic activity, which can be traded in an emerging networked society. Equally, the plight of the excluded is starker in developing countries with highly skewed distributions of limited economic wealth. Is it possible for those, graphically described as a 'fourth world' by Manuel Castells, to have their circumstances transformed by prospects of a knowledge economy? Ambitious programmes from international and national agencies are engaged in developing ways to bring people marginalised by the advent of ICTs to become capable of using these technologies. Though it could be argued that it is very early to assess (and learn from) these emerging programmes, it appears that many have run into problems. This paper seeks to analyse why such programmes are not working as expected based on revisiting the assumptions underpinning the twin notions of digital and social inclusion in Egypt. It begins by analyzing moves that conceptualise the digital divide as one of technological access and how that position leads to arguing that the market is the answer to bridging digital divides. In the next section, the importance of sociality is affirmed through the notions of social capital and social inclusion. The examples of the Information Technology (IT) clubs initiative and the Technology Access Community Centers (TACC) in Egypt are used to show that issues of sociality do not necessarily coincide with increasing flows of information.

2. Digital Divide as Connection to the Internet

Recognition of a digital divide arose in the mid-nineties and was predicated on the presence or absence of information technology and a connection to the internet. By 2001, figures from the US showed that digital divides were decreasing except for those based on ethnicity (Castells, 2002; NTIA, 2000). In 2003 the penetration rate of internet access was 54% of all US households with the rate of connections slowing, so that in the previous two years only 4% more households were connected compared with 9% in the year before that (NTIA, 2004). Castells (2002: 254) comments that, in the US, the digital divide '… *in terms of access to the internet, will be mainly the concern of the poorest, the most discriminated segment of the population*' seems overambitious. It appears that the slowing down of internet connections will leave a larger section of the US population without access for some time to come. Some of the optimism of a rapid diffusion of internet access was replaced by concerns about the emergence of another digital divide between those with high speed access and those with dial up connections. For example, in 2003 only 20% had broadband access in the US though this figure was rising rapidly (NTIA 2004). These connections correlate with social grouping with households in urban areas and those with high incomes being most likely to have broadband access (Turner, 2005).

Graphs of cumulative figures for internet connections are commonly presented in comparison with historical figures of the adoption of other 'comparable' technologies (see figure 1) (DTI, 2005; OECD, 2004). A common inference is that the uptake of digital technologies will follow other technologies. As a UK report of the Department of Trade and Industry puts it: '[o]*verall differences in inclusion will tend to be self-correcting … a key question is therefore how long it will take the market to reduce difference in terms of inclusion to near negligible levels'* (DTI, 2005: 14). The OECD argues that the digital access divide is slowly reducing and that '[d]ifferences are increasingly linked to unequal use, and the digital divide is progressively shifting from a simple and slowly reducing "access" divide to a more complex "use" divide. The Internet amplifies social differences as new uses emerge. This suggests that attention should increasingly be paid to "how to use" issues' (OECD, 2004: 8-10).
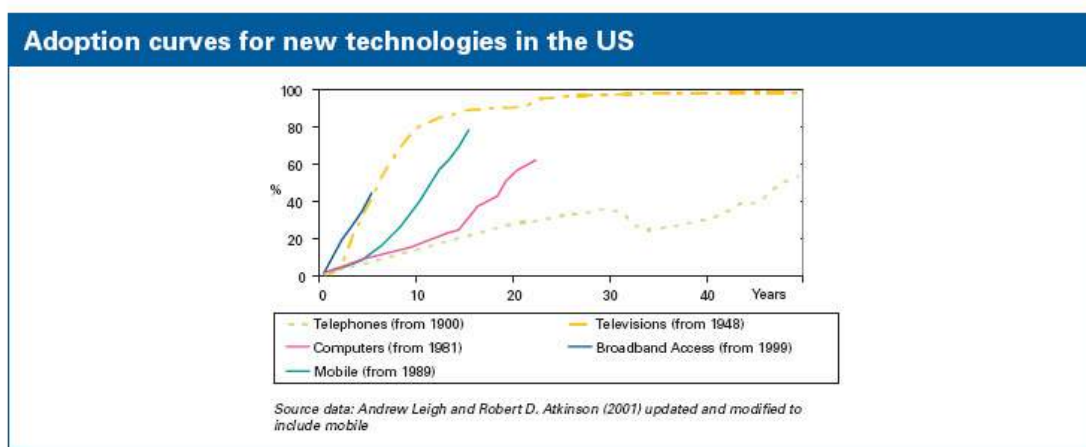
Figure 1: Adoption curves for new technologies in the US (from DTI, 2005: 14)

Thus, in contrast to Strover's (2003: 275) critique that ''[t]*he digital divide has been a symbolic banner of politicians and corporate largesse insofar as it substituted for more direct action against inequalities of income, education, and race'*, some governments now view the digital divide as a problem that will resolve itself over time through the mechanism of the market.

When it comes to developing countries, there are two distinct arguments at play. The first follows the views above as a recent report from the World Bank (2005) argues that the digital divide is 'rapidly closing' and that, if digital access is defined as access to a mobile phone then this has been reached by over 50% of the world's population and that nearly 50% of the world's population have access to a telephone land line (World Bank, 2005: 11). The way to enable increasing digital inclusion is to remove telecom monopolies and enable competition, which leads to lower internet connection costs through either mobile or fixed lines. The second more common position, recently endorsed by the creation of a Digital Solidarity Fund, is that the roles of national governments and local administrations are central to the bridging of a digital divide (Digital Solidarity Fund, 2005). For example, action on bridging an emerging digital divide has been fundamental to the World Summit on the Information Society (WSIS). WSIS, which is sponsored by the UN and the International Telecommunications Union, has held two meetings: one in Geneva in 2003 and the second in Tunis in 2005 and emphasises the key role of countries taking and co-ordinating action on bridging a digital divide (WSIS, 2003).

Both these arguments can be seen as end points of a continuum between two ideal types - complete state provision on the one hand and total provision by the market on the other. In fact, in nearly every country today, state provision requires the engagement of the private sector, and the operation of companies requires the state to enable a market to operate by creating, at a minimum, the appropriate regulative environment. But there are important issues at stake here. If the digital divide is represented as the lack of provision of connections to the internet then it becomes easier to argue, as seen above, that just like the diffusion of other consumer technologies in the past, private companies, if given a competitive environment, will provide the appropriate products. Indeed, it can be argued that competition allows new products to emerge and challenge prior assumptions. For instance, the Economist, in a provocative piece (Economist, 2005; cf APC, 2005) proposes that the '*wand waving*' of providing local infrastructure such as rural telecentres ignores the real problem of how to best use technology to promote bottom up development. Instead, it argues that mobile phones are the technology that makes the largest impact on development and governments should move from providing top down IT infrastructure projects to opening up telecoms markets. Further government action then becomes unnecessary as '… *firms and customers, on their own and even in the poorest countries, will close the [digital] divide themselves*' (Economist, 2005: 3). These recipes have strong similarities to views on the role of the market and private enterprise in development, associated with the International Monetary Fund (IMF), the World Bank and the World Trade Organisation (WTO). Key points are trade and financial market liberalisation, reduced public spending, and removing barriers to foreign direct investment. Policies such as these have been instated in many developing countries usually on the basis of IMF stabilisation packages which place strict limits on government spending. Governments which do not comply can be seen as poorly managed and risk losing access to external credit from other donor agencies such as the World Bank. These policies are creating a crisis of accountability where governments' economic policies are seen as tied to IMF conditions and unable to respond to social conditions. As one policy analyst has put it '[w]*hat the IMF and World Bank are doing is effectively tearing the heart out of democracy; holding periodic elections doesn't mean much when a nation's economic direction is hammered out between the IMF, the central banks, and the finance ministries behind doors that are closed to voters*" (cited in Lobe 2005: 1).

It is suggested that what is at stake here is far more than fine academic distinctions about what counts as a digital divide. How a digital divide is defined has important political and economic consequences. By setting up a divide in terms of access to the internet, it has become possible to argue by referring to past innovations that the market can (and will) provide access so long as that market is liberalised. Liberalising developing economies allows access by multinational companies and agencies into economies that, by definition, are poorly organised, and do not have indigenous companies that are able to compete. Coupled with this unequal relationship, the technologies being established are imported and, very largely, will continue to be imported from other countries. It is difficult to avoid the conclusion that the introduction of digital technologies may lead to long term dependencies on Western technologies and thus entrench unequal economic relationships.

So, how can social concerns be returned as central issues in discussions and policies on the digital divide? One limited approach is to view digital inclusion as addressing groups that the market cannot reach. Put bluntly, for social groups where it is not profitable to provide digital access by private companies, the state should intervene and provide social provision. This approach is complementary to a marketisation of the state discussed above. However, it raises the question as to whether a more far-reaching analysis of the importance of social groups can be advanced. The concept of social capital and social inclusion is one very promising approach which we will now discuss.

3. Social Capital and Social Inclusion

The notion of social capital draws on what Portes (1998:2) calls ' … *the positive consequences of sociability while putting aside its less attractive features'*. Social capital refers to the social networks between people and their importance in creating and maintaining relationships. It is generated through a person's personal relationships and their membership of informal and formal social organisations. Social capital is seen as having equal importance as other forms of capital, such as financial capital and human capital in the form of skills and knowledge. Three consequences of social capital can be developed (Portes, 1998). First, it can act as a source of social control in which tight community networks render external controls unnecessary as compliance is enforced through bounded solidarity. This is akin to bonding social capital, discussed by Putnam (2000), in which dense social networks are inward looking and create social solidarity. A second function of social capital is as a source of family support where a richness of parental and kin relationships are seen as helping children. The final and better known function of social capital is as a source of networking beyond the family or tight communities in which connections are seen as furthering individual mobility. Putnam refers to this as bridging social capital where a wide network of weak social ties may be very beneficial in gaining access to, for example, job opportunities.

Social capital can also have perceived negative consequences: strong ties within a tightly knit community may equally exclude outsiders and social capital within a community may prevent members changing. Geertz (1963 quoted in Portes, 1998) gives the example of successful entrepreneurs being constantly asked for assistance by other family members and community members with the result that their economic expansion is checked. Close-knit communities may also seek conformity by exercising strong social control on their members and preventing people from expressing alternative viewpoints.

The notion of social capital is useful both in explaining the uptake or otherwise of the internet in different contexts and in considering whether the internet can develop peoples' social capital. Keil et al. (2003) describe the introduction of a free internet service in the town of LaGrange, Georgia, US and the unexpected result that after 18 months of the service introduction, the penetration rate was only 45% amongst households. Poorer areas had a much lower penetration rate though one explanation advanced was a lack of 'key' people who use word of mouth to pass on information. An after-school club was also important in boosting the rate of use of the Internet. A resident and after-school aide found that helping children learn how to use the internet was beneficial and a route for others to learn as well. As she commented, '*I am concerned about the people who don't have access any other way, especially the kids'* (Keil et al, 2003: 8). The presence in places of aspects of social capital, such as the benefits of informal organisations and social networks, appear to be of help in going beyond an explanation of poor economic circumstances.

That the use of the internet can lead to increased social capital has been shown in a study by Hampton (2001) cited in Warschauer (2003). He studied another free broadband internet access project in Toronto and found a 60% penetration rate. By looking at the characteristics of those who used the internet and those who didn't, he found that those who did use it had more extensive social connections both within the local area and with others further away. Conversely, it is also possible that use of the internet may restrict social relations to a small group of people on the net or may reduce the richness of interaction between people as online access replaces face to face contact.

The emphasis on sociality in the notion of social networks is a development from the simplistic notion of technical connection based on market liberalisation discussed earlier. Within the World Bank, there is also an important strand of thought that is promoting the importance of social capital and of institutions in economic development (see Babbington et al, 2004). Putnam (2000) identifies a decline in social capital and social engagement over a number of years in America and sees that a

re-engagement is necessary if the health of US democracy is to be developed and sustained. His intervention shows a need for social inclusion and the development of social capital as equally important to focus on other forms of capital, financial or human. Using the concept of social capital, Warschauer (2003: 9) argues new technologies are central to the ability to access, adapt and create new knowledge and suggests that the digital divide is not the important policy issue. Instead, it is the capability to expand access to and the use of ICTs that promote social inclusion. He proposes that more attention is needed to investigate the social relations and social context in which internet access is provided, and he suggests that these social structures should be used to help promote the use of technologies especially by cultivating local leaders and champions. Innovation and flexibility of response is also very important.

To sum up, the notion of social capital and the related concept of social inclusion are important in drawing attention to major deficiencies in policies that identify digital divides as lack of technologies to access the internet and which use either market based responses or large scale initiatives to increase connection rates. In contrast, existing social networks are shown to be very important and new technologies need to be introduced using the resources of existing social capital while seeking to provide access to sites that augment that social capital. To a large extent, the story told so far is one of 'the positive consequences of sociability' discussed above. However, the other side of the coin is that sociability equally has negative features in terms of aspirations to expand access to new forms of knowledge and information. These too are of importance in explaining ongoing difficulties in providing access and continued use of the internet, especially in non-Western societies where societal forms may have different and equally valid practices in how sociability and information interrelate. This point is illustrated using the Egyptian ICT for development initiative.

4. Research Method

To address the aim of the paper, the research adopted different methods for data collection. First, documents that addressed the objectives, history, and achievements of TACCs, and IT clubs in Egypt were reviewed. Documents were collected using different Web sites, publications of the Ministry of Communication and Information Technology (MCIT), and a copy from some of the materials that were available on the (TACC) web site. Second, six interviews were conducted, two face-to-face interviews with two key personnel who were involved in the TACC project and four interviews with selected IT clubs managers. The first interview was with Mr. Reda Helmy who was acting as the chairman of Sharkeya Chamber of Commerce at the time when the idea of establishing the TACCs was negotiated and implemented. The second interview was conducted with Mr. Essam Rizk, Zagazic TACC manager. Four telephone interviews were conducted with IT club managers in Sharkya governorate. Although IT clubs are spread all over Egypt, the paper focused mainly on IT clubs in Sharkya as it is the governorate where the TACC project was first introduced, as will be explained shortly.

5. ICT for development initiatives in Egypt

"The Millennium Declaration Goals feature heavily in the designs for development in Egypt, particularly within social, employment, and gender contexts. ICT initiatives have shown great success in addressing some of the development goals, such as empowering the poor through e-Access initiatives" (MCIT, 2007a).

Since its adoption of the Millennium Declaration, the Egyptian government has made significant strides towards achieving the Millennium Development Goals (MDGs). In line with MDGs, the Egyptian Ministry of Communication and Information Technology has implemented a number of programmes and initiatives to move the country into the information era and to increase the use of ICT for achieving developmental objectives. MCIT identified three pillars of development that form

the core of ICT development to address the Declaration Goals (MCIT, 2007a). The third pillar is what this paper is focusing at and it relates to information access at all levels in society and empowering the poor through access to information and communication technologies.

'Access for all' is one of the MCIT initiatives for development that aims at enabling all citizens to have easy and affordable access to the opportunities offered by information technologies, and bringing IT to disadvantaged communities to improve standards of living and the socio-economic conditions in Egypt (MCIT, 2007b). In this respect, MCIT has implemented a number of programs, such as IT clubs and the Mobile Internet Unit that is equipped with computers and travels to remote areas to provide access to technology.

These programmes are supported by a variety of organizations such as UNDP, the Italian Cooperation and Microsoft Unlimited Potential (UP) grants[i]. Spreading technology clubs has been taking place in different governorates in Egypt. By February 2007, the number of IT clubs reached 1487 and those connected to the internet 1162, distributed among 26 governorates (MCIT, 2007c). The interest of the Egyptian government in spreading IT clubs is, on one hand, in line with MDGs and, on the other hand, with what Kamal (2004) and Wijkman and Afifi (2005) described as the successful achievements of the Technology access community centers project in Egypt initiated in 1998 and the interest of the government in replicating the idea in different governorates.

5.1. Technology access community centers (TACCs)

Three technology access community centres were established in April 1999 in the Governorate of Sharkeya in Egypt (approximately 70 Km northeast of Cairo). Sharkeya has 15 cities, 82 villages and 4,492 sub-villages. It has an average population of 4,220,000 with unemployment of 119,000 of its graduate inhabitants. Illiteracy is high among women, children and the elderly in Sharkeya's villages and sub-villages (Afifi, 2005).

The project for establishing the TACCs was co-funded by the United Nations Development Programme (UNDP) under a special programme known as Information Technology for Development, and by the United Nations Volunteer (UNV) programme. Egyptian partners include the Egyptian Cabinet Information Decision Support (IDSC), the Governorate of Sharkeya, the Chamber of Commerce, and the Investors Association - 10th of Ramadan City. The project was envisaged to run for two years then it was extended for another year. The project was implemented by the Regional Information Technology and Software Engineering Center (RITSEC)1. The Project included the establishment of three TACCs, 'ECOITEC' in the Chamber of Commerce to serve both commercial and public sectors, 'INFTEC' at 10 Ramadan city to serve both industrial and public sectors, and 'TACC' at Zagazig city which serves different community sectors such as traders, doctors, farmers, and students.

TACCs aimed at providing rural and remote communities in Sharkeya with affordable public access and connectivity to information communication technologies and, in particular, the Internet. The project also meant to offer a number of training programmes and skills enhancement for using ICT and assisting low-income segments of the community in accessing information regarding local services and recreational and educational information (Afifi, 2005). The proposed project was thus designed with the ultimate goal of empowering community members through the use of ICT for a variety of applications for benefiting human development (Hashem, 1999). A website was developed for the TACCs that provides information related to health, education, agriculture, and e-commerce.

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[1]RITSEC aims at promoting ICT in Egypt and the Arab region.

Within the limited literature available on the TACCs project in Sharkeya, which was mostly written during the funding period of the project, and from interviews conducted, the performance of these centers was praised mainly in terms of the number of users who received IT training and the number of web pages that were developed in Arabic (Kamel, 2004, Wijkman, and Afifi, 2005). However, by the end of the funding period, these TACCs couldn't sustain their existence and their website, which was praised on different occasions, is no longer available. One of the reasons behind that, as described by the interviewees who were involved in the project, is attributed to the spread of internet cafés which were not as many as they were when the project started. Mr. Essam explained that the project was offering a variety of services, for example training courses, both advanced and basic ones, access to computing facilities and to the internet which was still, by the time the project started, new to the community. He added that the project was also supported with committed staff who were highly paid. When the funding period of the project ended, the staff left as they were highly paid and the hosting organizations couldn't afford their wages. Some of them opened their own internet cafes later.

Assessing the performance of the TACCs is beyond the scope of this paper, but the argument made here is related to the basic assumption underpinning the notion of TACCs which is also reflected in a number of similar initiatives taken by MCIT, that securing access to technology and the internet will make information available to the public that can improve livelihoods and realize social inclusion. For example, according to Hashem (2001:2) *"Telecenters are playing a vital role in bridging the digital divide in Egypt. They provide wide community access to computers, to the Internet, to professional expertise and skills development. They also host a variety of training programs, and act as a local focal point for information content development. Tens of thousands of individuals are benefiting from such telecenters on a regular basis. This leads us to believe that telecenters may be instrumental in the digital inclusion of developing communities".*

The idea of the free flow of information expressed above assumes that through bridging the gap between those who have and those who have not, those who are excluded will become more involved within their own communities. However, it is argued in this paper that although the free flow of information is important, it is not enough to realize social inclusion and achieve developmental goals. This was emphasized by the IT club managers who were interviewed, and who agreed that there is limited use of the information made available over the internet for local and communities development. They stated that the most common use of the internet is basically for chatting, downloading music, and e-mail. Only students and researchers are those who are interested in searching for information related to their study.

In responding to the question of how for example peasants in Sharkeya are making use of the information available on the internet to improve their living conditions, one of the club managers stated *"peasants are not keen on getting information about new fertilizers or new irrigation methods in addition although the Arabic content available on the internet is increasing, information such as better prices and new markets for crops does not exist. Most of the peasants here are either selling their crops in local markets or to merchants whom they have been dealing with for years. The ones who might be interested in getting information for developing their agricultural methods as you are describing are big peasants who are working on a different scale and business level from the small poor ones".*

Another manager, whose club is hosted by one of the community development associations, explained that *"peasants are not interested in searching for information on the internet that is related to their work, even when the association organize agricultural seminars and workshops it is hardly attended by anyone and yet these seminars are still running. Every peasant has his knowledge and know-how and not willing to change it and see what others are doing".*

Another manager commented on the extent to which the information available on the internet, such as feasibility studies, can benefit someone who wants to start his own business and create a new work opportunity for himself: *"feasibility studies are not enough say the graduate has all the information he needs from the net, where can he get the money from. Although special funds are made available for youth and graduates it is not easy to get hold of these funds".*

In addition to what was mentioned by the IT clubs' managers, the relationship between availability of information and social inclusion can be further qualified specially in a country like Egypt where 'wasta' and social relationships and networks primarily regulate intra-societal allocation of resources. What is meant by Wasta and how it relates to the notion of social capital is discussed in the next section.

5.2 Wasta

"In the Middle East, a restricted job market and heavy competition for jobs understandably intimidate the young job seeker. One does not believe a job can be obtained without wasta assistance, and those with jobs to offer are eager to build up relationships with those of prestige who may in the future provide something in return. The economic uncertainties drive both employer and job–seeker to use the wasta system" (Cunningham and Sarayrah, 1993: 19).

'Wasta' is an Arabic term meaning intermediation or intercession. It denotes the person who mediates/intercedes as well as the act of mediation/intercession (Cunningham and Sarayrah, 1993). Wasta describes informal networks and relations that are based on friendship, or kinship that aim at the enhancement of the situation of the person seeking wasta[2]. It involves a protagonist intervening on behalf of a client to obtain an advantage for that client - a job, a government document, a tax reduction, admission to a prestigious university, licenses, a parliamentary seat, or other advantages and privileges. When many individuals are seeking the same benefit, only those with the strongest wasta are successful. Thus, succeeding or failing depends on the power of the wasta more than on the merits of the seekers: *"all things being equal, the stronger the wasta, the greater the likelihood of success in the plea. Since high-status people generally obtain the services of even higher status wasta, the system is skewed to those who already possess economic, social, and political advantages"* (Cunningham and Sarayrah, 1993:21).

Wasta, hence according to Palmer et al. (1989: 38), circumvents both the graduates policy and the examination process because unless you have a strong wasta it is less likely you will find a good job. According to Kilani and Sakijha (2002), Wasta is, first, a reflection of the phenomenon of dependence in society upon parents, friends, relatives and connections. Second, it reveals the lack of confidence the public has in state institutions and their ability to preserve and restore individuals' rights. If rights are usurped, it is Wasta and less so the judiciary system that can restore the right. When Wasta intervenes, the citizen is confident that he/she will get the appropriate respect they deserve. Finally, Wasta is inevitable so long as the system that supports it remains unchanged. The question now is how can access to ICT and the availability of information through the internet be of help to those who don't have access to Wasta?

One of the commonly cited examples for how access to ICT can be of help is in terms of employment. As stated on the MICT web site (MCIT 2005, 5-6), *"It is MCIT's conviction that knowledge of ICT will empower those without work and enable them to realize their full potential*

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[2] Similar to Wasta in the Arabic society, Guanxi exists in the Chinese society (see for example Luo, 2000, Xin and Pearce, 1996) .

and thus find gainful employment." It is assumed here that the selection and recruitment processes are treating all job applicants equally. However, as argued by Palmer et al. (1989:33), favouritism and wasta blunt the logic of merit-based recruitment and evaluation processes: *"Employee selection via wasta excludes those who do not have strong wasta; so a wasta based selection system does not treat each job applicant equally. However, given that wasta is central to Middle Eastern countries and can rarely be avoided in making or implementing a decision, facing up to wasta and acknowledging its presence and working with rather than against social pressures can achieve effective organizational performance"* (Cunningham and Sarayrah 1993: 181).

In such settings, it is difficult to assume that development and social inclusion through ICT and through access to information can be achieved in isolation from the political and social context in which it will be used, since they all act and interact, affect and are affected by each other. It is to the discussion of this point that we will turn in the next section.

6. Discussion

"Cyber-optimists believe that info-tech has become a vital engine of growth for the world economy enabling many enterprising firms and communities to address economic and social challenges with greater efficiency. In poor villages and isolated communities, a well-placed computer, like a communal well or an irrigation pump, may become another development tool, providing essential information about storm warnings and crop prices for peasants, or medical services and legal land records for villagers" (Norris 2001, 40–41).

According to Norris, Cyber-optimists support the positive impact of information technology on economic growth and overall quality of life. According to them, ICTs are crucial for achieving developmental goals and are regarded as one of the main mechanisms for creating market-level transformations. By providing a global infrastructure for communication and commerce and access to IT, developing nations can leapfrog to new stages of development. Such a technology-centric explanation for the digital divide, as the gap in the possession and utilisation of ICTs between the technology 'haves' and 'have-nots', has urged many developing countries to prepare and implement policies and strategies for the deployment of ICTs within their societies. For example, Egypt *"considers ICT training a national priority, as reflected in its inclusion in the national plan. The government has developed numerous training programs and formed partnerships with training institutes with the aim of developing ICT capabilities across the country. The key advantage to knowledge of ICT is that it allows people of any age or background to advance rapidly in their career, whatever it may be, while at the same time supporting national development"* (MCIT 2005, 5-6).

Policy solutions like those designed by MCIT to ameliorate the digital divide such as establishing technology access centers, delivering basic computer training courses, wiring schools and classrooms, tend to focus mainly on technology fixes as the medium for making information accessible on the assumption that such information can be transformed into digital opportunities in an emerging network society. For example, poor peasants, by having access to ICT and the internet, can get better prices and find better markets for selling their crops. This assumption of free flow of information for bridging the digital divide can be problematised on the base of the objectification of information from the practices and the context in which information can be applied and used as a resource. The example of peasants in Sharkeya emphasized this point and showed that although information can be made available through other media, such as workshops and seminars, 'how to use' information remains an important issue for the realization of social inclusion and development.

As argued by Warschaure (2003), the digital divide framework with the singular concentration on the computing devices and connectivity and the exclusion of other factors that allow people to use ICT, is a shortcoming of many well-intentioned social programs involving ICT for promoting social

development using technology. For Warschaure and other social impact scholars, the goal of using ICT by marginalized groups is not to bridge a digital divide by provision of equipment but rather to further a process of social inclusion through the effective integration of ICT into communities, institutions, and societies. One important mechanism for achieving that is through promoting social capital.

The concept of social capital has gained attention in global and local public agendas. For Putnam (1993), communities endowed with a rich capacity to form social networks are in a stronger position to resolve disputes, share useful information, and implement successful development projects. This understanding of the notion of social capital reflects what Portes (1998) calls 'the positive consequences of sociability'. The discussion of the notion of wasta in Egypt showed how social capital can operate in a different way than that assumed by Putman. The notion of wasta showed how social norms and personal affiliations in other countries do not work the same way as they do in liberal Western countries and how "social relationships can sometimes serve to exclude and deny as well as include and enable" (Field 2003:3).

In sum it could be said that access to computers, the internet and information is important but it can't directly lead to technological opportunities as there are other forces in play that result in having both beneficial and detrimental, intended and unintended consequences (Kvasny and Keil, 2006). Unless there are proper mechanisms to empower those with access to information to use this information and realise common benefits, these hopes for development can't be realized by simply giving assess to more information. This can be seen as one of the reasons why TACCs couldn't sustain their existence. According to Whyte (2000), the sustainability of telecenters at one level is inseparable from the information that flows through the telecenter. At another level, it depends on the way telecenters change the social exchange of information within a community to improve sociability and civic engagement, which seemed to have been missing in the TACC project and which MCIT needs to consider in relation to IT clubs.

7. Conclusion

There are calls by international organizations for widening access to technology in developing regions, asserting that there is a direct link between access to information technology and both greater economic development and better quality of life in poor areas. This claim has led to numerous ICT projects in a number of developing countries including Egypt. The Egyptian MCIT is supporting a number of initiatives to mobilize ICT for development and increase access to ICT in rural areas. According to the discussion in this paper, focusing on increasing technology outreach, although an important factor, is insufficient for realizing social inclusion and improving the quality of lives as envisioned. Focusing on the outreach fails to value the importance of information literacy and how to make use of information. Non-capital factors such as social capital and social relations are recommended as important mechanisms that can be of help in this regard. Nevertheless, taking the dimensions of social capital developed on the basis of research done in the western context and unproblematically seeking to use them in the contexts of other countries seems an optimistic one. The discussion of the notion of Wasta showed how social relations are functioning in a different way within the Egyptian context.

In conclusion, we can say that the digital and social inclusion of under-served and marginalized communities is not easily achieved by widening access to information and ICTs in developing countries. 'How to use' information is one of the challenges that has to be addressed before we can see the potential ICTs promise, particularly for achieving local development. More studies are still needed to explore the interrelationships between social capital and social inclusion in developing countries and the necessary transformations of state-society relationships in order to assure a process of dynamic social inclusion.

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A FLEXIBLE APPROACH TO INTEGRATING HEALTH INFORMATION SYSTEMS – THE CASE OF DATA WAREHOUSE AS INTEGRATOR IN BOTSWANA

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Abstract: The organizational complexity of health service provision is fairly high, given the many actors and the rapid evolution of both treatment methods and disease picture. Due to a dysfunctional health information system, the various actors in Botswana had created their own, independent information systems, leading to duplication of work and inaccessibility of data. This paper describes how the various actors of the Botswana health sector were brought together to work on health information systems integration through the development of a single, computer-based tool for collecting, processing, and analyzing data. This software, together with a set of shared routines that would save resources for the individual actor, became an *attractor*, an option that would create no losers, while all could win. Thus, for the first time, the fragmented network of health service providers could come together, an important first step in health information standardization.

Keywords: data warehouse, standardization, health information system, Botswana

A FLEXIBLE APPROACH TO INTEGRATING HEALTH INFORMATION SYSTEMS – THE CASE OF DATA WAREHOUSE AS INTEGRATOR IN BOTSWANA

1. INTRODUCTION

The main aim of this paper is to advance the understanding of theoretical concepts relating to complexity, derived from a study of the development of an integrated health information system in Botswana. Taking the existing fragmented health information systems as a point of departure, this study shows the complexity of the health services in the country. Complexity has been loosely defined as a product of the amount of different actors, the relationship between them, and the speed of change. In Botswana there are four ministries involved in providing health information systems, with sub-divisions of these also involved, each with different agendas. In addition, international organizations, such as UNAIDS, are present both as independent actors and partners of local initiatives. On top of this, the HIV/AIDS pandemic has turned the health situation in the country upside down over the last ten years.

Due to a dysfunctional original information system, each health program within the Minsitry of Health, such as Mother and Child Health or Home Based Care, has over the years created its own systems to accommodate its information needs. The underlying cause of this is the organizational complexity mentioned above, with several ministries involved in the process of gathering, analyzing, and utilizing data. The health programs themselves are also organized vertically, creating a fragmented environment within the Ministry of Health (MoH). Thus, the lack of coordination among these has led to a multitude of different information systems, of varying quality. Those health programs which have had more resources have developed well-working, isolated systems, some which are supported by computers. The less-resourceful health programs still rely on paper reporting up to the national level, where simple spreadsheets function as both data reports and data repository. The results are; overlap among the systems, duplication of work in supporting the various systems, but above all, less accessibility to data, that in turn hampers information use both at the district and national level. A project has been established to address these issues, in which the authors have been main participants.

The other aim of the project is to strengthen the district level, to increase the abilities of the local level to effectively manage preventive primary health care. Botswana consist of 26 health districts, varying greatly in size, population density, climate, and geography, and the motivation has been to enable the districts to better utilize their local expertise and knowledge through access to relevant and updated information.

The proposed approach was thus to integrate the various information systems within the framework of a district data warehouse. This would enable the health programs to maintain their independence, while at the same time benefit by getting access to relevant information and pool their resources. As a next step, this would be used to address overlaps, gaps and inconsistencies between the data sets collected and processed by the various information systems. This approach to standardization of health data take the constantly changing health sector into account and emphasizes flexibility and negotiations between actors through an evolutionary process (Braa et al, 2007). The bureaucratic models of standardization (agreements before implementation) are too slow and static to cope with the rapid

organizational and technological changes, such as seen in the health sector, and more flexible approaches are needed (Egyedi, 2002; Hanseth, Monteiro, & Hatling, 1996).

An open source software was to be the vehicle for integration, what we see as an attractor for change. All health information systems in use would be implemented in the software, creating one single system for collecting, processing, and analyzing health information. This system would make new and historical data easily accessible to all program managers and district health specialists. In addition, it would form a base from which to align the various programs' data reports, starting the long road towards standardization and an information system geared towards information for action and "need-to-know" information. It may be an appropriate way of working towards this standardization "in a situation increasingly dominated by strong programmes and multiple uncoordinated data sets and software applications"(Braa, 2006)

This article will proceed as follows. First, we present relevant theory, before we look at the Health Information Systems Programme HISP project and experiences from other countries. Then we present the case of Botswana, and discuss the experiences there. Lastly we look at implications for other similar projects, and the way forward in Botswana.

2. Conceptual framework

Complexity Science has been increasingly used to describe health systems (Tan, Wen, & Awad, 2005). Complex Adaptive Systems (CAS) is especially useful when dealing with changing environment and many actors. A CAS has been defined as "a collection of individual agents with freedom to act in ways that are not always totally predictable, and whose actions are interconnected so that one agent's actions changes the context for other agents" (Plsek & Greenhalgh, 2001). This changed context will lead to new actions, reflexively influencing the first acting agent. Order is not designed in CAS, but rather emerges over time. Central to this are attractors, "a limited range of possible states within which the system stabilizes" (Braa, Hanseth, Mohammed, Heywood, & Shaw, forthcoming). These attractors are focal points for the constant evolution of complex systems; technical or social constructions that attract agents to change behaviour in a certain direction. They have proven very useful to describe how complex systems can be formed. Attractors for change are preferred over battling resistance through strong leadership. Those who seek change should "harness the natural creativity and organising ability of its staff and stakeholders through […] the positive use of attractors for change, and a constructive approach to variation in areas of practice where there is only moderate certainty and agreement" (Plsek & Wilson, 2001).

An inherent property of CASs is its non-linearity. Even small changes in initial variables can lead to very different outcomes (Plsek & Greenhalgh, 2001). Attractors implemented at early stages do thus achieve even greater potential for changing the direction of the system's evolution.

Scaling and scalability is also important in complexity science. Here scaling is seen as the reproduction of the same structure as appears in other parts of the system (Eoyang, 1996). (Braa, Hanseth, Mohammed, Heywood, & Shaw, forthcoming) show how scaling can also involve flexibility to deviate from the original template or structure. Encouraging diversity and experimentation may in fact support the scaling process. When it comes to scaling of health information systems, little research has been done (Sahay & Walsham, 2006). One peculiar characteristic of Health Information Systems (HIS) is the "all or nothing" dilemma. Given the nature of health administration, data is only useful when you have "full" coverage. Health districts cannot be administered properly based on data from only half the clinics, or only half the health programs. An HIS's usefulness is thus closely related to its *completeness*.

An integrating strategy seeks to address this dilemma by offering a complete set of data collection forms adapted to the software. This in turns enables a rapid geographic expansion since the various collection forms are already known and used at district offices and clinics.

A related set of analytic notions are found in Actor Network Theory (ANT). Put simply, ANT describes a given context as interactions between heterogeneous actors, both technical and social (Monteiro, 2000). Each actor is itself an actor network, consisting of yet more actors. Because of the reflexivity of such networks, we "blackbox" networks and look at them as individual actors where this is useful for the analysis. Embedded in each actor are inscriptions, representing a force of influence these actors exert on other actors. Inscriptions can be strong or weak, and they can change. Studying these inscriptions is useful to see how actors influence each other and align themselves among other actors.

Combining CAS and ANT leads to an important insight. Attractors for change are communicated through the various actors' inscriptions. Making change attractive can be inscribed in technical and social artefacts (such as organizations). The flexibility of the District Health Information System (DHIS) software, inscribed through easy database editing and compatibility between variously defined databases, has been an important attractor for change in South Africa (see for example Braa, Hedberg 2002). This does not mean all inscriptions are attractors, as many inscriptions are focused on deterrence. In Latour's classic example of the hotel manager (Latour, 1991), the weight of the keys is a strong inscription to return the key when leaving the hotel, but the inscription is negatively formulated. It is not an attractor to change behaviour, but a penalty for not. Inscriptions can also be seen as weak/flexible or strong/inflexible. For example, a hammer has a weak inscription of action; it can easily be used for other purposes than the intended one. An assembly line has a strong inscription; it is not easily modified into other uses (Monteiro, 2000).

When dealing with different standards or different technologies, gateways emerge as a key concept (Hanseth, 2001). Gateways function as a pragmatic, and necessary, solution for complex, evolving settings. Standardization is not always possible, or desirable, and gateways can link these different standardized entities in a common network. In terms of ANT, gateways become border objects, being something two actor networks have in common linking them together. In the case of health information systems, gateways are typically needed between patient information system and systems only dealing with aggregated data. A gateway here would typically be a piece of software extracting aggregated data from the patient information system and presenting them in a readable format for the latter system. Other gateways are needed between a paper based system and a computer based.

3. The Health Information System Programme

While this paper focuses on Botswana, the work there is based on experiences from a larger ongoing international project, the Health Information System Programme (HISP). It was established in South Africa in 1996 (Braa, Hedberg 2002), as a combined research and development project based in Western Cape. While the software DHIS has since been piloted and implemented in a range of countries, from India and Vietnam in Asia, Ethiopia, Tanzania, and Mozambique among others in Africa, to Cuba in the Americas, it has only become a national standard in South Africa. The success of the approach in South Africa led to similar strategies being adopted for other countries as well. The strategy there was to define an essential data set, a collection of the most important data for management, while simultaneously prototype a software in a participatory process. The approach proved successful in reducing the amount of data collected and improving the data quality. However, conditions special to South Africa that made this approach successful has not been present in

other countries (Braa, 2006). Among these are the political will for change, the failure of competing systems, the long time frame, and the political attractiveness of HISP's philosophical foundation (Braa & Hedberg, 2002)((Braa, Hanseth, Mohammed, Heywood, & Shaw, forthcoming). An essential data set approach was less feasible in for example Cuba, where the extensiveness of data collected carried an important political message (Sæbø & Titlestad, 2004).

An important aspect of the HISP processes is what has been termed the hierarchy of standards (Braa & Hedberg, 2002). Each administrative level is free to define its own standards and information needs, given that it provides the information asked for by the "superior" level. Such a decentralization of information ownership has been essential in the development of streamlined information systems based on collecting information for action. The essential dataset could be expanded at each level if that was necessary for local management.

Botswana is part of the "HISP network", i.e. a wide network of health professionals and researchers who work along the same principles in many developing countries. Developing local expertise is essential to ensure sustainability, and the project seeks to create a south-south network, where developing countries can help other developing countries. Botswana has both received from and contributed to this growing network.

4. Methodology

The research has followed an interventionist approach. Following principles of Action Research (AR), the goal for the researchers has been to change the HIS in Botswana while simultaneously creating knowledge. Adhering to a Scandinavian strand of AR, with a political agenda and a focus on sustainability, this method has been the preferred one for most HISP related projects (Braa, Monteiro, & Sahay, 2004). One important lesson from this strand has been to base the action in networks rather than on singular units (Elden & Chisholm, 1993). The work in Botswana is thus part of a wider action research project, with the researchers being involved in similar processes in other countries.

Interpretive research methods (Walsham, 1993) have guided the analysis of the observations and experiences made by the researchers.

The authors have all been involved in the process of piloting DHIS in Botswana. One holds a resident position as IT Manager at the MoH, while the two others are external researchers that have spend considerable time working with the project in Botswana, as well as in other countries, including South Africa. Together, the external researchers have spent six months in Botswana, engaging in implementation, training, and adaptation, over a period spanning 18 months. In participating extensively in the project, the authors gained empirical experience and data from both formal and informal meetings and unstructured interviews, document analysis, and observation.

5. The Case of Botswana

Botswana is a Southern African country largely consisting of dry savanna and semi-desert. It is extremely sparsely populated, with the majority of the inhabitants living in and around a few urban centers. During 40 years of independence, Botswana has developed a mature democracy, and social and infrastructural development has been fuelled by exploitation of rich diamond fields. Compared to the region, and sub-Saharan Africa as a whole, Botswana is a prosperous and stable country. This has positive implications on any IS project, as the education level is relatively high, computer knowledge is good, and the telecommunication

infrastructure is well developed, and expanding. Though relatively rich and politically stable, Botswana has been especially hard hit by the AIDS pandemic, with an estimated prevalence of over 30 percent of the adult population. The result is the second lowest life expectancy at birth in the world, at 34.9 years (United Nations Development Programme, 2006).

5.1. The Botswana Health Service

Botswana has, due to its small population, a relatively shallow organizational structure. 26 Health Districts are organized directly under the Ministry of Health (MoH). Health facilities, including hospitals, clinics, mobile clinics etc, are organized under the districts. The MoH is responsible for policy and strategic development of health services in Botswana in line with general government policy. It is also responsible for health service delivery at the primary, district and referral hospitals. The district health services and primary health care services at clinic level is the responsibility of the Ministry of Local Government (MLG). Thus two ministries are involved in the day-to-day running of the health ministries.

Within the MoH, there are health programs that are responsible for various fields, such as Extended Program on Immunization, Tuberculosis, Home based care etc. Some of these programs have their own representatives at district level, but most are pooled under a District Health Team (DHT).

5.2. The Health Information System

The main provider of health statistics in Botswana is the Central Statistics Office (CSO) in the Ministry of Finance and Development Planning. Based on data collected by the Health Statistics Unit (HSU), an arm of CSO within the MoH, produces a yearly publication on health information. The latest published volume by the time of writing was from 2004, containing three years old data. The CSO was involved in an international project to improve its routines, but the focus was one defining reports rather than on implementing them in efficient routines. Due to this delay, the various health programs at the MoH have developed their own reporting structures. For all practical purposes, data that is three years old is not useful in health management. To monitor policies and take rapid action at disease outbreaks, the health programs have been forced to install their own routines and tools to collect data. This has several implications on the overall health information system.

First, there is a duplication of work. The Integrated Disease Surveillance Report program collects data on communicable diseases. They collect much of the same data as the HSU. Data that come from the same source at facilities are split into two information systems. In addition, this data is not always identical when it reaches the national level, indicating bad data quality.

Another example is the Prevention of Mother To Child Transmission (PMTCT) program and the Mother and Child Health (MCH) program, both of which collect data on antenatal visits and births. This duplication takes place in a setting with limited resources. The duplication of work also applies to the development and maintenance of information systems.

Second, the information systems developed by the different health programs are vertical and isolated from the other systems. Data from another health program than your own becomes more inaccessible. A multitude of parallel systems are handled by different people, at different levels.

Thirdly, the quality and technological level of the information systems vary greatly. Some programs have more resources, both financial and human, and have developed computer

based reporting structures, while other programs still rely on legacy paper systems. For example, the PMTCT program has invested in computers for all of its 26 districts officers. These computers are used to collect PMTCT specific data only. In one of the pilot districts, the district PMTCT officer, together with her computer, was located in a clinic separate from the rest of the District Health Team.
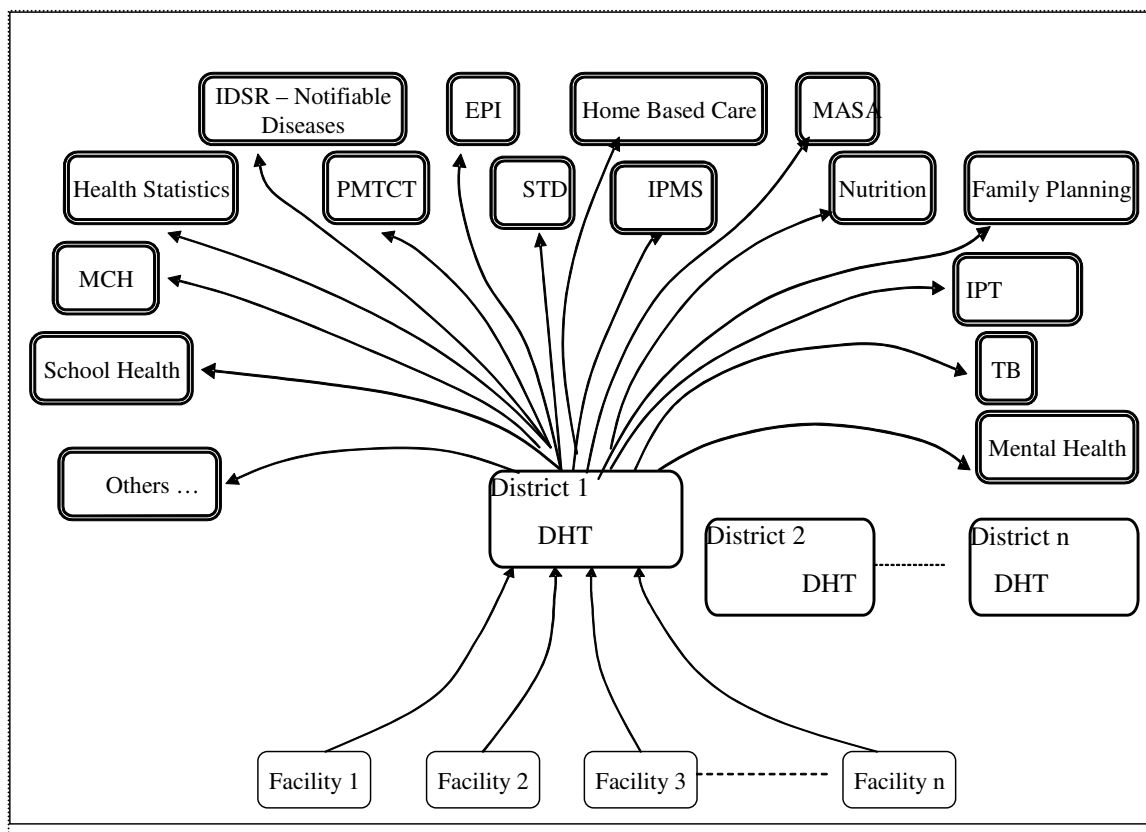
Figure 1: The current fragmented health information system

The figure above shows the information flow at the start of the project (Chandna & Hedberg, 2005). Data is collected at facilities, and reported to the DHT, which is here showed as one entity. However, even though a majority of the data is processed by one or two persons at the district level, some programs are handled by other nurses, who might even work at a different location. From the DHT the data is reported to the respective health programs. There is no national database containing all data, this is stored at each health program either electronically or on paper. A multitude of computer systems are used by the stronger health programs, such as PMTCT and TB, but mostly at the national level.

Information use at the districts is fairly developed, but the amount of data collected indicates that most is never used. Around 1500 data elements, that is, aggregated figures of diseases and conditions, are collected on a regular basis at the districts. Very little of this data is used to construct indicators (rates and ratios), most remains as raw data (pure figures).

5.3. Organizational Complexity in the health service delivery

As we have seen, there are several actors involved in the delivery of health services. The major chasm is that between the national and district level, run by two different ministries. The main recipient of health data is however the Central Statistics Office, who is responsible for preparing a yearly reports from different sectors. The MoH is further divided in different

health programs, from which the current fragmentation of information systems stems. The differences between them are exacerbated by their different resources. Some health programs are also supported by international NGO's, especially those related to HIV/AIDS. These programs have fared better in developing their own information systems.

The table below shows the four ministries involved in the health information systems in Botswana, and their respective role. The Ministry of Science, Technology and Communication is responsible for supporting the MoH regarding IT solutions, including various HIS software.

Ministry	Active departments	Responsibility	Level Active
Ministry of Health (MoH)	All health programs	Implement policies at national level	National, Hospitals
Ministry of Finance and Development Planning	Central Statistics Office (CSO)	Produce yearly health statistics publication	National
Ministry of Local Government		Execute policies from MoH, run clinics. Resource allocation and human resource management at districts and facilities.	Districts, Clinics
Ministry of Science, Technology and Communication	Department of Information Technology	Develop, maintain, and evaluate IT solutions for the MoH	National

Table 1: Ministries and their role in the Health Sector

A sample of health programs is shown below. Note that the PMTCT and MCH data have the same source. They have however very different information systems for the parallel reporting.

Health Program	Responsibility	Status
Health Statistics Unit (HSU)	Collect and prepare routine statistical health data	Statistical system at national level, which is very slow with 2 years of data not yet captured. Is formally responsible for all health data.
Extended Program on Immunization (EPI)	Monitor immunization	Have resources, independent IS, use EPI-Info software package
Prevention of Mother To Child Transmission (PMTCT)	Implement policies to reduce the rate of transmission of HIV from mothers to their children Antenatal care	Have resources, donor funded, developed independent information system. Overlapping data collection with MCH.
Integrated Disease	Collect and analyse data	Initiated as a response to the "slowness" of

Surveillance and Response (IDSR)	on particular important communicable diseases and provide responses	the official health statistical system, with which it has overlapping data collection. Has resources and independent IS, using Epi-Info.
Mother and Child Health (MCH)	Antenatal care	Little resources, collect data from same source as PMTCT, paper based information system of very poor quality

Table 2: A sample of Health Programs and their responsibilities

5.4. HISP in Botswana

The aim of HISP in Botswana was to strengthen the district level and reform the current health information system. Instead of various health information systems going through the DHTs, the DHIS would serve as a data warehouse both at the district and national levels. All data would be collected electronically at the districts, and be exported with e-mail to a national database. Figure 2 shows the future information structure. Extensive training would be given in information use at the districts.
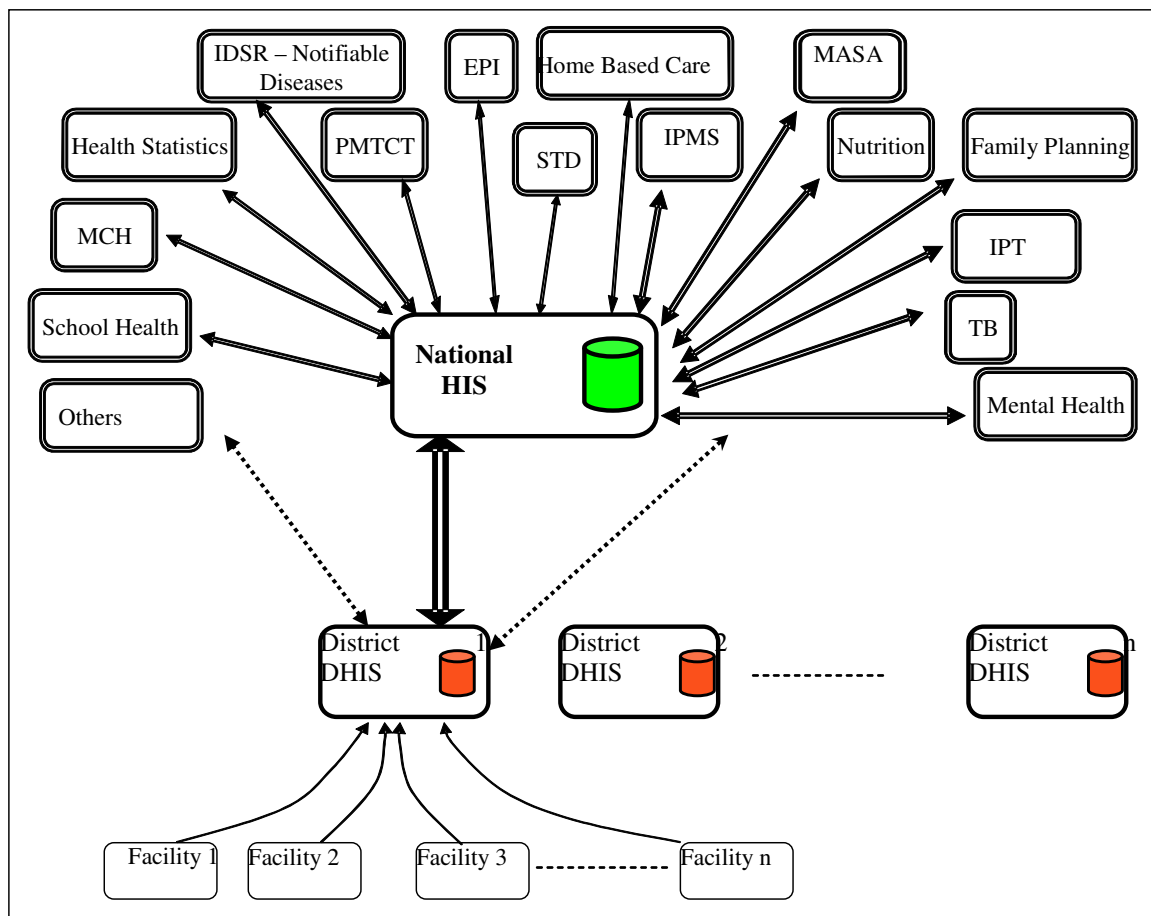
Figure 2: The proposed District Data Warehouse structure

The HISP project was initiated early in 2005, and four (out of 26) districts were selected for a pilot implementation. All existing paper forms were collected from most health programs, and adapted to the DHIS. An effort was made to make the graphical user interface of the DHIS look just like the existing paper forms. Training was conducted mainly for community health nurses and district health managers from the pilot districts, but also representatives from the

national level health programs attended. The DHIS database was populated with data from 2004 onwards, to be used as a historical base for analysis of new data.

The project was set up as belonging to the MoH, but also the Ministry of Communication, Science, and Technology was involved, as well as the Ministry of Local Government. All major health programs participated in the initial phase, providing their reporting tools to be adapted to the DHIS. Over the summer of 2005, data was entered in the pilot districts and inconsistencies between the paper forms and DHIS was sorted out. Several different versions of the paper forms exist in the districts. Descriptive of the situation, the project even encountered paper forms in the districts from the same release which were different.

The project has run into several problems related to the poor state of information technology knowledge in the health services. Computers have been in disuse due to hardware failure, virus attacks, reinstallation of operating systems, and a general lack of problem-solving expertise in far-away districts. Data exporting to the national level has taken place on flash disks, since proper internet connection is not yet available at all sites.

At the time of writing, HISP Botswana is planning a national roll-out to all districts, based on the experiences from the pilot district. Interfacing with existing software is an important part of this, to achieve full data coverage and present a possibility for program managers to continue old, established reporting routines while still being able to keep their data in the district and national data warehouse for analysis and storing.

Interfacing with patient data systems is also essential to build an integrated database. This requires gateways between DHIS and existing paper and electronic patient records to extract aggregated data. There is currently a multi-million dollar project ongoing, piloting the Integrated Patient Management System. This would be a main supplier of patient-based data, but at the time of writing there are several existing systems in use.

6. Discussion

We have so far described the fragmented and uncoordinated nature of the Botswana health information system. The problem arising from this situation is as seen by a senior official in the Ministry of Health that "there is no way to access or get overview of the essential information from across the various health programs and sectors. The only way to get an overview is to visit the individual offices one by one and thereby compile your own data, and that is not good enough". Lack of data standards and consistency between the data collected by the different health programs add to this problem. It has proven difficult to get all stakeholders to agree on shared standards for both what data to collect and procedures and technologies for their collection, processing and use. Consequently a more flexible approach to standardization has been selected (Egyedi, 2002, Braa et al, 2007). In an effort to balance the individual stakeholder need for independence and flexibility with the district and central managements' need for coordination and a certain level of control, a relatively loose integration and standardization strategy has been implemented; the data warehouse approach.

6.1. Creating an attractor – The Data Warehouse

The main challenges in Botswana were related to having the various actors coming together to address the problem of a fragmented health information system. Only when all actors are involved could one start to coordinate and standardize the system. Facing several ministries, and a range of uncoordinated health programs, a "shared" data warehouse was selected as the preferred approach. Each health program could continue to collect their own data on paper

forms in the health facilities, get support for capturing this data in the database at the district level and get the data transferred to the central level. If the program had their own computerized system, the data would be made available for them electronically in the required format.

The creation of a data warehouse can be seen as having two immediate results. It would make it easier to kick start the project by having a well known data collection structure and layout for both the national and district level, and it would serve as a vehicle for bringing the various health programs together. Once the system started to produce results and the actors learned about it, an attractor had been created.

Using ANT and CAS, we can highlight the effect of such an attractor. The DHIS is now itself an actor in the health system in Botswana. Its design and technical solutions carry certain inscriptions. Strong support for analysis is an inscription to use the data for health management. Easy maintenance of the database is a deliberate inscription encouraging local development of standards by people with less technical skills. In the case of Botswana, these and other inscriptions are supplemented with a complete set of health programs mirroring the existing paper forms. Each health program could be presented their own reporting forms, now computerized, and populated with historical data. As several of the major health programs had joined the project from the start, such as PMTCT, HSU, and IDSR, the project gained momentum. The software has assumed the function of an attractor for integration making "attractive" for other actors to join forces, and at the same time a starting point for local analysis of data.

While the project so far has had limited success in improving data quality and use, the attractor has been successful in, for the first time, bringing the various stakeholders together. There is now a strong consensus among the health programs and the ministries involved that an integration of the information systems following the data warehouse approach is necessary and the project has been given a mandate to work towards such a goal.

So far the system has been implemented only for four health programs in four districts. Nevertheless, as a prototype it has served the function of showing the actors that, indeed, a data ware house may serve the purpose of a "shared resource" for handling data, and for providing access to all data across health programs. However, it has also demonstrated inconsistencies in the current system of data standards and procedures; when same or similar data is collected by different health programs (e.g. MCH and PMTCT) the totals do not necessarily match. In this way inconsistencies in the current system has been made transparent and some first efforts to address them have been initiated. This example illustrates that the data warehouse approach has the potential to become a "vehicle" for standardization of data and procedures for their collection which allows for flexibility and an evolutionary process. Changes that are resulting from negotiations between individual partners, such as between MCH and PMTCT regarding data on deliveries and ANC, may be implemented in a piecemeal fashion without affecting other actors.

An important precondition for such a consensus is that all actors will "win" something, none will lose. Gateways between DHIS and existing software enables programs to continue using their own software if they so desire. No legacy systems are removed, but incorporated into a software where they can easily be modified by the respective health programs.

The data warehouse has also the effect of saving resources. A fragmented information system requires duplicate efforts to create and maintain collection and reporting routines, software, and paper forms. A common set of routines for all health programs, executed by a few

specially trained nurses, using one software, will save considerable amounts of time and money in a resource scarce environment.

6.2. Emerging order versus design

A central theme in CAS is that order is not designed, but emerges over time. However, one has a certain degree of leverage, and one way to cultivate, or nurture, a certain "design" is through the implementation of attractors. The attractor is an actor in itself, influencing other actors in the network. The success of using DHIS as a data warehouse (as opposed to an essential dataset approach) to form an attractor to align the interests of a range of actors, highlights our ability to steer the seemingly autonomous life of health information systems towards a desired state.

7. Conclusion

The health service in Botswana is a very complex organization, involving four ministries and many health programs. Due to a lack of coordination between these actors, the health information system has become extremely fragmented, with several parallel systems run by the various health programs. This fragmentation results in duplication of work, low data quality, and a lack of accessibility of data.

This paper has used the notion of inscriptions from Actor Network Theory to show how the software introduced in Botswana carries regulations and opportunities that makes it attractive for the various stakeholders. Seeing the health sector as a Complex Adaptive System, the creation of such an attractor has been a successful strategy to create a focal point, a force of gravity, and an arena, for the continuing efforts to standardize the various health information systems.

This attractor needs to be supported by gateways that can link it to the actors' interests. The data warehouse in Botswana has succeeded as an integrator precisely because it offers all actors a way of joining without risking losing. The approach became attractive in a resource scarce environment because it offered gateways that would ensure the continuation of the health programs' independence, while at the same time offering a data collection and analysis tool that is maintained jointly by the other health programs.

At the time of writing, a gateway between the software and a UNAIDS-run HIV/AIDS monitoring system is under development, aligning the interests of a strong and resourceful actor in a specific sector with that of the wider health sector. The attractiveness of DHIS has gained momentum for the integration efforts.

This paper is the product of on ongoing effort to reform the health information system in Botswana, and forms the basis for further studies on complexity in, and scaling of, health information systems.

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ANALYZING THE DEVELOPMENT OF MUNICIPAL E-GOVERNMENT IN PERUVIAN CITIES

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Abstract: This study uses a municipal e-government services framework to evaluate the development of municipal electronic government (e-Government) in Peruvian cities by assessing the web sites and services provided by each city. The findings show that the degree of development of e-Government in Peru is incipient, with the need to improve not only the municipal websites but also the municipal e-Government strategy in each city within a common framework. Finally, we compare the results obtained in Peru with other Ibero-American countries and, in general terms, this comparison reveals a poor level of e-Services development in Peru in comparison with its neighbors who are more developed.

Keywords: e-Government, e-Services, Peruvian cities, Ibero-American countries.

ANALYZING THE DEVELOPMENT OF MUNICIPAL E-GOVERNMENT IN PERUVIAN CITIES

1. INTRODUCTION

In the last few years, city councils of Latin America have made great efforts to harness the implementation and the use of information technologies. The municipalities' portals have become an important source of information for authorities and citizens, within the scope that denominates e-Government. As well known, e-Government is a relatively recent phenomenon that is not clearly defined. There are many definitions of e-government (Borras 2003; United Nations 2003; UNDPEPA 2002) and each one emphasizes the importance of interaction between citizens and government in different ways (Caldow 1999). The European Commission (2003) defines e-Government as the "use of information and communication technologies by public administration associated with organizational changes and new skills in order to improve public services and democratic processes as well as to reinforce public policies". In this context, e-Government is unambiguously presented as a process involving transformational change at the organizational level: "e-government is more than technology, more than the Internet, more than service delivery; it is about putting citizens and customers at the heart of everything we do and building service access, delivery and democratic accountability around them" (Department of Transport, Local Government and the Regions 2002).

With new information technologies, more individuals should have access to greater amounts of information, be able to participate in policy formation more effectively, and even challenge the existing 'political establishment' (Dutton 1999; Tsagarousianou et al. 1998; Dutton 1996). The Internet assists citizens to be more informed, improves access to information and allows individuals to publish alternative viewpoints. As Schuler (2000) argues, Internet technologies provide tools for strong democracy, such as email, forums and online access to documents. Lack of participation has often been blamed on the 'digital gap': Individuals are excluded from participation because they cannot afford access to the necessary technologies or do not have the training or background to feel comfortable using them (Haase and Pratschke 2003; Lenhart et al. 2003; McCaffrey 2003; Sciadas 2002).

The aim of this study is to assess the development of municipal e-Government services that are offered in Peruvian cities. Peru, officially the Republic of Peru, is a country in western South America, bordering Ecuador and Colombia to the north, Brazil to the east, Bolivia to the south-east, Chile to the south, and the Pacific Ocean to the west. In addition to being known as the cradle of the Inca Empire, Peru is the home of many indigenous ethnic groups. Therefore, it is a country with major historical and cultural standing. Peru' economy has become one of the most liberal market economies in Latin America. The country' petroleum, natural gas and power industries are expected to increase due to relatively high domestic and foreign influx of capital in tourism, agriculture, mining and construction sectors since 1995 (Weisbrot 2006). In 2005 Peruvian exports were worth US$ 17.1 billion (an increase of 34.6% compared to 2004) and it is expected to grow 35% for this year reaching US$ 23.5 billion at the end of 2006. Peru has grown in all sectors (energy, construction, commerce, fishing, manufacturing, tourism, etc), growing over 6.67% (one the fastest growth rates of market economies in South America) in 2005 and it is projected to grow 7% for 2006. For the next five years (until 2010) the Peruvian government has registered more than US$ 10 billion in private investment (both domestic and foreign) in the mining and energy sectors, as well

as investments of US\$ 15 billion in other sectors such as industry, commerce, tourism, seafood and agriculture, which will keep the economy growing annually at levels of 5% or more. Nevertheless, in spite of all these good indicators, poverty in Peru is high, with a poverty threshold level of 48% of the total population. However, the level is reducing slowly and it is expected to diminish to 20% of the population within 10 years.

We have used the municipal e-government services model proposed by Esteves (2005). The analysis of the Peruvian cities using this model has allowed us to obtain some results that illustrate the e-Government strategies used by Peruvian cities. Furthermore, Esteves (2006) has analyzed 9 Ibero-American countries with a sample of 686 cities. Thus, we compare our results in an Ibero-American context to evaluate the level of development of e-Services in Peruvian cities.

This paper is structured as follows. First, we describe the theoretical background. Next, we report the research methodology. Then, we present the findings. Finally, we draw some conclusions and further work.

2. BACKGROUND

Some initial studies in e-Government were centered in topics like e-Governance (Marche and McNiven 2003), Critical Success Factors (Ke and Wei 2004; Siau and Long 2004) and Balanced Scorecard (Gueorguiev et al. 2005). The implementation of e-Government like a critical project can be a difficult task because implies many risk factors that can threaten the success of the project (Evangelidis 2005). While many technologies are accepted as part of e-Government (i.e. e-Procurement or e-Payment systems), the governments are being slow to adapt processes, technologies and e-Business systems. Nevertheless, these technologies, models and practices are implemented and applied without adapting them to the work and patterns in public sector (Milner 2000).

According to Santos (1999), information technologies have been put to the service of a public management model, maintained since the first democratic city council, characterized by citizen orientation, the improvement of the management, the territorial and functional decentralization, the collaboration with private sector for realize the services, the quality and continue improvement of process and innovation. Bannister (2006) discusses how information and communications technology (ICT) might be used in the processes of governing as such has been limited to a few areas such as document flow management and executive support technologies. In this sense, Mariuchi (2001) mentions that services provided by municipal websites are to procurement of products and services, regulatory disclosure and notification, and collection of taxes. Other services include applying and renewal of licenses and permits online, payment of fines, online voting, and online public forums (Moon 2002).

The possibility of use e-Services in order to involve citizens in the public administration will be discussed using the model shown in the next section.

2.1. Municipal e-Government Services Model

Actually, the existing models of life cycle in e-Government (Accenture 2003, European Commission 2003) only consider a national environment. Therefore, we apply the municipal e-Government Services Model formulated by Esteves (2005) shown in figure 1. This Model includes 16 e-Services: applications (document downloads), council/municipal newsletter, browser/search engine, web map, street map, public transportation, email, telephone listings, mobile services, online transactions, follow up services (monitoring), digital certificate, citizen folder, online

payments, site personalization and citizen participation. This model considers five phases, which represent different degrees of maturity and technological sophistication and complexity.
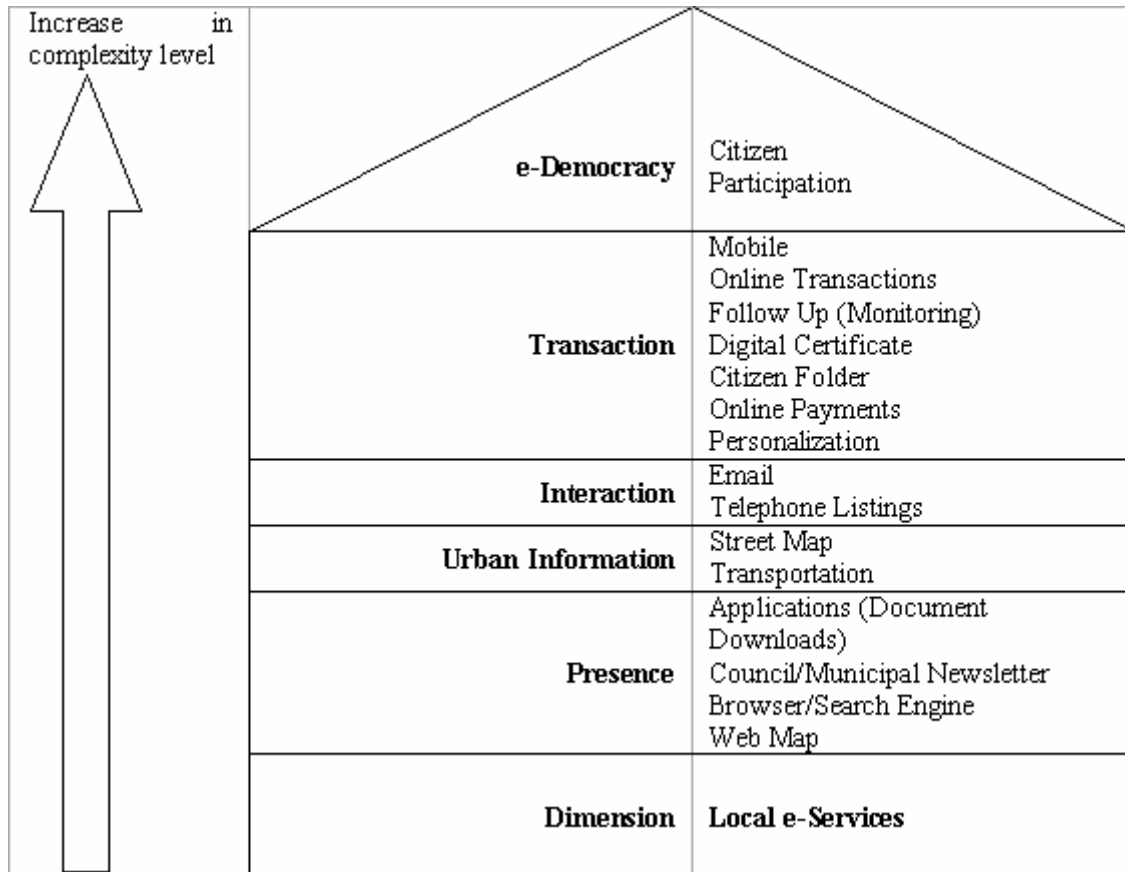
Figure 1. Municipal e-Government Services Model

Each phase is defined of the following way:

•   Presence – In this phase, e-Services publish information to the citizens. This means that there is online information and it may include basic search tools and to do things such as downloading documents.

•   Urban Information – This phase provides information on street maps and urban transportation. This information sometimes demands advanced technological tools such as GIS (Geographic Information Systems) or the opportunity of fast search.

•   Interaction – This phase considers simple communication between the citizens and the council members/staff. The contact will be done with telephone lines or email.

•   Transaction – This phase includes a set of services that allow a bidirectional electronic interaction between citizens and the council. These services include authentication, application processing and so on.

•   E-Democracy – Includes citizen participation services such as online forums, blogs, chats, online communities and online surveys on municipal topics.

Each subsequent phase represents an increase in the ability to provide information and services as well as to improve the communication between cities and municipalities. After defining the e-Services in each phase, we have created an indicator to measure the state of municipal e-Government development in each city. We have named it e-Value. To calculate the e-Value, we gave to each phase a weight: 0.25 for Presence services; 0.5 for Urban Information services; 0.75 for Interaction services; 1 for Transaction services and 1.25 for e-Democracy services. Then, we have calculated the percentage of e-Services offered in each phase on every city and multiplied it by the weight of every phase (i.e. Miraflores = 3x0.25+0x0.5+2x0.75+3x1+0x1.25 = 5.25). The definition of e-Services is shown in table 1 and was obtained from Esteves (2005).

PHASE	E-SERVICE	DEFINITION AND REQUIRIMENTS
Presence	Applications (Document Downloads)	Proceeding documents (general information, planes and so on)
	Council/Municipal Newsletter	Acts or change description of laws in the council (decrees mainly)
	Browser/Search Engine	To find information inside city web pages
	Web Map	Map of the website
Urban Information	Street Map	City map with all streets (can be static or dynamic, like someone specialized search engines)
	Transportation	Transports in the city: buses, meter or something like that (can include how arrive to the city)
Interaction	Email	There is an email to send or request information with the council
	Telephone Listings	There is a phone number to call to the council
Transaction	Mobile Phone	Is possible to access to the content to website from a mobile phone (i.e. WAP) and receive information by council through mobile phones (i.e. SMS or similar)
	Online Proceeding	Is possible to do a proceeding in the city website, i.e. change address, request of circulation permission, request commercial license and so on
	Follow Up (Monitoring)	Citizen can follow the state of their proceeding (even if it were not initiated online)
	Digital Certificate	Is possible obtain certificates (i.e. domiciliary certificate), in a direct way or through the website
	Citizen Portfolio	Citizens can access to their information and they can update it
	Online Payments	The neighbor can pay some proceeding (i.e. a permission, a commercial license and so on) through website, generally using debit or credit card
	Customization	Is possible personalize the website according to the user
e-Democracy	Citizen Participation	Exists discussion forums related to solve city problems

Table 1. Classification e-Services in e-Government framework

3. METHODOLOGY

We have used the same sample criteria as Esteves (2005) study. Therefore, we studied cities with more than 50,000 inhabitants. In the case of Peru, there are 138 Peruvian cities with this characteristic. The information about cities population was obtained from Peruvian "Instituto

Nacional de Estadística e Informática" (INEI), which is the entity responsible of the National Systems of Statistic and Informatics in Peru and supervises all related official activities in these topics.

Data collection occurred between November 13, 2006 and November 20, 2006. In order to consider the final sample, all cities that did not have a website or those that did not have an active website (i.e. when it indicates that their web page is under construction or in maintenance) were eliminated from our research sample. Then, we obtained 86 Peruvian cities divided in 21 regions. We evaluate each one of the Internet tools available in these 86 city websites using Esteves (2005) municipal e-Services model in which each successive phase represents an increase of the capacities to provide information and services, and the improvement of the communication between the city councils and their citizens. We used an indicator denominated e-Value that was explained in the previous section. After obtain e-Value, we compared it with the number of inhabitants of each city to find the existence or not of some correlation. Finally, we compare Ibero-American findings obtained by Esteves (2006) with our findings.

4. FINDINGS

4.1. Analysis by City

Table 2 reports Peruvian cities, according to the municipal e-Government services model, that have an e-Value higher than 3. Also, we show the Peruvian average at the end on the table.

CITY	PRESENCE	URBAN INFORMATION	INTERACTION	TRANSACTION	E-DEMOCRACY	INHABITANTS	E-VALUE
Miraflores	0.75	0	1.5	3	0	77543	5.25
San Isidro	0.75	0	1.5	3	0	55309	5.25
Villa el Salvador	1	0.5	1.5	1	0	367436	4
Cajamarca	0.5	0	1.5	2	0	156821	4
La Molina	0.75	0.5	1.5	1	0	124468	3.75
Moquegua	0.75	0	0.75	1	1.25	50075	3.75
San Borja	0.5	0.5	1.5	1	0	102762	3.5
San Martin de Porres	0.75	0	1.5	1	0	525155	3.25
Iquitos	0.75	0	1.5	1	0	157529	3.25
Tacna	0.5	0	1.5	0	1.25	97247	3.25
Surquillo	0.75	0	1.5	1	0	84202	3.25
Pueblo Libre	0.75	0	1.5	1	0	71892	3.25
Cutervo	0.25	0	0.75	1	1.25	53382	3.25
PERU	0.40	0.05	1.27	0.23	0.07		2.02

Table 2. Peruvian cities with e-Value higher than 3 and Peruvian average

The findings show that Miraflores and San Isidro are the most developed Peruvian cities in terms of municipal e-Government, both have an e-value of 5.25 on a total of 11.75 possible. These Peruvian

cities, in the Lima region, are the heart of economic and financial activities in the country. The main municipal e-Services offered by Miraflores are online proceedings like purchase of birth, marriage or death certificates; and online payments of taxes. San Isidro offers mainly a follow up on the account statement and online payments of taxes or administrative debts.

The Peruvian average e-Value (2.02) shows a very poor development of municipal e-Government. Very few Peruvian cities offer e-democracy and urban information e-Services. However, interaction e-Services are the most offered by Peruvian cities. Lima is the region that has more cities in the table above (8 cities), followed by Cajamarca with 2 cities. No Peruvian city offers e-Services in all phases simultaneously.

On the other hand, we analyzed the correlation between population and e-Value and we concluded that there is not significant correlation between them because the value obtained (correlation = 6.35%) is very low. This finding confirms Esteves (2006) study that has already shown that the municipal e-Government is not related to the municipal population.

4.2. Analysis by Region

We have also analyzed the results by region as shown in table 3.

REGION	CITIES	PRESENCE	URBAN INFORMATION	INTERACTION	TRANSACTION	E-DEMOCRACY	E-VALUE
Moquegua	2	0.88	0.00	1.13	0.50	0.63	3.13
Cajamarca	4	0.31	0.13	1.13	0.75	0.31	2.63
Loreto	3	0.67	0.00	1.50	0.33	0.00	2.50
Tacna	2	0.38	0.00	1.50	0.00	0.63	2.50
Lima	29	0.51	0.09	1.34	0.41	0.00	2.35
Ancash	3	0.33	0.00	1.50	0.33	0.00	2.17
Piura	6	0.46	0.08	1.38	0.00	0.21	2.13
Ucayali	2	0.63	0.00	1.50	0.00	0.00	2.13
Lambayeque	2	0.38	0.00	1.50	0.00	0.00	1.88
Junín	3	0.33	0.00	1.50	0.00	0.00	1.83
Puno	3	0.17	0.00	1.25	0.33	0.00	1.75
Huánuco	2	0.25	0.00	1.50	0.00	0.00	1.75
Apurimac	1	0.25	0.00	1.50	0.00	0.00	1.75
Ica	2	0.25	0.00	0.75	0.00	0.63	1.63
Cusco	5	0.20	0.10	1.20	0.00	0.00	1.50
Callao	4	0.25	0.13	1.13	0.00	0.00	1.50
La Libertad	2	0.38	0.00	1.13	0.00	0.00	1.50
Arequipa	8	0.28	0.00	0.94	0.13	0.00	1.34
Ayacucho	1	0.25	0.00	0.75	0.00	0.00	1.00
San Martin	1	0.25	0.00	0.75	0.00	0.00	1.00
Madre de Dios	1	0.00	0.00	0.75	0.00	0.00	0.75

Table 3. Results by Peruvian regions

The findings show that Moquegua is the best region with an average e-Value of 3.13; followed by Cajamarca (2.63) and then Loreto and Tacna, both with 2.50. Lima, in spite of being the cultural, industrial, financial and transport hub of the country, is in the 5th position. An important issue to consider is that Lima region has about one-third of the nation population living in its metropolitan area. Furthermore, different cities that form Lima region have different level of municipal development of e-Government. So, there is a lack of synergies among Lima region cities. In the same way, Arequipa is a city in southern Peru and the nation's second most-important city. However, Arequipa region is in the 18th position, it is almost at the end of the general classification. Therefore, we can confirm a high level of centralization that exists in Peru since cities near from an important economic focus have lower municipal development of e-Government than the main cities.

In addition, only presence and interaction dimensions include 20 and 21 regions respectively. So, practically every region offers some e-Services related with these dimensions. The other dimensions have a lower representation by regions, only 7 regions offer transaction dimension and only 5 regions consider the two remaining dimensions.

Then, we analyzed the correlation between Peruvian regions and municipal e-Services dimensions and we concluded that there is a significant correlation between the number of cities by region and the urban information dimension (correlation = 42.93%). Therefore, these municipal e-Services are mainly offered by regions that have more cities with more than 50,000 inhabitants.

4.3. Comparison with other Ibero-American countries

Table 4 presents the percentages of municipal e-Services provided by each Ibero-american country.

PHASE	E-SERVICE	PE	SP	PT	BR	CO	CR	VE	CH	ME	AR	E-SERVICE AVERAGE
Presence	Applications (Document Downloads)	89	93	85	31	95	75	59	81	41	86	73.3
	Council/Municipal Newsletter	32	70	67	94	86	25	9	81	27	80	57.4
	Browser/Search Engine	18	78	72	46	39	0	8	33	30	42	36.8
	Web Map	16	86	67	51	18	50	4	31	30	32	38.8
Urban Information	Street Map	10	91	54	7	21	25	75	19	11	26	33.9
	Transportation	1	88	67	41	4	0	4	1	3	32	24.0
Interaction	Email	87	94	95	92	89	100	83	94	47	91	87.0
	Telephone Listings	86	86	97	86	87	50	95	89	42	97	81.3
Transaction	Mobile phone	1	23	10	0	2	0	0	0	0	4	3.9
	Online Proceeding	3	61	23	92	34	25	4	34	33	6	31.5
	Follow Up (Monitoring)	13	27	46	16	25	13	3	4	2	23	17.4
	Digital Certificate	2	50	8	49	5	0	3	34	11	20	18.2
	Citizen Portfolio	0	16	5	1	0	0	0	4	4	1	3.1
	Online Payments	2	7	15	53	9	0	1	6	3	0	9.6
	Customization	0	17	44	5	4	0	0	0	0	0	7.0

e-Democracy	Citizen Participation	6	17	31	95	32	12	5	3	17	0	21.8
Country Average		23.0	56.5	49.1	47.4	34.4	23.4	22.1	32.1	18.8	33.8	

Table 4. Evaluation of municipal e-Services in different countries (source Esteves 2006)

Table 4 shows that the most developed municipal e-Services are email (87%) and telephone listings (81.3%), followed by applications/document downloads (73.3%) and council/municipal newsletter (57.4%). All the rest of municipal e-Services are below 40% of development.

Peru has an average of municipal e-Services of 23%, with this result is near of Costa Rica (23.4%) and has a better position than Venezuela (22.1%) and Mexico (18.8%).

These results show a first approach because e-Services have different value according to the phase which they belong. We obtain e-Value from a weighted sum of different municipal e-Services. Therefore, table 5 is a better way to compare degree of development of Ibero-American countries.

COUNTRY	E-VALUE
Spain	5.23
Brasil	4.92
Portugal	4.70
Colombia	3.23
Mexico	3.02
Chile	2.90
Argentina	2.89
Venezuela	2.21
Costa Rica	2.16
Peru	2.02

Table 5. Ranking of countries according to e-Value (source Esteves 2006)

The average e-Value obtained by Peru (2.02) is clearly the worst of all the evaluated countries in our sample, that it was led by Spain with and average e-Value of 5.23. It reveals a very incipient level of municipal e-Services development in Peru, in comparison with its neighbors who are more developed.

5. CONCLUSIONS AND FURTHER WORK

The analysis of the websites of Peruvian cities shows that the most of its only taking advantage of their websites like unidirectional communication with citizens. Therefore, they only send information from the council towards the citizen. The degree of municipal e-Services development is in general, very low. None of the Peruvian city reaches an excellence level in municipal e-Services. Not even Miraflores, the city that reached the best position in Peruvian cities ranking, has an optimal level of development and it only obtains 5.25 of the 11.75 maximum e-Value. Also, very few cities offer the set of e-Services considered in the study as the basic dimension. No Peruvian city offers e-Services in all phases simultaneously.

Most Peruvian cities offer interaction e-Services to citizens about email and phone contact; but their have a lack of develop to mechanisms like Web Map and Search Engine, so that citizens can find that information easily. We think that the Peruvian municipalities could use a gradual and sustainable model of growth for their municipal e-Services like the municipal e-Government services model proposed by Esteves (2005). The future challenge for the most of Peruvian cities is to develop a strategy that positions its website like preferred channel of interaction with their citizens. Furthermore, they need to develop synergies among Peruvian cities and regions.

One of the limitations of this study is that we considered only cities with most than 50,000 inhabitants. The main reason was to compare our results with previous research made by Esteves (2006) that considered this size in his sample. Another restriction was to analyze only the e-Services offered by cities and not consider the degree of citizen access in this websites. We will plan to study the citizen vision and compare it with the e-Services offered by municipalities to prepare a "gap analysis" between the e-Services that exists and what of them really are used by citizens. Also, we are analyzing other methods to weight the value of e-Value rather than using a linear model. Complexity theory may help on the development of a new weight method.

In terms of further work we attempt to validate these results by conducting case studies and interviews with the responsible for e-Government at a municipal/regional level. Finally, this study poses a future research question regarding the way Peruvian municipal governments take into account all the information that may be collected from the communication between government and citizens. For instance, if at the moment of a decision making process, local governments have had citizens' opinions into account.

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FREE AND OPEN SOURCE SOFTWARE – DEVELOPMENT AS FREEDOM?

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Abstract: The claim is often made that free and/or open source software is somehow a *natural fit* for developing countries and for reinforcing the process of development itself. This case is made, not only by hobbyists, zealots and other technology dissidents, but by august establishments such as UNESCO and the UNDP, influential NGO organisations, companies and individuals, as well as governments themselves. We argue in this paper that the assumptions which underlie such claims are not unproblematic. By looking at the evolution of South African government Free/Open Source Software policy we address the question *Whether the choice of using FOSS or proprietary software should be based primarily on cost and technical criteria or whether it should be based on reinforcing human development?* In answering this question we recognise the complex relationship between ICT and development, but also illustrate the importance of the non-technical complexity of ICTs themselves.   ICTs, particularly in the form of software, are not neutral tools but have embedded property and power relations which impact upon the nature, pace and direction of that development.

FREE AND OPEN SOURCE SOFTWARE – DEVELOPMENT AS FREEDOM?

1. INTRODUCTION

The question posed in this paper is whether the choice between using Free/Open Source Software (FOSS) and proprietary software to address the "digital divide" is best seen as a choice between competing technologies, to be decided on the basis of cost and technical appropriateness, or whether it is the non-technical characteristic of freedom in FOSS which holds the key to addressing and transforming the divide in a way which reinforces a more human developmental agenda. Following the conference theme of e-Government, a number of South African government policy documents on FOSS are examined. We conclude that whilst the FOSS rationale has the potential of contributing to more than just closing technical gaps, the position reflected in various strategy documents and policy recommendations has been primarily that the divide is a technical one which can be bridged at a lower cost if a FOSS approach is adopted.

Developing countries are well aware of the potential benefits of Information and Communication Technology (ICT) in terms of development "There was at one time some debate as to whether information and communication technologies (ICTs) were relevant to developing countries, but this debate has been resolved with a clear yes answer. The question has become not whether, but how ICTs can be beneficial." (Walsham & Sahay, 2006, p.7) Many policies promoting use of ICT have resulted in large investments in ICT infrastructure and launching of e-governance initiatives. Often the expected potential fails to be realized due to the huge gaps and disparities in ICT access, connectivity and skills, as well as the often exaggerated potential espoused in the policies. Additionally, the question of whether using Free and/or Open Source Software (FOSS) can be more beneficial than proprietary software for developing countries needs to be asked. Fundamental in addressing such a question is what we mean by development and the process by which that development is taking place.

Development has many different meanings for many different people. Clarity over what is meant by development is needed before a link between ICTs and development can be made. The discourse on linking ICTs and development is not harmonious. Using critical discourse analysis Roode et al (Roode, Speight, Pollock, & Webber, 2004) illustrate that a highly technical approach to bridging the 'digital divide' is evidenced in the speeches of major South African ministries. Roode et al (2004) argue that a more human development approach is needed to address development in what they view as both social and technical divisions. Likewise within the FOSS 'community' there are many divergent views and rationalities over the underlying philosophy of free and open source software in development. Linking all three elements, ICTs, development and FOSS cannot be simply taken as given.

This debate on FOSS takes place after we firstly introduce the concepts of 'digital' and 'socio-techno' divides (section 2) and briefly outline the debates on ICTs and development (section 3). In section 4 the main debates around FOSS are outlined and in section 5 we discuss the position expressed of the South African government in the major ICT policies and documents.

2. 'DIGITAL 'AND 'SOCIO-TECHNO' DIVIDES

Contemporary times have seen an increasing debate on the role of marginalisation, globalisation and the information society. Globalisation, it is argued, is accompanied by rising inequality (Madon & Sahay, 2002, p.1). The work of Castells (2000) explains how the

structures in place in a global economy reinforce the exclusion of vulnerable people and how important it is to tackle this exclusion by ensuring that they are linked to the rest of the global market. Castells refers to the groups of people affected by this inequality as the 'Fourth World'. These people and regions in the world are excluded from the economic flows associated with globalisation. The 'Fourth World' consists of multiple black holes of social exclusion (Castells, 2000). Thus, the new global economic system is at the same time highly dynamic, highly exclusionary, and highly unstable in its boundaries. While dominant segments of all national economies are linked into the global web, segments of countries, regions, economic sectors, and local societies are disconnected from the processes of accumulation and consumption that characterise the informational/global economy (Castells, 2000, p.102). Globalisation is selective and conditions of history and geography shape the access that groups and societies have to global flows.

Castells, along with other authors, would argue that a key factor in being included in the information society is the connection of individuals and society to networks of information (Castells, 2000; Madon & Sahay, 2002).

> ICT's are not inherently a cause of exclusion, but lack of access to the means of communication increasingly used by the rest of society has the potential to systematically worsen the relative position of excluded individuals and groups. . . . While writers have emphasised the need to build "informational networks" to combat marginalisation, less has been written about how this can be done in practice and the underlying challenges that exist. (Beck, Madon, & Sahay, 2004, p.282)

Large segments of the population are cut off from the new technological economic system. This is often referred to as the 'digital divide' which is commonly "... understood to be a reference to classes of people at risk of being excluded from the rising tide of economic prosperity fueled by great advances in information technology." (Kvasny and Truex, 2001) However, Roode et al (2004) argue that the term 'digital divide' is a misnomer and results in approaches to development which are 'technocentric'. They argue that there are underlying structures which cause this exclusion which need to be addressed in a more holistic and people centred development approach, which they term 'sociocentric'. They argue that the term 'socio-techno' divide is more appropriate.

More commonly described in the globalisation and development literature is the argument that ICTs can be used to bridge the divide between the 'haves' and the 'have nots'. The debate of how modernisation causes tension between tradition and new opportunities is a recurrent theme in African literature.   In *Things Fall Apart,* Achebe (1962) describes the story of culture on the verge of change and how the new opportunities and techniques that the missionaries bring could lead to the eradication of traditions such as story telling and traditional methods of farming, harvesting, building, and cooking. More recently, Mda (2000), in *Heart of Redness* describes a village split into groups supporting tradition and a group supporting plans to build a casino and tourist resort in the village.

However, more directly relevant to this discussion of the 'socio-techno' divide is Akpan's (2003) reference to the dialectical nature of globalisation. Akpan notes that there is an inherent tension in globalisation which can create wealth for some countries whilst systematically impoverishing others and also that it "at once integrates and disintegrates communities" (Akpan, 2003, p.266). Though Akpan doesn't develop the argument of the dialectical nature of globalisation in her case study of Nigeria her argument is relevant here. The role of ICTs in this development process is not uniformly understood and it is to this debate that the following section turns.   In sections 4 and 5 we take the issue further by showing that ICTs themselves, particularly software, contain their own contradictions (in

embedded property and power relations) which impact on this dialectical process of globalisation and development.

3. ICTS AND DEVELOPMENT

Our readings indicate that there are predominantly three narratives around ICT and development:

(a) Economic development and the role ICTs play in expanding markets and creating more business opportunities;

(b) Socio-economic development and the role ICTs can play in e-Government and in the delivery of better quality services;

(c) Development as freedom and the role ICTs can play in accessing information, creating networks and improving democracy.

This categorisation echoes the three stages of development outlined by Avgerou et al (Avgerou & Madon, 1993, p.124): economic growth, basic needs and self-determination.

If a country achieved economic growth all would benefit was the premise of the first paradigm. This largely fits in with the notion that developing countries are simply low income countries and informs the main debate in the 1960s and 1970s. By improving the Gross National Product (GNP) of the country everyone could then be better off, governments could deliver better services to the citizens and job opportunities would increase. ICTs in this scenario are seen as a means to expanding the global market in which a country can trade, having ready access to information about these markets and therefore the opportunity to achieve growth. In this way a developing country could 'leap frog' the usual, slow, apparently universal development trajectory that their western counterparts have followed from primitive to developing to industrial and the current modern informational societies. In summary, access to ICTs implies access to greater markets implying better economic growth opportunities.

The second debate recognises that development is more that simply the improved income of a country and that basic needs of the citizens must be met regardless of the economic status of a country. In this scenario both the social and economic status of the citizens are important. The redistribution of wealth enables basic needs to be meet. Max-Neef's Human Scale Development Model is one example which focuses on the needs that were required to be met. This model argues that fundamental human needs are the same in all cultures and in all historical periods, though the satisfiers of these needs are culturally specific (Roode et al., 2004). Indicators such as the Human Development Index, which incorporate measures of access to health and education, employment and other resources, is another example. ICTs can assist in this scenario by enabling government services to be more easily accessed and by enabling more effective and efficient communication with its people. Service delivery can be enhanced through using ICT as a tool, for example telemedicine in the health sector or provision of telecentres in the education sector or in communities. In summary, the focus of this approach is on the output rather than the process of development where ICTs can support governments in addressing its citizens needs.

The last debate focuses more on the conceptualisation of development as the freedom of people rather than specifically their social and economic status. It encompasses the realisation that human development and economic growth are inextricably intertwined in a complex manner. In this scenario the rights and responsibilities of people within a country

feature prominently. A more people centred debate is provided in the writings of Todaro (1991). His three core values of development were life sustenance (the ability to provide basic needs); self-esteem (to be a person), and: freedom from servitude (to be able to choose).

> Development must, therefore, be conceived of as a multidimensional process involving major changes in social structures, popular attitudes, and national institutions, as well as acceleration of economic growth, the reduction of inequality, and the eradication of absolute poverty. (Todaro, 1991)

Around the same time Sen argues more specifically that the focus should be on the ability to choose as the overriding premise for development (Sen, 1999). Sen's capabilities approach to development focuses on the expansion of human capability as the root of progress of individuals and societies. This implies enhancing the capability of people to lead worthwhile and less vulnerable lives, whilst simultaneously improving their productivity and employability. In order to do this Sen identifies five types of freedom: (1) political freedoms, (2) economic facilities, (3) social opportunities, (4) transparency guarantees and (5) protective security (Sen, 1999, p.10). As Gay aptly summarises,

> … the requirements for development can be described as an individual's ability to participate freely in the political process, the mechanisms and capacity to seek economic well-being, the networks and connections which make social integration possible, free access to reliable information sources, and structures which allow personal safety (Gay, 2003, p.1).

In an era where technology transfers are predominantly from the North to the South what is fundamentally different in Sen's perspective is the centering of the individual in the process of development - a significant move away from the more collective output perspective of the previous two paradigms.

> The ends and means of development call for placing the perspective of freedom at the center of the stage. The people have to be seen, in this perspective, as being actively involved - given the opportunity - in shaping their own destiny, and not just as passive recipients of the fruits of cunning development programs. The state and the society have extensive roles in strengthening and safeguarding human capabilities. This is a supporting role, rather than one of ready-made delivery. The freedom-centered perspective on the ends and the means of development has some claim to our attention (Sen, 1999, p.53).

Irrespective of the position on what development means there are a number of important critical viewpoints which need to be considered in looking at what constitutes, and is constituted by, ICTs. In summary, some of the main dangers for viewing ICTs uncritically are:

- The uni-directional nature of the technology transfer from North to South (Heeks, 1999; Roode & du Plooy, 2002; Nhampossa, 2005);
- The strongly related assumption of technology as context independent and so universally appropriate (Roode & du Plooy, 2002; Nhampossa, 2005);
- The strong promotion of computers and IT as essential components of development by international development agencies (which as Roode and du Plooy term 'uncritical technoidolatry' (2002, p.217));
- Not heeding the warning against 'technopoly' (".. the total submission of all forms of culture .. to the sovereignty of technique and technology" (Roode & du Plooy, 2002, p.218));
- The focus on the technical aspects rather than the communication aspect of ICTs. Most ICT's and IS design do not enable marginalised people to demand information

that is useful to them nor enable them to disseminate their own information. (Heeks, 1999; Madon & Sahay, 2002)

We can conclude then from this overview that the link between ICTs and development is far from straightforward – there is certainly potential but it depends on how critically ICTs are viewed and the meaning of development adopted.

4. FREE SOFTWARE DEVELOPMENT AS FREEDOM

Given the clear lack of consensus in the literature about the nature of the relationship between ICTs and development, it is worthwhile to consider whether FOSS introduces any elements which radically effect the discourse. Of course software is only one part of the ICT 'bundle' of technologies and systems but, particularly in light of the convergence of traditional communication technologies with digital systems and devices, it plays an increasingly important role. If the aim of the exercise is to 'narrow the digital divide' which exists between rich and poor, in order that those who are currently excluded can be included and henceforth enjoy the resulting benefits of informational development, then it is possible to view FOSS as a potentially *more efficient* way of achieving this. Indeed, this seems to be the driving motivation for much of the promotion of FOSS in the ICTs for development agenda (Hoe, 2006; World Summit on the Information Society (WSIS), 2005). Given an over-arching social goal to address the 'digital divide' and accelerate the access to and 'uptake' of ICTs, then the lower cost, flexibility and adaptability of FOSS over proprietary alternatives clearly suggests a good fit. At least at the level of meeting the software needs of informational development.

Certainly part of the vision of an ICT based Information Society suggests a widespread presence of computers in schools, universities, clinics, hospitals, government offices, community centres and businesses through which citizens can acquire skills, communicate, access services and conduct business. Two aspects which seem frequently to be missing from approaches to ICT and development, including those referred to above, are (1) the origin of the ICTs and (2) the related question of ownership and intellectual property. Deployment of computers and software is expensive and attracts long term recurrent rental costs in terms of copyright licence fees as well as hardware renewal and maintenance.

For example, extrapolating figures from the May 2006 Business Software Alliance annual piracy study (Business Software Alliance, 2006), a total of US$376 million was spent on desktop computer software licences in South Africa in 2005[1]. This figure has been steadily growing at a rate which considerably outstrips national economic growth. The same report estimates the total amount paid for software in "emerging countries" in 2005 as US$6 billion (with an estimate of a further US$12 billion worth of unpaid software). As the rate of ICT penetration continues to expand in support of, or in consequence of, increasing development it is reasonable to expect these primarily South-to-North flows of licence costs to increase, become more entrenched, and to be pursued more vigorously.

On one level then, FOSS may offer a lower cost alternative to proprietary software. And indeed it may not – given the near zero marginal cost of information goods such as computer software, there is much which the proprietary software industry can, and does, do to compete on price – ranging from turning a blind eye to pirated "special editions" to direct donations of software to schools, community centers etc. The argument that FOSS may be a *best fit* for developing countries on the basis of it being less expensive can be a perilous one. Whilst there are many (including the authors) who believe it to be substantially true, there are a

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1   The BSA piracy study reports that South Africa's 36% 'piracy rate' corresponds to a retail value of US$212 million. The remaining 64% was presumably paid for.

barrage of total-cost-of-ownership surveys which claim otherwise, though few of these studies are contextualised to developing countries (Ghosh, 2003). If indeed ICTs are such an absolute prerequisite for development then perhaps the price is worth paying.

The globalisation of norms around the protection of rights of software copyright holders has become increasingly institutionalised through organs such as the World Intellectual Property Organisation (WIPO) and multilateral treaties such as the Trade-Related Aspects of Intellectual Property Rights (TRIPS) agreement which is binding on members of the World Trade Organisation (WTO). Whereas progress towards the goal of providing universal access to ICTs (narrowing the digital divide) may be slow and faltering, the creation of a globalised framework for extraction of rentals for ICT usage, cementing the flow of payments to mostly the USA and Europe, has been far more resolute, rapid and comprehensive. Enticing though the lure of proprietary software might be, particularly when it can be easily pirated or donated, May cautions of the "TRIPS trap" which cannot be evaded forever (May, 2006).

The fear that copyright holders of mainstream proprietary software have (that their potential revenues are being "stolen") even results in localised hardware assembly being discouraged. The piracy study referred to above (Business Software Alliance, 2006) looks favorably on the growth in the laptop computer market as well the importation of "branded" computers because these systems tend to be shipped with proprietary software pre-installed and paid for. In many sectors, for example motor vehicles, the growth of an indigenous assembly capacity is seen as a developmental step forward. In the ICT hardware sector it is a development which is frowned upon.

Yet it may well be patents which pose the biggest threat to the development of productive capacity by newcomers in the knowledge age. These barriers to technological development can be clearly seen in the filing of patents in African countries. The WIPO annual report for 2001 reveals extreme asymmetric activity. For example, of the 150 000 patent applications filed in each of the offices of Lesotho, Malawi and Mozambique, only one was by a Lesotho resident, two by Malawi residents and one by a Mozambiquan resident. Armed with a self proclaimed belief that intellectual property rights are absolute, and supported by a barrage of tools of coercion (for example, TRIPS), private interests from developed countries are claiming property rights across Africa at an alarming rate. In countries like South Africa, where there may be a real possibility of an emerging software industry, the tide of foreign computer program patent applications is growing (Jolliffe, 2005). The fact that South Africa, like most other developing countries as well as the countries of the European Union, theoretically excludes computer programs from patentability is no effective barrier. The filing and granting of patents takes place outside of the public eye and few patent offices in developing countries have the resources to oppose the claims to private property of large multinationals. James Boyle makes a compelling analogy (Boyle, 2003) with the enclosure movement of 17[th] century Europe – in our case the intellectual land grab is more aptly compared with colonial land appropriation. That these patents may have a stifling effect on our ability to develop our own capacities, for example in terms of FOSS development, is fundamentally a question of freedom linked to national determination.

This then leads us to question whether FOSS offers more in terms of freedom. One rather obvious problem with the term free software is that software cannot really be free. At least not in the sense of freedom. Only people can be free. If we acknowledge that the important thing about free software (and we can include open source in this) is not that the software is free, but rather that it in some ways allows people to be more free, then we can start to explore the emancipatory potential in a sensible way. It is this sense of freedom which can be linked to Sen's concept of development as freedom.

Contrary to much that has been said about free software, free culture, free science and open access and its applicability to developing countries, the rationale of freedom is as important, if not more so, in our context as the rationales of low cost, efficiency and security. The terms in which we articulate this freedom must go beyond and escape the narrow impasse of the "freedom debate" as it currently stands in the FOSS world, and also embed itself in our broader historical narrative of freedom. In the next section we examine the extent to which South African government FOSS policy is informed by this rationale of freedom.

5. SOUTH AFRICAN FOSS POLICY DOCUMENTS

South African government policy regarding the use of FOSS has evolved over a relatively short space of time and reflects many of the debates referred to above. The following documents represent key events in the unfolding process and are discussed in the text below:

NACI document	2002 (updated in 2004)
GITOC strategy document	2003
Recommendations to the PNC	2004
Go-Open Task Team strategy document	2005

Table 1: South African FOSS policy documents reviewed

Perhaps the single most important catalyst for development of policy in this area was the 2002 National Advisory Council on Innovation's (NACI) report[2], *Open Software and Open Standards in South Africa – a critical issue for addressing the digital divide* (NACI, 2002). The document was written at a time when the value of the South African Rand had just experienced a sudden and dramatic fall which exposed the very real risks associated with an ICT strategy which was firmly tied to dollar based licence fees. Whereas the element of licence cost is a clear motivation behind the strident pro-FOSS proposals contained in this document, there are a number of broader developmental and societal aspects to the arguments presented. The report claims that FOSS provides a "useful tool to allow developing countries to leapfrog into the information age", but importantly also goes on to indicate how "arrival" in this information age is not only more viably achieved using FOSS (a cost argument), but also that the use of FOSS fundamentally effects the *nature* of this information age.

Arguments made in the NACI document which have frequently been overlooked or downplayed in subsequent policy and strategy documents include:

(a) the importance of combating the threat which broad software patents pose to the development of FOSS;

(b) the association of the right to free software usage and development with freedom of expression and the free exchange of ideas, and;

(c) the recognition that FOSS (notably Linux) is already being used by individuals, academia, businesses and NGOs because they have the freedom to do so, rather than as a result of government policy.

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2   The National Advisory Council on Innovation (http://www.naci.org.za/) is a body set up by the South African Act of Parliament to advise the then Minister of Arts Culture Science and Technology, as well as Cabinet as a whole, on science and technology issues.

A number of FOSS usage/development scenarios are presented in the form of short cameos which provide the reader with grounded examples of benefits accrued to small business owners, educators and scientific researchers by using FOSS. Though some of the arguments may be viewed as naïve with the benefit of hindsight, the NACI document had an enormous influence in kick-starting government policy development. It is interesting to note that the NACI document introduces its own terminology, 'Open Software', in preference to Open Source or Free Software. The justification[3] for this, was that constant use of the term 'source' is too technical suggesting the importance stressed on the non-technical arguments presented. It could also be argued that it also indicated a sensitivity to the schism which had begun to open between the Open Source and Free Software movements and the desire to take a non-partisan approach.

In July of 2004 the original NACI report was updated and a new version (v2.6.9) appeared on the NACI website. The title was expanded to read *Free/Libre and Open Source Software and Open Standards in South Africa – A critical issue for addressing the digital divide* (NACI, 2004). The new NACI document expands upon the previous work, taking into account more recent developments but did not have the same impact as the original document.

One of the first concrete outcomes of the NACI document was the January 2003 OSS strategy document compiled by the OSS working group of the Government IT Officers Council (GITOC, 2003). What is interesting about this strategy document is that, while it borrows significantly from the NACI document, it discards much of the richness of the rationale and concentrates on efficiency and effectiveness arguments. This emphasis is reflected in the title which talks unambiguously of Open Source Software. Free software is referred to briefly in the glossary. This emphasis is perhaps not surprising given that the mandate of the GITOC is primarily to deliver IT services to government. The basic policy foundation is stated thus:

> Government will implement OSS where analysis shows it to be the appropriate option. The primary criteria for selecting software solutions will remain the improvement of efficiency, effectiveness and economy of service delivery by Government to its citizens (GITOC, 2003, p.24).

Whereas the familiar benefits to society are trotted out, the primary emphasis is on finding solutions to the challenge of IT deployment in government. Where that challenge can be met with FOSS it is to be encouraged. If proprietary software is "more appropriate" then it should continue to be used. The potential effect of the patenting of software, which was of concern to the authors of the NACI document, receives no mention in the GITOC document. This is perhaps ironic as this was the period when a steady trickle of software patents, notably from US multinationals, started to be registered in, and granted by, the South African patent office (Jolliffe, 2005).

The GITOC strategy was accepted by cabinet. Despite some strong recommendations, it seems there were sufficient loopholes to allow the bulk of the state IT infrastructure to maintain and extend its existing cosy relationship with the proprietary software industry. For the most part it seems it was business as usual in many state departments.

The apparent lack of teeth in the GITOC strategy was picked up by another report, this time commissioned by the Presidential National Commission (PNC) on Information Society and Development in January 2004[4]. The PNC report (Levine et al., 2004) notes the slow progress

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3   The authors also appeal to the literary symmetry between Open Software and Open Standards.

4   "Open Source Software and the Information Society – Policy and strategy recommendations to the Presidential National Commission of the Republic of South Africa", January 2004 available from http://

towards implementation of the GITOC strategy and makes a number of recommendations aimed at enhancing the existing strategy. In particular the basic policy foundation quoted above is expanded with the provision that

> When OSS is *not* implemented, then reasons must be provided in order to justify the implementation of proprietary software (Levine et al., 2004, p.4).

Whereas the recommendations of the PNC report appear on the surface to reflect a more radical position on FOSS promotion, there are some respects in which it also succeeds to muddy the waters. The new issue of Open Content is introduced for the first time and its importance is raised to the same level as FOSS. For example one of the case studies presented describes a web-based local government content management system written in Microsoft Visual Basic and released under an apparent "OSS licence constrained to the government domain". The fact that the project emphasises the release of government information under Open Content licences apparently compensates for the fact that the software platform used remains proprietary. The report fails to confront the issue of patents, despite lengthy descriptions of "intellectual property" issues. Despite its weaknesses, the PNC report made some important contributions to the SA FOSS policy debate. Besides the policy enhancements aimed at providing teeth to the existing policy, the report reasserts the responsibility of government to impact on and facilitate the wider use of FOSS in society, i.e. it can and should do more than simply work on becoming a model user of FOSS.

The PNC report reflected frustration at the slow pace of implementation of existing FOSS strategy within government. Many of its findings and recommendations made its way into the next significant attempt to shape government policy - the Go-Open Source Task Team Conference of August 2005, Johannesburg (Levine, 2005). The Go-Open campaign was a joint initiative aimed at promotion and awareness raising around FOSS in South Africa. It was supported by the Shuttleworth Foundation[5], the Meraka Institute of the Council for Scientific and Industrial Research and Hewlett Packard. The policy recommendations which emerged were substantially similar to those of the PNC report, including a timeline for concrete implementation proposals and projects. The impact of this report will likely be felt in an updated policy of the GITOC which is due to appear before cabinet[6]. In some respects it is more of the same; in other respects the language has hardened somewhat. What remains missing is the sense that this is contested terrain – the Go-Open report proudly describes itself as "not radical". It is as if there are no power relations to confront.

In summary, we can say that South African FOSS policy has gone through a significant and active process of maturation. Starting with the discussion document of the national Advisory Council we have moved towards an increasingly concrete cabinet policy with a bold implementation strategy. This forward movement has not necessarily been accompanied by a deepening engagement with the rationale of freedom and human development. The emerging dominant rationale has been one of efficiency and effectiveness.

7. CONCLUSION

We have seen that the literature suggests no simple link between ICTs and development. The context of globalisation ensures that, far from being a common project of "enlightenment" bringing light to dark places and narrowing divides, ICT development and deployment takes

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5 The Shuttleworth Foundation is an organisation set up in South Africa by Mark Shuttleworth, creator of the Ubuntu linux distribution.

6 Since the time of writing, the new FOSS policy has been accepted by the cabinet of the South African government – the policy is available from http://www.dpsa.org.za.

place within a fiercely contested global political economy. Developed countries use their influence in institutions like the WTO and WIPO to entrench and strengthen intellectual property mechanisms to ensure long term rental income in the information age and to stifle follow-on innovation from newcomers.

FOSS is a potentially disruptive influence on the ICT industry. It is in the interest of multinational companies in developed countries to absorb, accommodate and diffuse the disruption to maintain existing market dominance – as we have seen with recent moves between Microsoft and Novell. Developing countries clearly have a different interest. The evolution of policy discussion in South Africa reveals that, for the most part, there is perhaps too much hesitancy to offend the incumbent proprietary industry. Whereas the benefits of FOSS are articulated across a range of documents, albeit for the most part in utopian terms, there is a reluctance to acknowledge the potential use of FOSS as an emancipatory tool to challenge established patterns of under-development.

It is also important to caution that there is not a sole voice within government. In a similar way in which the FOSS community is often portrayed as a homogeneous group, so too is government. The internal dynamics and differences of government departments are inadequately understood, especially over a time line such as South Africa's where huge changes within government have take place since independence in 1994. This mythical notion of governmental cohesion permeates much of the ICT literature which view all levels and sectors within government as a homogenous whole, bereft of differences. In a multi-leveled and multi-sectoral institution there exists many different rationalities.

Whereas the summary of debates around ICTs for development illustrate that the nature of development is the subject of ongoing exploration, the nature of these ICTs, particularly the property relations embedded in software 'technology', has not received the same degree of attention. Returning to Akpan's comment on the dialectics of globalisation, we postulate that there is a fundamental contradiction within practices of ICTs for development which are based on, or are indifferent to, the use of proprietary software. Increased development (however that is defined) which is premised on using such ICTs results in increased long-term dependence and the reinforcement of historical, pre-digital divides - the real divides between the powerful and the powerless and the free and the un-free, of which the digital divide is certainly a symptom and in some respects a cause. In relation to our question raised *Whether the choice of using FOSS or proprietary software should be based primarily on cost and technical criteria or whether it should be based on reinforcing human development?* we can conclude that FOSS has at least the potential to address the digital divide in a way which makes us more free, not less free. The fact that we might save a few dollars in the process is a bonus.

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Gendered Perspectives on the Digital Divide, IT Education and Workforce Participation in Kenya

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Abstract

In this paper, we present a study on gendered perspectives of the digital divide, IT education and workforce participation. Using an interpretive approach, a team of four Kenya- and US-based researchers interviewed thirty-two women and thirty-one men matriculating in an IT program offered by a university in Kenya. Our findings indicate significant similarities in male and female response. Both groups described the digital divide as a complex phenomenon that occurs at individual, national and global levels. However, men were more likely than women to see the divide as bridged as a growing number of Kenyans gain IT access and skills. Both sexes perceived significant opportunities for well paying careers in the IT workforce, and this served as a primary motivator for enrolling in the IT education program. However, women tended to reflect on significant structural barriers, such public policies that failed to facilitate the development of the IT sector, gender discrimination by employers, and training which provided them with insufficient technical skills to enable them to effectively perform in the workplace.

Keywords: Gender, Information and Communications Technology, Information Society, Sub-Saharan Africa, Kenya.

Gendered Perspectives on the Digital Divide, IT Education and Workforce Participation in Kenya

INTRODUCTION

Much of the discourse on information technologies (IT) and development converges on the empowerment of women. To speak about empowerment, however, necessarily assumes that women are currently disempowered. Women are often challenged by fewer opportunities for employment in the formal economy, lower levels of career advancement and lesser compensation for equal work. Patriarchal structures socialize women to conform to conventional gendered roles that are associated with motherhood, caretaking, and domestic work. Further, Hossfeld (1990) offered that these dimensions can be characterized as the "triple shift" whereby women are involved in paid labor in the formal sector, paid labor in the informal sector, and the uncompensated labor associated with their personal households.

Development policies and programs characteristically utilize IT to advance modernization, promote social and economic development, and improve the status of women. Public policy findings on gender and social inclusion – as published in the *World Bank's 2001 Report Gender and Growth: Africa's Missed Potential* - demonstrated that when women thrive, an entire community, society and/or country gains and experiences along economic, health care and education dimensions (World Bank, 2001).

We borrow from the work of Sen (1999) to conceptualize development. According to Sen, development is a process of expanding the real freedoms that people enjoy. While most developed nations (e.g., the G8) would define a measure of a country's freedom by its gross national product (GNP), this perspective is limited in scope. Personal income provides means to expand freedoms, but Sen expands this notion by including determinants of freedoms, such as health care, education, political and civil rights. Development, therefore, requires the eradication of sources of oppression, such as gender and racial discrimination, social and economic deprivation, neglect of public facilities, intolerance, and over-activity of repressive states. When these sources of oppression are eradicated, individual freedoms are expanded.

In this study we focus on both male and female perspectives on the digital divide and the role of IT-related education and careers in facilitating development in Kenya. Much of the gender research in information systems (IS) focuses on demographic disparities with an emphasis on exclusion of women in the IT workforce and educational pipeline which prepares them for this work. More recently, however, gender has been integrated with studies of racial and ethnic minorities, people living with disabilities, developing regions and economies, and other disadvantaged groups to form comprehensive research areas including the digital divide, social inclusion, and underserved communities. Moreover, these emerging areas are gaining importance in the field as evidenced by the conference theme of social inclusion at the 2006 International Federation on Information Processing Working Group 8.2 (IFIP WG 8.2) conference and underserved communities at the 2006 International Conference on Information Systems (ICIS).

Our guiding research questions include:

1.   What are common perspectives regarding the digital divide?

2.   How and why have these digital divide perspectives motivated men and women to gain an IT-focused education?

In what follows, we begin by situating our work in extant literature on the digital divide. Next, we describe our research methodology which is based on an epistemology which recognizes both similarity and differences among the male and female informants, and the research team. Our interview protocol and methods for reducing and analyzing data are described as well. We conclude by offering our analysis and interpretation of this data.

LITERATURE REVIEW

With the development of complex and modern IT, both developed and underdeveloped countries are exploring ways to enjoy the many benefits that these technologies enable (Dutta, 2001; Goodman, 1994; Mbarika et al., 2002; Straub et al., 2001). Sadly, however, a digital divide between developed countries and underdeveloped countries looms large. The digital divide is defined as the "differential capabilities of entire social [or regional] groups to access and utilize electronic forms of knowledge" (Straub, 2003 p. W477), segregating the "haves" from the "have-nots" in the information society. While much discussion on the digital divide has focused on inequality which occurs among different social groups within a single country (Hoffman and Novak, 1998; Payton, 2003; Kvasny and Payton, 2005), we note here the international digital divide between different countries (Straub, 2003). This digital divide is abundantly clear when comparing IT in Sub-Saharan Africa (SSA) with the countries of the West like the US or the UK. For example, while the US and the UK have been enjoying Internet connectivity for more than two decades, Eritrea had its first Internet connection only in 2000. Similarly, and closely related, while the US boasts more than 60 telephone lines per 100 people, many SSA countries still share less than 1 line per 100 people. The use of IT in SSA also lags considerably even when compared to other underdeveloped regions, such as those in Central America.

In a plea at the World Summit on the Information Society, former United Nations Secretary General Kofi Annan (Annan, 2003) called for the US information technology community to involve its innovative dynamism to bridge the digital divide that threatens to marginalize development prospects. The UN has approved $6 million for the "Internet Initiative" in Africa and a further $11.5 million for IT projects under the banner of "Harnessing Information Technology for Development."

Another form of digital divide in Africa is the intra-continental divide. While the more developed Northern and Southern regions of Africa might be able to develop and grasp contemporary IT, as well as other economic development advances, the same is untrue of sub-Saharan Africa that essentially trails North and South Africa. For example, while South Africa enjoys a teledensity of over 10 telephones per 100 people, the sub-Saharan African region still barely has a teledensity of 1 per 100 (Mbarika and Mbarika, 2006).

The third form of digital divide in Africa and even some parts of the US is the "within-country" digital divide (Straub, 2003). In Kenya, our country of focus, women are just now getting increasingly engaged in IT education as well as IT-related careers. These women have historically been given the traditional "stay at home mom" role which, without minimizing its importance, has disenfranchised the Kenyan woman from fully participating in the information age. This segregation within country is not unique to sub-Saharan Africa. For instance, the digital inequity in the American educational system creates a lost cohort of would be skilled, knowledge workers – particularly among lower income and/or Black youth (Payton, forthcoming; Payton, 2006).

METHODOLOGY

To gain insights into the ways in which the digital divide is experienced in Kenya, we conducted structured interviews with 63 students (32 women and 31 men) enrolled in the Bachelor of Business Information Technology program at Strathmore University in Kenya. All of the informants were in their third or fourth year of study, and were enrolled in the "Social Impact of ICT" course which was being taught by the fourth author. All informants are of Kenyan nationality, recent graduates from secondary schools, 20 to 22 years of age, and mostly single. These were primarily fee paying students who financed their education through work, loans and scholarships. Most have completed or are currently engaged in an internship with a company. These characteristics of the informants are summarized in Table 1.

Number of interviews	64			
Age	20-22			
Year of undergraduate study	3 to 4 years			
Industry attachment (internship)	Completed or in-process			
Length of interviews	20 – 25 minutes			
Female Informants (N=32)	Adhiambo	Anyango	Arusi	Aza
	Badu	Becca	Bibi	Burhani
	Chanya	Dalila	Deka	Desta
	Eshe	Fola	Hasina	Issa
	Kaya	Kesia	Loiyan	Makena
	Marjani	Nazi	Ndila	Neema
	Nyamu	Saada	Selam	Sharik
	Thairu	Wanabui	Zahara	Zalika
Male Informants (N = 31)	Abu	Adem	Ajani	Anwar
	Barke	Belay	Chata	Chike
	Davu	Diallo	Faraji	Gamba
	Genet	Guban	Haruni	Ige
	Jabari	Juma	Kabili	Keon
	Leeto	Mablevi	Makalo	Morathi
	Nyack	Oringo	Polo	Raimi
	Shakir	Taye	Yaro	

Table 1: Characteristics of Informants and Interview Process

Interview questions were developed to uncover different expressions of common themes around the digital divide, IT education and workforce participation. The genesis of the full set themes and representative questions are detailed in a prior paper that focuses on the female respondents (Mbarika, et al, 2007). For this paper, we focus on the subset included in Table 2[1]. We selected these themes as a pragmatic way of reducing the volume of data and conceptually to remain consistent with prior studies in developing countries as documented by the Women's IT-Based Enterprise for Development[2] and the site's well-regarded case studies by information systems scholars, such as Morgan, Heeks and Arun (2004). Though these studies converge on women's issues, they offer a foundation for theorizing concepts which inform our research questions.

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[1] The complete interview protocol is available by request to the authors.
[2] http://www.womenictenterprise.org

Themes	Interview Questions
Definitions of the Digital Divide	In your own words, what is the digital divide? Some people say that the divide has been bridged since we have provided people with computer and Internet access and training. Do you agree? Why or why not?
Motivation for learning about IT	In your opinion, why do men participate in this IT program? What is at stake if you do not learn about IT?

Table 2: Research Themes and Questions

The fourth author, a researcher located in a university in Kenya, administered the interviews. During the interviews, each informant received the same interview questions in the same order. Informants were instructed to reply to the questions by anonymously writing their responses in a booklet. We believe that the anonymous nature of the responses along with the informants' established relationship with the interviewer may increase the trustworthiness of the responses. The response booklets were, then, sent to the co-authors in the US for data analysis. This interview process resulted in approximately 130 pages of interview texts.

Two US researchers began by independently reading and coding the interview texts. Texts with similar codes were typed and grouped together for more focused analysis. During focused analysis, we searched for high-level themes that addressed our two research questions: the meaning and impacts of the digital divide as well as motivations for attending course.

FINDINGS

In what follows, we present the thigh-level themes that emerged from our analysis. For each theme begin with female narratives followed by points of agreement and disagreement of male responses.

MEANINGS AND IMPACTS OF THE DIGITAL DIVIDE

The first group of questions focuses on the self-determined meanings of the digital divides. With this question, we were interested in seeing how informants connected issues of social inclusion with IT. It provided a way to hear them talk about their family members and peers who may not have an intimate relationship with technology.

We observed that one woman and seven (roughly 20%) men believed the problem had been solved. Ige's response typified this perspective which sees issues of access and cost as largely resolved. "We have access to the core of IT, the relevant aspects that the digital divide centers on". The remaining informants argued that the divide remains. Looking closer into their responses, we found that the divide existed at the personal, national, and global levels. At each level, disparities such as age, knowledge, use, and policy were structured as binary oppositions such as West/Africa, skilled/unskilled, absence/presence of IT, male/female, behind/caught up, urban/rural and old tech/new technology. This type of binary formulation is consistent with the dichotomies found in much of the prevailing digital divide discourse (Kvasny, 2006; Kvasny and Payton, 2005; Payton, 2003).

At the individual level, the divide was seen as a gap in both access to technology artifacts as well as the know-how to make effective use of these artifacts. Nineteen of the women adopted this standpoint and defined the divide as the difference between *"computer literate and*

computer illiterate people" (Issa)*, "those who have easy access to technology and those who don't"* (Selam)*,* and *"those who have some IT skills and those who don't have"* (Thairu).

Most men framed the digital divide in terms of individual disparities, but the dimensions tended to be broader than those posed by women. For instance, Ajani used age to describe the digital divide as *"the gaping disparities between generations in different parts of the world in regards to their knowledge of IT, the technologies they use, legislation in place and the general understanding of IT issues among the general population.* Cost was only mentioned by Yaro and Raimi, *"Computers can be acquired more cheaply but they are not free. You still need to have money to access them"*(Raimi). Anwar used the dimension of time to construct his standpoint. *"The digital divide is the gap created between the digital age and the traditional age. The digital age includes the use of computers, telecommunications, networks, Internet and the web. The traditional age includes the use of ladders."* Guban suggested that the features of and physical access to IT artifacts contribute to the digital divide. *"Even if we have been provided with computers to bridge this gap, those computers are of lower technology. Let's say Pentium ones which have virtually ceased to exist. Thus we can't say that the bridge has been narrowed. Also the Internet does not help in bridging the gap because of the different ways of accessing this resource".* Jabari suggested even more factors which include *"the availability of IT resources and awareness of opportunities in IT either between men and women, different geographical regions, educational endowment, or between races".*

At the national level, a female informant expressed this dichotomy spatially as *"the way that some parts of the country that is the rural areas lack information technology tools while the urban centers have most IT tools"* (Aza Ndila acknowledges: *"Yes we at this learning institution have been provided that but all this is mainly concentrated in the major towns. The rural areas have been left far behind such that the average for the country is quite low compared to that of the developed nations. Thus we cannot say it has been bridged based on the numbers/statistics of the cities"*.). Barke, the only male to discuss the divide from the national level, suggested, "Even access to the Internet is limited to those who are aware and able to access it. Some places in Kenya … have no access to a radio, forget the computer!"

At the global level, women used language such as the gap that exists between *"third world nations and industrialized countries in terms of IT"* (Hasina)*,* and *"developed nations and developing nations in terms of knowledge about IT and how it can be used to better living standards"* (Nyamu). Selam provided a rather fatalistic narrative that speaks to the frustration of being situated in a nation that is always being measured according to Western criteria that are continually expanding. She lamented, *"It will be hard to catch up with the West. In fact, it will be impossible. This is because IT works in levels. You move from one level to the next. And since IT is always changing, by the time we move to another level, the industrialized countries will be yet at another level".*

Men, such as Adem, offered similar perspectives – *"It's the fit between those who care IT literate (mostly Western countries) and the ones who are not IT literate (mostly Third World countries).* Polo contended, *"Kenya and the developing world are still behind in technology and IT as the developed world continues to make great strides in IT and technology."*

MOTIVATIONS FOR LEARNING ABOUT IT

Nearly one-third (10 out of 32) of the women who participated in the IT educational program at Strathmore University did so because they perceived the field as new and exciting with many job prospects. Women believed that there were substantial employment opportunities upon graduation because there were few IT professionals competing for jobs - *"not many*

people in Kenya have this sort of information [and] this is because currently in Kenya there lacks professionals in this field" (Issa). Not only were jobs seen as plentiful, they were also seen as well paying. Makena, for instance, believed that *"IT programs have proved to be more well paying careers than other technical careers in the country. This is due to the wide usage of IT in various sectors such as banking firms. This provides a good basis for the women to work in a different sector while applying their IT knowledge".*

Men are overwhelmingly motivated by the same career and economic factors as women. *"Men participate in this IT program firstly because they hope to achieve their goal of earning some substantial income after the course"* (Morathi). In addition to income generation, men shared a future orientation. *"Men do participate in this IT program because IT is currently experiencing vast advancements especially in developing countries like Kenya and it seems that there will be a bright future as we enter the electronic age"* (Taye). Only a few men made the argument that IT is a male domain. For instance Chike contended, *"IT is the only potentially successful sector in the future of business. And men are more affiliated to risky jobs that normally have high return. Technology are gadgets and dynamics and that is what makes up men's toys."*

Two motivators, however, were pertinent for women only. First was the view of IT as a way to engage in entrepreneurship. According to Arusi, *"I want to be a business person in the future. I want to own my own business in Kenya so I need business and management skills. However, I also realize the role of IT in today's society. I wanted to know how to link the two – business and IT –and how I can use the two to develop my ideas of a business I hope to start".* In a similar fashion, Deka noted, *"Since I have the basics of IT and my course provides a grounding I can build up on my own, I could start my own enterprise using this knowledge".* For women, such as Zalika, business ownership was once a dream that now can potentially be achieved. *"Given that I would like to learn IT so that I run my own IT firm in future. If I do not take this chance to learn IT, then my dream will not be accomplished".* One male informant, Anwar, supported the view that IT could facilitate entrepreneurship for women. "Women can use IT to improve their standard of living. For example, they can use the Internet to facilitate marketing for products, such as self-help groups to market their ciandos[3]".

The second was the view that expressed by 23 women that IT programs could facilitate gender equity. For instance, Badu reflected, *"Since the initiation of gender equality, women have been able to overcome all sorts of challenges and exploit their potential to the fullest. As a result of this there has been more of women participation".* For her, IT offered an opportunity for overcoming oppression and competing head on with men. Neema stated, *"Gone are the days when there were specific jobs/careers for men and women. Women now want the challenge.* IT represented a vehicle that would enable women to engage in a profession which has been historically perceived as a male domain. Chanya observed, *"The reason for participating in this program is to broaden the job skill and not stick to the stereotype that certain jobs are for women. IT has impacted many areas and even women realize that there are job opportunities that come with this vast growth. They therefore want to be part of it."* For Tamu, *"The simple reason why women participate in this IT program is because men do the same thing. Equality is something that women have all been fighting for and have accomplished their goal. If a man can participate in IT, why shouldn't a woman do the same thing?"*

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[3] The ciandos are very popular hand woven African female handbags (from sisal), primarily produced by the Kikuyu women of Kenya. More recently, just as many African creative ideas have been "stolen" by other non-African nations, it has been reported that this native Kenyan artifact has been 'patented' by Malaysia - to the dismay and heartache of many Kenyans and Africans.

Women also appeared to be strongly influenced by national polices and public discussion which promote gender equity. There was the belief held by women such as Adhiambo that "*women have a better understanding of the technological world so that when we begin our career we will be able to successfully represent other women in our country*". The desire to represent Kenyan women was also salient in Eshe's reflections on changing societal norms on parenting girls. *"Due to the empowerment of women in recent years, more and more parents are becoming interested in the girl child and encouraging the girl child to become active in society. More and more women want to play an active role in their society and in the world, and this being the information age, women want to be involved in the IT sector (not to be left behind their male counterpart)."* There was a sense of societal change in the women's discourse; challenges may exist, but gender relations are improving. For instance, Becca stated, *"As a Black Kenyan woman, it is my decided opinion that women participate in IT programs due to the rising gender awareness in the country. It is as a result of the awareness that women can compete on an equal platform with men, and the Gender Equality Act that we have been empowered to participate in IT"*.

Thirteen (13) male informants supported this view of empowerment. However, some men constructed IT in ways that reproduce established gender roles. *"Women participate in IT programs in order to uplift their knowledge on issues surrounding IT. The knowledge is used to upgrade women projects (i.e. family learning) and building the nation (i.e. women need take IT as a strategy to live in a world dominated by men, women use IT to get their spouses-online dating).* Others, such as Adem offered more liberating definitions. *"In recent times women have ventured into traditionally male dominated industries as a way of empowering themselves. I think that they are participating in IT for the same reason [as men]."* Chata furthered this point.

> *Most women participate in this program to fill the vacuum created by the domination of male counterparts in the field of IT. They have realized that they too are capable and given the same conditions to operate in. Women have also endeavored to participate in this program so as to be informed of the various technological changes since women form the major part of the social fabric they have to be well informed so as to foster development.*

DISCUSSION

Our study examined the perspectives of Kenyan women and men on the digital divide along with the participation in the IT workforce. Through interviews with 32 female and 31 males students enrolled in Strathmore University in Kenya, we have attempted to include male perspectives which are generally untapped in the IT gender literature. Our findings largely reiterate the gendered perspectives found in similar studies conducted in other countries, but they also provide insights into the localized causes into what appear as global perspectives.

Both cohorts were highly optimistic, embracing IT as a practical mechanism for achieving entry into the male dominated, technology workforce. Both groups advocated for IT skills and competencies to facilitate economic development and a myriad of other benefits often coupled with IT. IT access and training was seen as imperative for their individual career success as well as the development of the entire nation. Female IT workers were seen as playing an integral role in such development. Both groups expressed nation transformation via technology-based services and products, and employers with greater business and technical expertise. Moreover, both women and men articulated the need for improved public policies to facilitate infrastructure and workforce development.

However, women expressed some unique standpoints. For instance, they desired cultural change that provided them with educational and employment equal to that of men. "To the degree that the male breadwinner role is pushed more and more into the background, women are forced to earn their livings in a combination of the private and the public spheres." (Hossfeld, 2005, p 5). However, while women felt compelled to work outside of the home, they went perceived barriers which negatively affect their entry in the IT workplace. One particularly salient barrier was the perceived unwillingness of employers to hire inexperienced workers – given the perception of IT being a male dominated sector. Women noted the opportunities afforded by entrepreneurships. Historically, women in the sub-Saharan Africa region have engaged in entrepreneurial endeavours. We suspect that entrepreneurship provided both a mechanism for avoiding the perceived gender biases held by hiring managers as well as a reasonable avenue for paid employment.

While the women and men in our study showed very positive attitudes towards gaining an IT education, despite expressed challenges, more research is needed in this area. Given that we concentrated our study on an urban IT-based university, findings cannot be generalized to the experience with women in the rural parts of Kenya which constitutes over 70% of the country's population. Our study, like most studies that portray a positive view in terms of growth of information technology in sub-Saharan Africa, tells the story of the urban African "elites." Again, we contend that future studies should concentrate on rural, "forgotten" parts of Kenya and other developing nations. The discourse of location (urban versus rural; or mainstream versus displaced) is not unique to Kenya. The US and other Western nations have their share of adversity associated with location, displacement, and socioeconomic disadvantaged groups. The digital divide discourse will not only extend the debate on the disenfranchisement of certain groups from access to information technologies, but also disenfranchisement of given regions, such as these rural areas, hence presenting a more viable platform for sustainable IT growth.

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EVALUATING LARGE SCALE E-DEVELOPMENT PROJECTS : AN EMPIRICAL STUDY OF LAND RECORDS INFORMATION SYSTEM IN KARNATAKA

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Abstract

E-Government projects, which seek to improve government services and access to information for citizens, could extend over vast territories, extensive user groups and varying local contexts. Decentralization of management, while essential for success, introduces a further element of diversity. An assessment of such projects would need to be based on extensive data acquisition and analysis based on statistical methods to get the right degree of coverage. In this paper we develop a model for evaluation of IS projects oriented towards E-development in terms of seven factors. An extensive empirical study and analysis of the Bhoomi project in Karnataka state in India reported in the paper validates the model. The model could serve as a basis for evaluation of large scale E-Government projects.

EVALUATING LARGE SCALE E-DEVELOPMENT PROJECTS: AN EMPIRICAL STUDY OF LAND RECORDS INFORMATION SYSTEM IN KARNATAKA

1. Introduction

E-Government, the public systems counterpart of an older "e-Commerce" has emerged as a phenomenon that is engaging the attention of politicians, policy makers, and citizens across the world. Governments have made and continue to make huge financial and political commitments to make E-Governance a reality. Many countries both developed and developing, have embarked on ambitious multi-year programmes to create more citizen centered, effective, and efficient governments (Grant, G., and Chau, D., 2005). Reports emanating from developed countries suggest that the uses of Information Technology (IT) in the administration of public organizations are proliferating, from relatively straightforward office automation to a vast array of more sophisticated and complex applications that support many functions (Wimmer, A., 2001, Gant J.P., and Gant D.B 2002, Hasan S., 2003, Verginadis et al 2004). According to a 2002 International Data Corporation (IDC) study, China's investments in IT will grow the fastest at a compounded annual rate of nearly 40% (IDC 2002). In India, according to National Association of Software and Service Companies (NASSCOM) estimates, the state and central governments spent a combined amount of $890 million towards IT in 2001-02, a number which is expected to reach $6 billion in 2007-08 (NASSCOM-McKinsey Report 2002). Realizing the importance of IT, Indian Government has created a separate Ministry of Information Technology to promote IT in the country, and also approved the allocation of two to three percent of the budget for IT. Applications of IT are therefore increasingly pervasive in Government organizations in developed countries to a large extent and to a less but growing extent in developing countries.

Benefits of E-Government

E-Government, as electronic government is popularly called, refers to Government's effort to enhance access to and delivery of government information and service to citizens, business partners, employees, and governmental entities through information technologies (Devadoss, P.R., Pan, S.L., and Huang, J.C., 2002). E-Government is predicated on leveraging the capabilities of Information Technology to deliver services provided by governments at local, municipal, state, and national level (Grant, G., and Chau, D., 2005). Major benefits from E-government initiatives include: increased efficiencies in government operations, decentralization of services and administration, increased accountability, and improved resource management. Research by the OECD (2003) suggests that E-government can be an important catalyst for public sector reform agendas, as a tool of reform and as an instrument for improving administrative processes and governance.

Much of the research literature on IS in developing countries consists of descriptive case studies and qualitative research (See for instance Avegerou and Walsham (2001), Krishna and Madon (2003)). This may be the appropriate methodology and presentation given the complexity of the context and process issues, and exploratory nature of many projects. However in countries like India where considerable experience has accumulated in implementing IT projects, there is increasing interest in scaling up projects to hundreds of installations (Sahay and Walsham 2006, Krishna and Walsham 2005). Implementers,

managers and owners (Government and public at large) would need measures for monitoring the status and evaluating success or otherwise of such extensive projects. We argue in this paper that it would be feasible and useful to adopt a   quantitative, statistics based methodology to address issues like validation of models and exploration of features of large scale implementations.

In this study of a project in Karnataka, a province (a "state" in the terminology used in India) with a population of 60 million in India, the context is of one of rural, agricultural area in a developing country. The study focuses on a project named "Bhoomi" (A Sanskrit word which translates to "Land"), a large scale project for management of land records in the state. The project which has been implemented to cover the complete territory of Karnataka is operational in 176 centers across state. The project appears to have met most of the objectives set forth by the planners and reached a stable stage and therefore provides scope for a quantitative study. We have therefore for this study adopted a quantitative approach with extensive data collection based on a structured questionnaire followed by a multivariate analysis.

Key Research Question

While E-governance holds lot of promise for countries across the world, there is lack of clarity on many issues. Many projects are conceptualised and implemented in a top down fashion with little sensitivity to local issues and therefore meet with limited success.

Multiple stakeholders are involved in such projects. Objective is facilitation of public at large. The citizen-user is therefore the primary stakeholder. However the perspectives of Government functionaries at senior as well as lower levels and private parties associated with projects have to be taken into account as they own and operate the systems. Technical and economic factors also need to be considered, as they are vital for long term sustenance of projects. Features like good user interfaces, hardware maintenance and location of centres also have a role to play in this regard. Therefore the question we would like to explore is:

How is the success of a large scale E-governance project to be evaluated?

We proceed to develop a detailed model involving all factors relevant to such projects and report on an evaluation based on the model. The Bhoomi project implemented for computerizing land records in Karnataka, a major province in India with population of 52 million, provides a perfect setting to address the above question.

2. Bhoomi- An Information System for Management of Land Records in Karnataka, India

India is a union of twenty-eight states and seven federally-governed union territories. It is the largest democracy in the world and has a federal form of Government. India is largely an agricultural country with around 60% of population dependent on agriculture for livelihood (Indiastat 2006). Agricultural land is a very important asset and ownership of land (or lack of it), is a critical factor in determining economic and social status. Disputes over ownership often lead to violent conflicts. Maintenance of records of ownership of land has been the privilege of upper castes and has been a source of inequities in the socioeconomic system over a long time. Improvements in maintenance of land ownership records are thus a major factor in development of rural areas of this vast country.

Bhoomi, centred around a publicly accessible information base which consists of computerized database of land records, was implemented by the Government of Karnataka with technical resources provided by the national agency the National Informatics Center (NIC). The project was designed fully in-house by NIC. Under this project all 20 million land records of 6.7 million landowners in 176 taluks have been computerized. Bhoomi constitutes a fully automated system to carry out changes on land records data. It incorporates synchronization with the regular fieldwork done by village accountants and the revenue inspector and provides facility to scan field mutation (ownership change) order passed by revenue authorities and the notice served on the public interface.

The project has won the international recognition as a finalist in Stockholm challenge award 2002, silver medal in the CAPAM innovation award 2002, and was the Finalist TechMuseum award 2002. Moreover, the World Bank acknowledged the project to be a major success and has included it as part of S*hanghai learning process*, which emphasizes that as countries attempt to extend successful approaches to poverty reduction, or sustain them over time, they must be able to learn from the past experiences-from success as well as failures.

The focus of the Bhoomi information base is the Record of Rights, Tenancy, and Crop inspection (RTC). RTC is a very important revenue record containing all relevant data relating to land held by an individual or a group of individuals such as area, tax assessment, water rate, classification of soil, number of trees, nature of possession of land etc. In the manual system, prior to computerization, the original RTC was maintained by village accountant and a duplicate copy was maintained at the taluk office. The manual system of maintaining records had lot of drawbacks:

- 20 million land records were maintained by 9000 village accountants
- Manual record system was prone to manipulation
- Farmers faced harassment and extortion while requesting a copy of their land records and also while applying for change in title of land ownership
- Delivery of land records in time as and when needed for farmers was not possible
- Mutation, change of ownership, process was cumbersome
- Collating and analyzing data for taking appropriate administrative decisions was difficult and error prone.

The earlier efforts to computerize land records failed for various reasons but Karnataka Government mandated that Bhoomi- Computerization of land records would have to be undertaken and finished in all sub districts by March 2002 and provided full support for its implementation.

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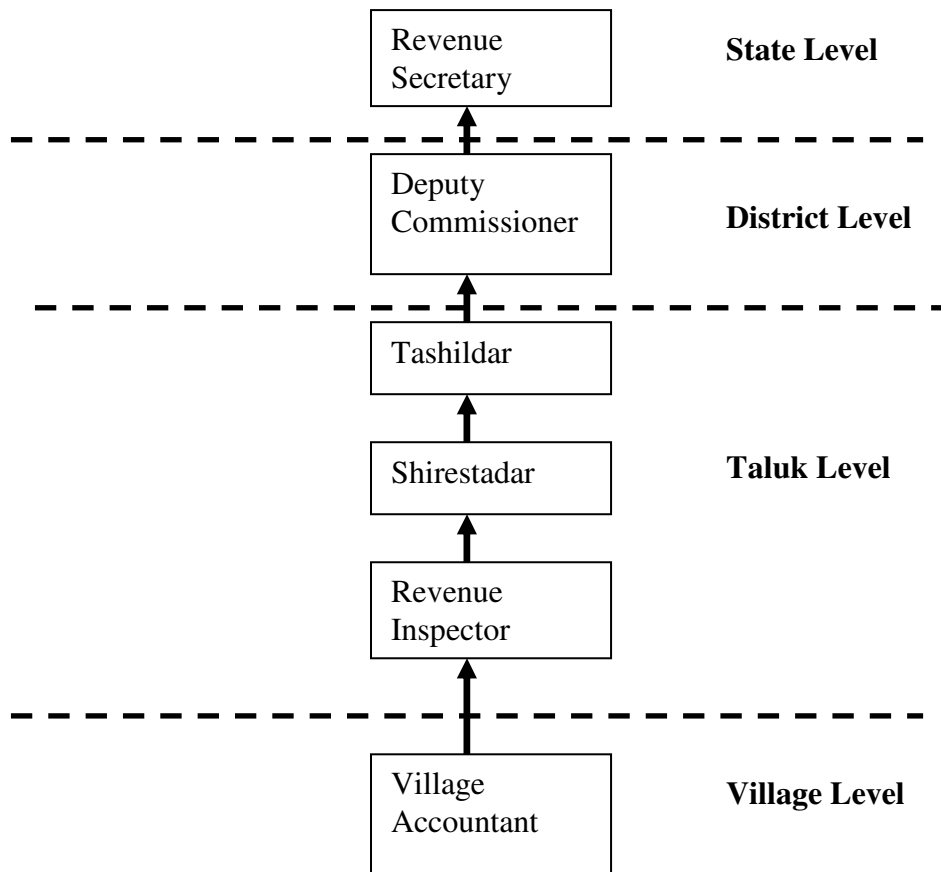
Figure 1

Figure 1 shows four levels of state administration. Karnataka state is divided into four regions namely: Bangalore, Mysore, Belgaum and Gulbarga. All 27 districts in the state fall into one of the above mentioned 4 regions. Each district is divided into taluks, which in turn comprise number of villages. At the village level, village accountant is the head of a village. Single village accountant looks after many villages, ranging from a minimum of 5 villages to a maximum of 20 villages. Ten to fifteen village accountants are supervised by a revenue Inspector. A "Shirestadar" supervises 5-10 Revenue inspectors. At taluk level, a functionary named "Tashildar" is responsible for the each taluk and supervises the entire government administration. Figure 1 also shows officials at various levels of administration.

Bhoomi project was implemented at Sub-district or taluk level. After digitizing the data pertaining to land records Bhoomi Computer Kiosks were established in each taluk. The key features of the Kiosks have been as follows:

1. User interface in local language (Kannada)
2. Farmers can collect their land records from such kiosks instantaneously with no paper work
3. Farmers can lodge requests for change in land title (mutation) with assured result within statutory period without having to approach any official
4. Facility for the citizen to see the transaction online as it happens
5. Ensuring authenticity and integrity through Biometrics system

Functioning of the Bhoomi Computer kiosks:

The onus of the smooth functioning of Bhoomi Computer Kiosks at each taluk lies with a team comprising of Kiosk Operators, Bhoomi operators and Shirestadar. Kiosk operators are responsible for issuing land records to farmers as and when requested. There are 1 to 3 kiosk operators at each kiosk delivering the land records. Bhoomi operators are involved in updating the database by scanning the documents based on the requests received from the citizens. Shirestadar is responsible for smooth functioning of the kiosk on day-to-day basis.

Role and responsibilities of Shirestadar concern all aspects of successful operation of Bhoomi Kiosk. He is responsible for ensuring regular backup of data. The Shirestadar ensure that computers and other equipments are maintained properly and ensures sufficient preprinted RTC stationary and ribbons are available. He also has the legal responsibility for approval of notice correction, mutation, and sustaining any objections as per court orders.

The System is decentralized in that each kiosk contains the details of the land records of that particular taluk only and as a result they are independent of other kiosks spread across the district as well as the state.

3. Criteria for Evaluation

Heeks (2002) defines a successful Information system as one in which most stakeholder groups attain their major goals and do not experience significant undesirable outcomes. The present research identifies stakeholders of the Bhoomi project and also considers factors which ensure their goal attainment. Stakeholders in the Bhoomi Project are Citizens, Kiosk operators and the Government. The role of Citizen-user in this case has 6.7 million instances who are landowners. As the system is fully decentralized and centers are located in widely differing economic contexts and geographic locations with distinct local histories, success in one area or region does not imply success anywhere else. The success of such a system cannot be established by any logical, deductive reasoning as might be adopted in case studies. It requires a robust framework incorporating characteristics of successful implementation which can be basis of data collection on a very wide scale.

To evaluate the Bhoomi project at a detailed level, the framework proposed by Delone and McLean (1992) model of IS success is used by us as a starting point. These authors, after comprehensive review of 180 articles published in major IS journals, identified 100 measures for evaluating IS success utilized by different authors. They synthesized these measures into six-factor taxonomy of IS success. The categories of the taxonomy are *system quality, information quality, IS use, User Satisfaction, Individual impact*, and *Organizational impact*. They constructed a relational model that interrelates the six variable categories.

The Bhoomi project was implemented for providing better services for the citizens, mainly farmers. The primary objective of the project is to provide land records to the farmers quickly thereby avoiding unnecessary delays and harassments as existed prior to computerization. So it is essential to evaluate Bhoomi project from the perspective of farmers who are the intended beneficiaries of the information system. Delone and McLean IS success model takes into consideration only the system users, who are both accessors (primary users) and beneficiaries (secondary users) of the information system. Whereas in the present case, accessors and beneficiaries of the information are two different groups of people. As the Delone and McLean model fails to consider two types of user groups in a single model, it is essential to have two different questionnaires since it cannot be assumed that satisfaction of primary users

will lead to satisfaction of secondary users. The present study will incorporate the secondary users' survey also to make the study complete to a larger degree.

The model of IS success which has been adopted by us to the context of E-Government projects is shown Figure 2.

4. Research Design

The study utilises a field study methodology and a questionnaire-based data gathering technique, as per definitions in Boudreau, M., Gefen, D., and Straub, D.W., (2001).
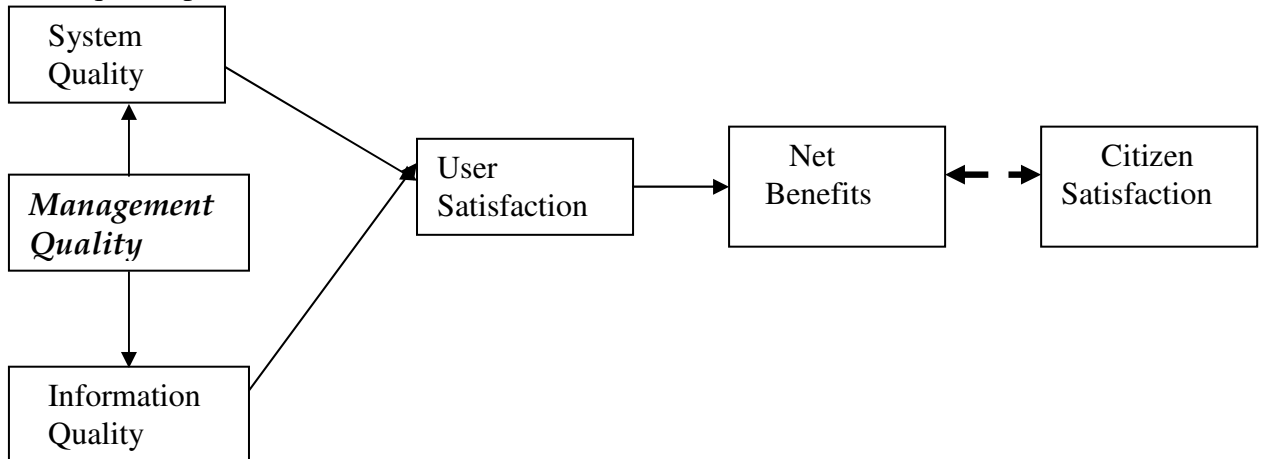

Figure 2: Research Model

Data Collection Method

Validation of the proposed hypothesis in the current study involved the measurement of the respondent's perception of various factors in the organisational setting, and his/her job and organisation related attitudes and behaviours. When we need to measure attitudes opinions, expectations and intentions of respondents, which represent internal states of respondent not amenable to direct observation, questioning them is the best and perhaps the only method (Sacket and Larson, Jr., 1998; Cooper and Emory, 1995; Churchill, 1994) A standardized questionnaire was thus used to collect data from the respondents. The principal advantage of a questionnaire is its adaptability to fit the research problem sought to be addressed. Further, it is more economical than observation, both in terms of time and cost. The major limitation, however, is that the quality of information generated depends to a great extent on the willingness and the ability of the respondent to answer the questionnaire. The design of the questionnaire must therefore ensure that this limitation is overcome to a considerable extent.

The questionnaire for the survey was designed for self-administration. However, the mail survey method was not chosen because of poor response rate and incomplete responses that are likely considering the target groups of rural entrepreneurs, grass root level administrators and farmers. Instead, the following procedure was adopted:

- Meetings were held with the top management to obtain approval and support for conduct of study at taluk levels spread across the Karnataka state
- Key persons in each taluk with whom schedule of data collection could be worked out were identified.
- The questionnaire was administered personally by the one of the researchers to appropriate persons and collected back as and when completed.

In order to get the consent of top management for accessing project sites for data collection and emphasize the worth of the study, the model proposed to be tested was outlined to them. However, this model was not revealed to the actual respondents filling up the questionnaire, as this could bias their responses.

Questionnaire Design

Measures for the variables like system quality, information quality, user satisfaction and net benefits, have been adopted from validated scales used in prior research studies, with appropriate modification, where necessary, to suit the context of the current study. Measures for variables like management quality and citizen satisfaction have been designed newly for this study. As mentioned earlier, two different questionnaires were designed for administering to two different set of population: kiosk operators and citizens. The target population, kiosk operators and citizens, were predominantly local people well versed in vernacular language but not in English language. This necessitated preparation of the questionnaire in local language, which is Kannada. An English version was also prepared. Items of all variables in questionnaire were translated into Kannada, for better understanding by the respondents. The questionnaire had items both in English and Kannada. For this purpose, translation from English to Kannada was done by an expert initially. In order to validate the correctness of translation, another expert translated the Kannada items back into English. The two versions did not vary to any significant degree. After the design of the questionnaire, a pilot study was conducted with a sample of 30 respondents drawn from different taluks with a view to assess the questionnaire in terms of (a) its understandability by respondents, (b) internal consistency and (c) suitability of the context. The internal consistency (cronbach's alpha) of all the scales in the questionnaire was above the minimal norm of 0.70 (Nunnally, 1978).

The scale used to measure each variable in the questionnaire is elaborated below, with label to the left of each item indicating the code used to represent it in data analysis. A 5-point Likert Scale was used to measure each of the items listed below as follows:

1 = Strongly Disagree, 2 = Disagree, 3 = Neutral 4 = Agree and 5 = Very Strongly Agree.

1. Net Benefits:

Net Benefits have been measured using 6 item instrument developed by Torkzadeh G., and Doll W.J (1999). The scale was developed to measure the impact of IT/IS applications on task productivity and customer satisfaction. The overall reliability of the scale is 0.92. The empirical evidence also supports the convergent and discriminant validity. The following are the items used to measure Net Benefits in the current study:

a. Task Productivity – extent to which an application improves the users' output per unit time. Items are
   1. System saves me time
   2. System increases my productivity
   3. System allows me to accomplish more work than would otherwise possible

b. Customer Satisfaction – the extent to which an application helps the user create value for the firm's external customers. Items are as follows:

   4. System improves customer service
   5. System improves customer satisfaction
   6. System helps me meet customer needs

2. User Satisfaction:

User Satisfaction is measured using a single item. Baroudi and Orlikowski (1988) developed a shorter version of the 39 – scale user satisfaction instrument developed earlier by Ives. et al. Based on their empirical analysis, they note that a single-item measure of user satisfaction can be conveniently used when only an over all indication of user information satisfaction is desired, with no interest in particular areas of content or discontent. Given our interest in capturing a global measure of user satisfaction with the application and concerns about survey length and respondent convenience, we chose to measure User Satisfaction with a single item. This single item global measure enables a reasonable assessment of IS usage variations in the current context. It is stated as follows:

1. I am satisfied with the system

3. System Quality:

System quality was measured using two items selected from Doll and Torkzadeh's (1988) user satisfaction instrument and adapted to the present context. Doll and Torkzadeh found a reliability alpha of 0.85 for the two items. This has been empirically assessed by Rai et al. A five point likert scale was used to measure system quality, with higher scores indicating greater ease of use, and hence, greater system quality. Following items are used for measuring system quality:

1. System is user friendly
2. System is easy to use

4. Information Quality:

Information Quality is measured using seven item scale developed by Rai, A., Lang, S.S., and Welker, R.B. (2002) The validity was found to be 0.88. A five point scale was used to measure each item of the scale in such a way that higher scores indicate greater information quality. Following items are used for measuring information Quality:

1. System provides the precise information needed
2. System provides output that is exactly what is needed.
3. System provides sufficient information to enable me to do the task
4. System has errors in program that must be worked around
5. I am satisfied with the accuracy of the system
6. Output options are sufficient for my use.
7. Information provided is helpful to address my questions or problems

5. Management Quality

Management Quality is measured using a eleven item scale. The scale was developed based on the case study done as well as from the conclusions of the researchers relevant to present study.

1. At state level, management provides me regular training
2. At state level, management ensures all support needed for the project
3. At the state level, management ensures that software is improved/modified according to the changing requirements.

4. At district level, officials are committed to the project
5. At taluk level, officials ensure adequate manpower for the project
6. At taluk level, officials regularly update the data
7. At taluk level, officials are committed to the project
8. At taluk level, officials encourage me to use the system
9. At taluk level, officials ensure all facilities for smooth functioning of the Bhoomi kiosk everyday.
10. At taluk level, officials provide necessary support for the smooth operations of kiosks
11. Getting help regarding the functioning of Bhoomi from any officials including state, district or taluk level is easy

5. Data Acquisition and Analysis

Sampling Procedure

The population for the study consists of kiosk operations and citizens across Karnataka State. Kiosk operators are involved in accessing the government information using the software and provide the necessary service to the citizens. Considering that the variables in the study included respondents' perceptions of factors in the organizational setting, it was decided to limit the study to the sites which have been in operation for at least 3 years and were considered successful. Further to ensure that the respondents were able to provide information sought in the questionnaire, it was decided that they should consist of kiosk operators who have spent at least 2 years in their current work environment. Citizens in the sample are people who have availed the services of Bhoomi kiosks by obtaining copies of records or those who had applied for change of title.

There are 176 Bhoomi kiosks spread cross the 27 districts across Karnataka state. At an aggregate level, Karnataka state is divided into four regions: Bangalore, Mysore, Belgaum and Gulbarga divisions. From each region it was ensured that at least three districts were included for the study. In Bangalore division 4 districts (Bangalore Urban, Bangalore Rural, Tumkur, and Kolar), in Mysore division 4 districts (Mysore, Hassan, Chamraj Nagar, and Mandya), in Gulbarga division 3 districts (Gulbarga, Bellary and Koppal) and in Belgaum division 5 districts (Belgaum, Haveri, Uttara Kannada, Bijapur and Dharwad) were sampled. Overall data was collected from 72 Bhoomi centres located in the above-mentioned 16 districts. Even though convenience – sampling procedure was adopted, it was ensured that data was collected from different centres will be fair representation of entire population. Details of sampling statistics are provided in Table 1.

Total Number of Divisions in Karnataka Province	4 (Bangalore, Mysore, Gulbarga & Belgaum)
Total Number of Districts in Karnataka Province	27
Total Number of Districts from where data was collected	16
Total Number of Taluks in Karnataka Province	176
Total Number of Taluks from where data was collected	72

Table 1: Sampling Statistics

Data Collection

Data for the present study was collected from seventy two kiosk operators in seventy two taluks spread across Karnataka. From each taluk, data for citizen satisfaction was collected from five citizens who have availed the services of Bhoomi in the respective taluk centre. Details of data sources are provided in Table 2.

The principal objective of the study was to evaluate the influence of different relevant factors on the success of the Information System implementation. As mentioned earlier, success of the implementation is a multi-dimensional construct: Information Quality, System Quality, User Satisfaction and Net Benefits. Management Quality will affect Information Quality and System Quality which in turn affects the User Satisfaction, which in turn will lead to Net Benefits.

Preliminary Analysis

Preliminary analysis consisted of exploring and cleaning up the data. It included a confirmatory factor analysis of all observed items, to assess the measures of various constructs with regard to multi-dimensionally of constructs used which could pose problems in data and analysis and interpretation. The multidimensionality of constructs can lead to an improper measurement model in LISREL (technique for structural equation modeling used), culminating in interpretational confounding. The next phase of the preliminary analysis was used to determine the distribution of variables used in the study, their means and standard deviation, and their reliabilities (cronbach alpha). This was followed by investigation of intercorrelations among the various study variables.

Number of Kiosk operators from whom data was collected	72
Number of graduates among kiosk operators	22 (30% of the sample)
Number of non-graduates among kiosk operators	50 (70% of the sample)
Average work experience of the kiosk operators	2.3 years
Number of Citizens from whom data was collected (in the ratio of five citizens for every taluk from where data was collected from the Kiosk operator)	360

Table 2: Summary of Data Sources

Results

This section presents the results of the various analyses undertaken as described in the previously. The results are discussed under two broad headings: preliminary analysis and structural equation modeling. Under preliminary analysis sample description, means, standard deviation, and reliabilities of variables, dimensionality of variables using factor analysis have been provided. Some of the results of structural equation modeling have been elaborated subsequently.

Means, standard deviations, and ranges for the latent variables are reported in Table 2. To compute these descriptive statistics, multiple item scales were summed and averaged. Alpha

reliability (cronbach's alpha) estimates for the multiple-item scales are reported in table 3. Each alpha exceeds the minimum acceptable level of 0.70 recommended by Nunnally (1967)

Variable	Symbol	Mean	Standard Deviation	Minimum	Maximum
Information Quality	IQ	4.14	0.827	1	5
System Quality	SQ	4.01	0.88	1	5
Net Benefits	NB	4.05	0.856	1	5
User Satisfaction	USAT	3.78	1.10	1	5
Management Quality	MQ	3.65	1.01	1	5

Table 2: Properties of latent variables.

Variable	Number of Items	Cronbach Alpha
Information Quality	6	0.94
System Quality	2	0.84
Net Benefits	6	0.88
Management Quality	10	0.91

Table 3: Measurement Properties of Multiple-Item scales

Factor Analysis:

A factor analysis of all items was covered using all the responses in the questionnaire. Details of factor analysis are reported elsewhere (Purushothaman 2006). For Information Quality based on factor loadings and Cronbach alpha one item out of seven (item 4 in the list given earlier in this paper) was dropped and six retained. Based on similar analysis, both items were retained for System Quality, and all six items for Net Benefits were retained. Out of 11 items in Management Quality, two items (item no. 4 and 5 in the earlier list given in this paper) were dropped and 9 items could be retained.

Confirmatory factor analysis of multiple-item scales and the estimation of fit indices for the structural modelling were performed with the LISREL 8.5 computer package (Joreskog and Sorbom 2001). Each of the 25 response items was allowed to load only on its associated latent variable. Likert-type scales with each item having more than three values for its measurement, a condition which West, S.G., Finch, J.F., and Curran, P.J., (1995) consider essential for treating items as continuous variables in the LISREL analysis, is used. As a consequence, response items were assumed for analysis purposes to be measured on continuous scales. LISREL models were estimated with a covariance matrix and the maximum likelihood estimation method. The maximum – likelihood estimation method has been found to provide good parameter estimates even when the data deviate moderately from a normal distribution (Chou and Bentler 1995), S.G., Finch, J.F., and Curran, P.J., (1995)

establish an absolute value of two for univariate skewness and seven for univariate kurtosis as maximum limits for acceptable departures for normality. For each latent variable, the loading of one item was set to equal 1.00, which prompts LISREL to generate loadings for other items in terms of a common scale. The error variance of single-item scales was set to zero.

Validation of Model Propositions

We discuss below three hypothesis (out of a total of six evaluated and reported in Purushothaman (2006)) which flow from the model for success developed in section 3.

Hypothesis – 1

Increase in system quality will cause increase in user satisfaction

The above hypothesis is supported by the results obtained by structural equation modelling. The structural coefficient of the path between System Quality and User Satisfaction is 0.17 in the LISREL model.   The structural coefficient was significant at 0.05 significance level ($p<0.05$). It can be concluded that increase in System Quality will cause increase in user satisfaction by the existing data. System quality refers to the ease of use and User friendliness of the system. So it is quite obvious that user will be satisfied when the system he uses is very user friendly and easy to use. In the present study the User interface was designed in the local language and as a result the system users did not face any difficulties in navigating through the system. So it can be concluded that higher the System Quality higher will be the User Satisfaction.

Hypothesis – 2

Increase in user satisfaction will cause increase in net benefits.

The above hypothesis is supported by the results obtained by structural equation modelling. The structural coefficient of the path between User Satisfaction and Net Benefits is 0.35 in the LISREL model. The structural coefficient was significant at 0.49 significance level at 0.01. ($p<0.01$). It can be concluded that increase in User satisfaction will cause increase in Net Benefits by the existing data. System user is satisfied by the system as it provides correct and precise information whenever he needs it and also the system is easy to use. This will help him in doing this job in much lesser time which results in serving more citizens. So User Satisfaction positively impacts Net Benefits.

Hypothesis –3

Success of the E-government projects from system users' perspective is positively associated with the success from citizen's perspective.

The correlation between citizen satisfaction and system user satisfaction was strongly significant ($p<0.000$) and the correlation coefficient was 0.725. Thus the hypothesis is supported by the data. With the help of the system, system user is able to provide information needed by the citizen quickly and correctly. The citizen is happy when his work is done

quickly without any hassles. So one can conclude that higher the System User Satisfaction, higher will be the Citizen Satisfaction.

6. Conclusion

Success of E-Government projects needs to be assessed in extensive and varying contexts and as such would need to be based on models of success amenable to appropriate data collection and evaluation schemes. Success of the Bhoomi project is validated in terms of the model developed by us and hopefully points towards a new stage of maturity in implementation of E-Development projects in developing countries.

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BUILDING PARTICIPATORY NETWORKS AROUND HIS: EXPERIENCES FROM KERALA, INDIA: A CASE STUDY FROM INDIA

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Abstract: This paper addresses the challenge of developing participatory networks to support the design, development and implementation of health information systems in the context of public health in Kerala, India. While traditional participatory design in Information Systems research has its origins in Western workplaces, the context of public health in developing countries brings to the fore very different challenges and also opportunities. Drawing upon an ongoing empirical analysis of an action research efforts to introduce, scale and sustain health information systems in Kerala, this paper, tries to analyze some of these challenges and networks. A key argument made is the need to examine the challenge of participation from the perspective of networks, rather than locally-based single systems which traditional PD theory generally has been based upon.

Keywords: Participatory design, participatory networks, health information systems, Kerala, India.

1   INTRODUCTION

Information and communication technologies (ICTs) in primary healthcare settings offer a number of opportunities to enhance the efficiency of administration and to improve delivery of healthcare services (Raghavendra & Sahay 2005). However, Health Information Systems (HIS), manual and computer based, in developing countries have been described as being grossly inadequate due to various reasons like the gathering of irrelevant and poor quality data, duplication among parallel HISs, lack of timely reporting and feedback, and poor use of information (ibid.).

The Health Information Systems Program (HISP), India, is part of the global HISP network initiated by the University of Oslo in 1994. It is a non-profit organization which aims to develop sustainable computer-based HIS in Indian states through the introduction of a Free and Open Source Software (called DHIS – District Health Information Software) (Braa et al., 2004). HISP's strategy to achieve sustainability of DHIS entails continuous capacity building at the local levels so that the health staff in the field can independently assume the ownership of managing their information processing needs and associated activities. Achieving this objective, we argue, requires establishing and strengthening of participatory networks in which the health staff (i.e. the end users of DHIS) also participate in the design and implementation of the relevant software applications. However, to make these networks sustainable and scaleable, they need to necessarily extend beyond the health staff, and include various other stakeholders (for example, NGOs, political bodies, educational institutions etc). Creating such multi-leveled networks is however, a non-trivial task, fraught with complex problems and challenges arising from technological, social, cultural and political issues (Avgerou, 2002). Understanding the nature of challenges involved in creating such participatory network, and how they can be addressed is the focus of this paper. The empirical setting for this analysis is provided by the ongoing HISP initiative in the state of Kerala in southern India.

The rest of this paper is organized as follows. In the next section, we briefly consider the literature on participatory design in the context of Information Systems (IS)/HIS, and the implications this has in the context of developing countries. A brief outline of the research methods adopted is presented in Section 3, followed by the case study description in Section 4. The case analysis, focusing on the challenges and approaches to building participatory networks is presented in Section 5, followed by some brief conclusions.

2   PARTICIPATORY DESIG IN IS/HIS

Over time, researchers have increasingly argued that IS should be viewed as socio-technological heterogeneous networks (Walsham, Symons & Waema 1990), rather than as primarily technical artifacts (Lyytinen and Klein 1985). These arguments have led to the adoption of various socio-technical design approaches (Asaro 2000), an increased sensitivity to the social context of IS design (Avgerou 2002), and a grater emphasis on enabling user participation (Bødker 1996; Obermeyer 1998).

Notions of participation in IS primarily evolved in the West, and limited attempts have been made to incorporate them sensitively in IS projects in developing countries. However, in recent years, with increasing emphasis on how the lack of the social systems approach contributes to partial or complete failure of many IS projects in developing countries (Madon 1993; Heeks 2002), researchers have emphasized the need to develop more effective ways to engage with the particularities of local cultures (Ojo 1992; Korpela 1996), including the structures that typically inhibit (or enable) participatory processes in IS design (Sahay & Walsham 1997; Braa & Hedberg 2002). However, despite this increased realization,

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achieving participation in practice is extremely complex for various reasons which we will discuss.

Participatory Design (PD) in the domain IS research and practice in the West has been largely confined to organizational settings, and shaped by their societal contexts (Kanungo, 2004; Puri et al., 2004; Lyytinen & Klein, 1985). PD in these settings was inspired for three main reasons: (i) to improve the quality of systems (Asaro, 2000), (ii) to ensure better work life quality and power sharing with workers (Iivari & Lyytinen, 1998; Bjerknes & Bratteteig 1995; Ehn, 1993; Mumford, 1993; Floyd et al., 1989), and, (iii) to redress the dominance of technical and managerial control over workers by enlarging the scope of emancipation (Lyytinen & Klein, 1985; Hirschheim & Klein, 1992, 1994).

The PD paradigm flourished in the particularities of the given societal settings in Western countries. For example, in Scandinavia, participatory approaches thrived because of the homogenous and open nature of societies, high literacy and living standards, solidarity amongst these countries including tradition of cooperating in research, well developed modern infrastructure, social democratic polity, influential trade unions positively inclined towards technology induction, intensive use of computers, and the presence of small and medium-sized organizations (Iivari & Lyytinen 1998; Boland, 1998). However, by and large, none of these facilitating conditions exist in developing countries, which represents a major point of departure vis-à-vis the Western contexts with respect to developing participatory processes. But, a positive feature from a developing country perspective, for example India, is that there has been a rich tradition of community participation in the day-to-day social life of people and development initiatives outside of the IS arena. For example, India's freedom movement led by Mahtama Gandhi is a classic illustration of people's participation on a massive scale. Numerous examples of community participation in rural development can also be cited (Chambers, 1994; Puri & Sahay, 2003). There is the need, therefore, to draw upon participatory experiences from these domains to gain insights into how community participation may be enabled, nurtured and sustained in the PD of IS, particularly those to be developed and used in the rural and social developmental settings.

More recent critical analyses of PD suggest that while PD may be necessary, it is not sufficient in itself to ensure the success of IS (Beck 2002; Howcroft & Wilson 2003). Also, PD theory and practice need new directions in the changing socio-economic situations both in the West and the developing world as s result of rapid globalization (Giddens, 1991). Iivari and Lyytinen (1998, p. 167) have opined that IS design methodologies tend to be an "offspring of their time, reflecting for example dominant research trends and theories of that time." This perspective is upheld in Dahlbom's comment (2003, pp. 105-107) that with the service sector becoming the more predominant employer, for example, in contemporary Scandinavia, as compared to the earlier era of industrial production, a new idiom for achieving non-oppressive automation was required. "A new agenda of action research will have to be developed, new large scale projects with trade unions and public agencies are waiting to be initiated, involving both users of information technology and, more important, consumers as well, in a consumer oriented approach to services" (ibid., p. 105).

Similar views have also been expressed by Mumford (2000) in her retrospective analysis of socio-technical design. With the growing trend of large organizations of the previous era becoming multinational or transnational enterprises, with distributed production and other related processes, supporting IS have also been rendered more complex and distributed, consistent with the emerging organizational needs (Georgiadou et al., 2006). A noticeable recent trend in the IS field, therefore, has been the re-conceptualization of IS as Information Infrastructures (II). IIs subsume different technologies, networks, standards to support a diversity of application areas over time and space (Hanseth, 2000). At the application level, a

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key characteristic of II is that "it is shared by a large user community across large geographical areas such that it might more appropriately be seen as an infrastructure than as a system" (Hanseth & Monteiro, 2004). Therefore, the traditional PD theories need to be revisited and researched within these new perspectives, particularly in the light of newly emerging IS design and application trends, for example the increasing emphasis on implementing ERP system in organizations, outsourcing, and emphasis on contextual approaches (Markus & Mao, 2004). A key area for this re-conceptualization concerns participatory design.

Contemporary research on HIS in developing countries has emphasized the need to enhance the use of participatory processes of various stakeholders in order to make HIS to succeed (Byrne & Sahay, 2003; Braa 1996, Korpela et al., 1998). However, a number of complexities like history, geography, culture, infrastructure, inadequate skill levels and pressures of everyday work impede the adoption of participatory processes (Byrne & Sahay 2003), and the creation of "information experts." However, creating teams without the adequate involvement of key stakeholders usually fail to reflect the needs and practical reality of service providers and managers, and does not encourage the ownership of the systems (RHINO 2001, p.3). Research has emphasized the contribution of participatory processes to HIS development; however, these have particularly been articulated in Western settings where the conditions are quite different from the developing country primary health care situation (Byrne & Sahay, 2003). For example, a psychiatrist in Norway may see about 2 patients a day, while in India the corresponding workload could be more than 100 patients. This excessive workload no doubt serves as an impediment to implementing participatory processes.

More recently, IS researchers have advocated that rather than merely seeking participation in IS design in the "classical" sense, it is essential that these efforts are supplemented and strengthened by seeking support of higher networks of power and politics. For example, the crucial challenge is to deal with the politics surrounding complex ISs like HIS in order to create extended networks of working relations (Suchman, 1994). Creating and sustaining such participatory networks, which Braa et al. (2004, p. 342) call "networks of action," aim at "aligning heterogeneous networks of routines, technology, and learning within politically contested terrains of opposing projects and ideologies in an effort to promote sustainable, replicable changes."

In summary, while participation is increasingly being acknowledged as being important to nurture, it is difficult to achieve in practice in the primary health settings of developing countries due to various contextual reasons including a lack of tradition of using computer-based HIS, complexity of both the application domain and the technology itself, the lack of timely availability of relevant and reliable data, and the political-bureaucratic driving of the health management programs. The time-honored PD methodologies also need to be reassessed and revised to take into account the current "network" approaches to IS/HIS design. Learnings from other participatory experiences outside of the ICT domains also need to reflected upon to promote PD in the IS contexts of developing countries.

3 RESEARCH METHODS

3.1 Research Setting

The present research was carried out in the state of Kerala, which is situated at the southernmost tip of the country. Despite low per capita income, several quality-of-life indicators in the state are remarkably close to those prevailing in the developed world. These indicators comprise, amongst others, a higher literacy rate, low infant mortality rate, a matriarchic social system emphasizing the empowering the role of women in the society, and

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a less intrusive caste cauldron. Kerala *democratically* elected its first communist government (a first in India; also, in the world) in 1957. The communist party has since been re-elected several times, its latest accession to power being in the recent elections to the state assembly in 2006. The people of Kerala are reputed to actively participate in the political processes, are greatly conscious of their constitutional rights, and insist on having a decisive say in the state's governance by political parties.

The high quality of life, despite the low per capita income has come to be known as "the Kerala Model," which may be taken as an early prototype of sustainable development (Parayil, 1996). However, despite the high quality-of-life indicators with respect to public health, Kerala faces challenges of increasing incidence of hypertension, depression, suicides, diabetes and cardiac problems, more common in Western countries. Infectious diseases like diarrhea, hepatitis, tuberculosis etc. are still prevalent. Additionally, the state suffers from economic underdevelopment and unemployment, which has led to a severe decline in the quality of medical care in government hospitals. Other than immunization and sterilization, most of the populace's health needs are met by the private sector (Vohra, 1999), thereby causing an increase in the cost of medical care for the ordinary citizen, and the risk of marginalization of the population who cannot afford private health care.

Kerala, the site for the empirical analysis in this paper, has a unique history and tradition of the use of participatory processes and grass root democracy given the strong left movement that has existed since independence in 1947. This tradition provides some unique opportunities and also challenges for incorporating participatory processes around HIS. The well-run Palliative Care Society in Malappuram is a success story of participatory planning in Kerala (Bollini et al., 2004) However the volatile economy mainly based on remittances from expatriates (Kurian and Thakore, 1979) and the increasing privatization of healthcare (Levesque, Haddad et al., 2006) are posing major hurdles to Kerala's healthcare environment, especially with the public domain.

3.2 Research Approach

The specific research study reported in this paper adopted health systems research methodology, wherein technological solutions are offered to streamline and improve the quality of routine paper based health information system that has been in existence for many years. The mixed reactions of enthusiasm, feeling of threat and repellence among the various stakeholders and its impact in the overall program implementation are depicted in the case study.

After getting permission from the then Health Secretary in December 2004, HISP India conducted a situation analysis in early 2005, and developed local alliances like with a national level reputed public health institution and also an IT university. In early 2006, the DHIS 2.0 (District Health Information Software Version 2.0), a free and open source software (based on Java and MySql) was customized and deployed in the 19 Block Primary Health Centers of the pilot district in Trivandrum. System facilitators were hired by HISP India who were responsible for enabling participatory processes involving the field level health staff, and try to get them to take ownership of the systems so that they could independently conduct their information processing activities, including data entry, report generation and its transmission to the next level of the administrative hierarchy which is the district. Various challenges were experienced during these processes, however, arguably a working model for a district level HMIS for Kerala has been established and demonstrated to various stakeholders. Political negotiations, including an evaluation of HISP against a large government supported initiative, was carried out leading to a decision to scale up the existing efforts to all facilities in the district

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(including all PHCs, government hospitals and urban health centers). This new implementation phase is starting in April 2007, which in due course will be evaluated and extend to the whole state.

4   CASE STUDY: PARTICIPATORY NETWORKS AROUND HIS DESIGN AND IMPLEMENTATION

The existing HMIS in Kerala is mostly paper-based and includes a great number of forms that travel through different administrative levels, e.g. from a sub-centre to Mini Public Health Centre (PHC)/Block PHC/Community Health Centre (CHC)[1], and then upwards to the district level medical/administrative hierarchy. The forms are consolidated at each level and put together manually by a health worker for submission to the next level. Apart from the state sponsored program, forms related to the national health programs are also required to be filled starting from the lowest field unit, consolidated, and sent to the next level, till the final reporting formats are prepared at the state headquarters. This data collection and reporting mechanisms tremendously add to the workload of the already over-burdened health staff at all levels, resulting in the deterioration of the reliability and quality of the reported information. Consequently, the healthcare services delivery is also adversely affected.

The HISP project was initiated in Kerala in November 2004 with the aim of implementing a computer-based HIS in the primary health sector. Through various meetings, different stakeholders were identified and a participatory meeting was successfully conducted where the respective ideas and interests were expressed and identified. Possible areas of collaboration were also discussed. The participants in this meetings comprised representatives of state government, health and educational institutions, an earth sciences research group (to facilitate GIS development), a local software development firm, the HISP-India staff, and faculty from the University of Oslo.

Following the suggestion of Director, Health Services, the piloting of the DHIS software took place at Vizhinjam CHC. Here, the local health staff explained their work routines, the data collection and reporting formats to be prepared at the prescribed frequency. They also gave their own thoughts and suggestions around the new reporting system proposed by HISP.

Two training seminars were organized for all the 19 medical doctors located in Trivandrum district – one from each block PHC/CHC. Several medical doctors studying for the Master of Public Health (MPH) program at the Sree Chitra Tirunal Institute of Medical Sciences and Technology (SCTIMST), an eminent participating educational institution, also attended these seminars. The contents of this training were focused on basic concepts of HMIS, data collection and data quality, the importance and relevance of choosing and designing health indicators appropriate to the local contexts for improved decision making. The participants were also sensitized to the use of GIS and associated maps for assisting in better planning of the public health activities and their monitoring. Hands-on sessions on the use of HMIS software (DHIS) were also imparted to the participants. The participation of the MPH students was crucial as they constitute the next generation of medical doctors, many of whom would potentially work and be associated with HMIS in the near future. These seminars yielded many valuable fresh ideas, views and professional opinions. Issues that were discussed included the problems with data manipulation by field workers due to high

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[1] Subcentre is the grassroot level health facility for every 5,000 rural people that is manned by two basic healthworkers. There would be one Mini PHC/PHC for every 20,000 rural people that has a medical team with one/two basic doctors. In addition, for every 80,000-1,00,000 rural people, there would be a Block PHC/CHC (a first level reference centre) having inpatient services and specialist doctors

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achievement pressure from higher levels, the need for constructive feedback, the importance of training (to use the system), priority of forms to be computerized, conformity of reporting requirement and who should be responsible for data entry in the clinics. All in all, the participants were very positive and enthused towards the induction of DHIS as they felt it would alleviate some of their existing problems. There was skepticism from some quarters, such as if the current staff would lose their jobs because of automation. These concerns needed to be addressed adequately by HISP, such as by assuring the aim was not to reduce staff but to qualitatively change the kind of work they do – a shift from reporting to analysis.

After conclusion of the above seminars, PCs where placed in all the 19 clinics in Trivandrum district. Alongside, all of the health staff in these clinics were introduced to the use of computerized HMIS, and also provided an initial exposure to the functionalities of DHIS and how these were to be used. These training sessions were held in the local language (Malayalam) by the IT staff hired by HISP-India to play the role of system facilitators in the clinics. Currently, a junior health worker in a clinic usually spends between two and four hours every day filling out data entry forms, and to attend to other information related activities. Therefore, the health workers were positive towards the introduction of the computerized HMIS, and looked forward to the software to easing their workloads. The doctors were also very helpful during these training sessions, and it was evident they had well oriented the staff in advance.

A lot of inputs were given throughout the sessions of training seminars and demonstrations. As the staff was keen on having as many reports as possible computerized as early as possible, the most important reports to be given priority were identified. To ease the work load of the Junior Health Inspectors (JHI) and Junior Public Health Nurses (JPHN)[2], it was decided to design a single format containing all the data elements they had to collect. This way, they would not need to fill out the same data several times, and redundant elements would be eliminated. As the work areas of the JHIs and JPHNs often overlapped, there would sometimes be a duplication of the same data element collected by both. For example, if the JHI had registered three cases of measles and the JPHN had registered two, it would be hard to say how many cases there actually were because they could have reported the same incident twice. HISP India aimed to solve this problem, as suggested during the above training, through making different forms for the JHIs and JPHNs so that their work would not overlap and they would have a checklist to follow when out in the field.

Eight months after the DHIS implementation was started, the health staff have gained sufficient competence to independently conduct their routine information processing activities. However, HISP has not been able to yet establish the informational link to the next level of the reporting hierarchy, which is the district office, where the processed reports from the PHCs are received. A key reason for this has been the presence of a parallel government supported initiative to develop an HMIS. This project, supported by the European Commission (EC), is adopting a contrasting model as compared to HISP. While HISP focuses on decentralized computing with a focus on user control, this agency is proposing a centralized architecture with one copy of the application being stored at a state level server, data being entered from the district level (not PHC) online into the state application. 95% of their project costs are related to hardware and software acquisition, and 5% on capacity building, while the reverse is the case with the HISP approach.

The parallel development being done by government agency, and the fact that the EC has already provided funding, made it a problematic situation in which there is a potential

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[2] The junior health staff who work out in the field and sees patients. JHIs are male and JPHN are female.

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crossing of paths of the two initiatives. The HISP team garnered political support for their efforts based on an evaluation of the costs of respective applications, HISP solution was presented as being about 90% cheaper than the top-down centralized formulation. Furthermore, HISP is playing the "free software card," emphasizing how this crucial aspect is in conformity with the stated policy of the current leftist government as against the licensed and proprietary approach exercised by the other agency. In December, an evaluation was carried out of the HISP and the government initiative, and HISP was selected for further implementation.

5   ANALYSIS AND DISCUSSION

As HISs are complex, interconnected heterogeneous systems that are deeply embedded in social, cultural, political, technical and contextual issues, they need to be designed not only with a technical orientation, but with considerations for a variety of other components both technical and non-technical. These components are for example, health staff at different levels, government officials, technical infrastructure, work routines and organizational health structures. PD is seen as a foundational method in reaching the goal of empowering the peripheral levels in health care systems and to create local action (Braa 1996; Byrne & Sahay 2003; Puri et al., 2004).

PD has been used to a great extent through the HISP project in Kerala. The HISP India team thoroughly mapped the context in which the project was introduced, the health staff was involved in how the reports should be computerized, their prioritization, how the work could be reduced at the sub-centre level, thus providing important inputs to the DHIS2 customization and adaptation processes. The main PD activities were conducted at the collaboration meeting, the training seminars, the demonstrations in the clinics, and the ongoing capacity building processes carried out through the system facilitators. Additionally a multitude of meetings with different stakeholders provided the necessary involvement of local powers. For example, the DHIS 2.0 outputs were shown to the Gram Panchayat (a locally elected village level body) who also have indicated their interest in receiving the reports locally. The intensive involvement of the local public health institution which in addition to have played the key role of providing technical inputs related to public health needs, have also helped to develop the local credibility of the initiative, something which is very important in the leftist Kerala's political environment.

Compared to the environment where the Western PD models evolved with work-democracy focus, for example in Scandinavia, the motivation for PD in developing countries differs quite substantially since workplace democracy is not as widespread or as important a priority as in the Western world. The focus in developing countries is how IT can be used to develop and empower deprived communities (Braa, 1996) and how PD can provide important inputs to improve systems development, and with it seek to empower peripheral level health workers and lead to local action and improved health conditions. It is evident that the use of PD is highly context-sensitive and that transfer from one context to another must be done only with high knowledge and understanding of the context in which it is transferred (Walsham, 2002). This is particularly important when developing large, complex infrastructures such as HIS.

Developing countries often are more politically centralized and highly hierarchical, hence a combination of bottom-up and top-down approaches have to be used. Only using a bottom-up approach will lead to limited support from management and executives, which negatively affects sustainability and scalability. However, only concentrating on a top-down approach will not yield the desired outcome of ground level empowerment and developing sensitive systems that reflect the local needs and priorities.

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Based on the issues mentioned above, it is apparent that the use of PD needs a re-conceptualization in order to suit contexts outside of the Western world and in the development of larger and more complex, interconnected systems which are becoming more and more common. Four areas of re-conceptualization are discussed below.

5.1 Building participatory networks

In traditional PD theory, participation has implied the involvement of end users. From the experiences with the HII development in Kerala, it is evident that this perspective of PD is not sufficient. We argue that a shift from user participation to broader stakeholder participation is needed since HII is a large and interconnected network involving many actors apart from end users, and represents a vast number of diverse interests. In Kerala, for example, these stakeholders ranged from health staff, community members, government officials, educational institutions, non-governmental and private organizations and systems developers. Initiating the development of this HII with the traditional PD approaches would have most likely not been successful, as it would have led to a number of unfulfilled interests and resistance of stakeholders whose support is crucial. The aim should be to create both multi-sectoral and multi-level participatory networks of these actors. Multi-sectoral network building facilitates consideration of a majority of interests in all the constituencies of the infrastructure, and contributes to achieving sustainable solutions. Involvement of multiple levels is crucial to soliciting support of decision-making top levels in order to nurture and sustain local level participation and action.

5.2 Context Sensitivity

In developing countries, the context of PD differs greatly from In December, an evaluation was carried out of the HISP and the government initiative, and HISP was selected for further implementation. While literature rather focuses on the individuals who participate in development projects, we argue that prior to commencing PD activities in HIS development the context should be thoroughly analyzed in order to reveal situational issues which may influence these activities. These contextual issues may be of political, social, cultural, geographical or infrastructural in nature and need to be fully comprehended to enable successful inculcation of PD processes. For example, HISP India conducted detailed situation analysis over six months to be able to map contextual issues in Kerala prior to initiation of the project. Through this analysis, hierarchical structures, political conditions and the state of infrastructure were understood. Without knowledge of and consideration of these issues, participatory processes would most likely not have succeeded to the extent they have so far in the project. Hence we argue that the context of which it introduced needs to be included into the PD paradigm as an important factor for the success of participatory processes, for example through "reverse participation," where the system developers immerse into the local context to develop a deeper understanding of the requirements, in contrast to participation in general where the staff need to learn about the system. Both these forms of participation are required to develop linkages for mutual learning.

5.3 Focus on outputs, not just techniques

Researchers have characterized PD as an important success factor in IS development for subsequent acceptance of the system by users. However, often PD is adopted as a matter of form without thoughtful consideration the desired outcomes expected to be produced. A number of different PD techniques have been developed over the years, for example PICTIVE which produces an initial mock up of the system, intended to be modified by the users. However, the focus should be on how such techniques work in the context they are introduced to, and what will be the output, rather than merely being used mechanically. If necessary, the

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PD techniques should be modified to suit the situation in which they are to be applied. We argue that a re-conceptualized PD should focus on the outputs and results expected through its application, rather than the emphasis on the use of the technique in itself. A focus on outputs is fundamental to the scaling of the system, as consideration needs to be given to how these outputs become integrated in the socio-political-cultural-institutional conditions that shape and inform use processes.

5.4 Focus on structural and behavioural changes

Bass and Shackleton (1979) distinguished between industrial democratic aspirations of the Scandinavian and European strands of participation in workplace settings, and the participative management approaches, for example in the United States. They argued that while industrial democracy movements constituted formal, structured and often legally supported mechanisms, participative management tended to be more informal and its practice in organizations varied as per individual managerial styles and corporate ethos. The participative approaches were thus considered to be behavioral. Therefore, issues that could be addressed using these approaches tended to be different. These researchers argued that, for example, job satisfaction could be enhanced using participative management, while the issue of increased financial benefits to employees was relevant in an industrial democracy debate.

For example, in Kerala, the introduction of computerized HIS potentially entailed behavioral aspects, for example how health workers participated and gave inputs for finalizing user specifications based on their understanding and knowledge around health issues specific to the locale. Markus and Mao (2004) also pointed to the relevance of considering behavioral and psychological aspects of participation to address the gap in the perceptions of users around system requirements, and its development as perceived by the IT experts. The structural changes on the other hand facilitate and sustain participation, and determine the outcomes of IS development projects. In the case discussed, structural aspects refer to how the existing work routines need to be modified and embedded into the new computerized environment of primary health management.

6   CONCLUSIONS

Participation in a developing country context requires different considerations as compared to initiating similar processes in the Western settings. It is important to approach such environments with considerations of the users' positions, customs, ways of thinking, varying institutional and political settings. In order to empower the lower levels, the top echelons need to be included in the process, especially during its initiation, as their formal endorsement helps to create the space for lower level participation. In complex networks such as the HII, many diverse, often conflicting, visible and hidden interests of different stakeholders need to be carefully understood and resolved towards alignment. The building of participatory networks can bring these stakeholders together to achieve a well defined and common objective, such as improving healthcare governance through the use of computerized HMIS. Such participatory networks should be constituted of both multiple sectors and levels in order to assure system sustainability and success.

Based on the experiences in Kerala, we argue for the need of re-conceptualization of PD towards their use in an II context. The main areas of re-conceptualization identified are: (i) building of participatory networks, (ii) context sensitivity, (iii) focusing on outputs and not on the PD methodologies alone, and, (iv) inculcating a judicious mix of both behavioral and structural aspects of participation. While highly germane to the effective use of PD in developing countries, this re-conceptualization is also applicable to the developed world where there also are differences in cultures and contexts between countries, which need to be

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carefully taken into account while designing larger, more interconnected and complex IIs, for example the Enterprise Resource Planning Systems (ERPs).

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