Achieving interoperability between DHIS2 and SOS Children's Villages' Program Database

A case study investigating the child care information ecosystems in Ethiopia and South Africa

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Preface

The research conducted for this thesis is the result of a joint effort between the Department of Informatics at the University of Oslo (UiO) and SOS Children's Villages (SOS) Norway. The data collection was performed by a research team consisting of myself and two fellow students at the University of Oslo. This particular thesis, however, is solely written by me.

SOS Children's Villages is a non-profit and non-governmental organization that provides care and support for children in so-called *alternative care*, meaning not in the care of their biological parents. SOS also provides support for families in need. Being an international organization, SOS naturally partakes in the child care information ecosystems in all countries they operate in while keeping their own information system for organizational purposes.

This thesis also heavily features the digital system District Health Information Software 2 (DHIS2). In short, DHIS2 is an open-source, web-based health management information platform. Due to its generic and customizable nature, however, it is not restricted to health-related usage.

The information system contexts presented in this thesis are *selective*, meaning that only the aspects of the information systems that were deemed to be relevant to the research goals will be discussed. This is done to not overextend the scope of this thesis. The basis for this thesis is, however, a data collection that primarily sought to form a *holistic* view of the child care ecosystems in Ethiopia and South Africa. For a more holistic view of these child care ecosystems, I would refer the reader to the thesis written by my research partners - Arnesen and Haga, 2020 - who opted for a wider scope and focused more on the constraining and enabling factors of these child care ecosystems.

Abstract

This thesis demonstrates how the generic software package District Health Information Software 2 (DHIS2) can become interoperable with SOS Children's Villages' primary data warehouse - the Program Database. Through this demonstration, it further proposes DHIS2 to be implemented as a Child Care Management Information System on a governmental level, and for interoperability to be achieved between it and digital systems used by various Non-Governmental Organizations tasked with the care of vulnerable children to improve data management in child care information ecosystems.

The interoperability is discussed on *three levels*. At the syntactic/technical level, interoperability can be achieved by utilizing REST-based APIs. Furthermore, it is argued that semantic interoperability can be achieved by the development and utilization of a child care information exchange standard. This approach is also argued to simultaneously positively impact several of the more prominent constraining factors of the child care ecosystems presented in this thesis. Lastly, while it acknowledged that the organizational/political level is the most complex interoperability to achieve, it is argued that establishing the aforementioned child care standard and DHIS2 in the child care ecosystems would ease the difficulty of aligning organizational and political actors.

DHIS2 has primarily been utilized as the national Health Management Information System in various African countries. Impacts of digital systems - including DHIS2 - in African health ecosystems have been extensively researched. In contrast, there exists little comparable research on child care ecosystems, and children without parental care have little presence in statistics. Similar to the African health sector, constraining factors like organizational and political misalignment, infrastructural challenges, silo-based systems, and duplication of work were found to impact the child care ecosystems in Ethiopia and South Africa.

Qualitative data were collected digitally and during a six-week-long field study in the African countries Ethiopia and South Africa. This thesis specifically addresses constraining and enabling factors, as well as future initiatives and current digital systems within the Ethiopian and South African governments and SOS. The aim is to combine the research findings with existing literature and research to assess whether there is a need to introduce a digital system like DHIS2 to these child care ecosystems, and if so, how to do it.

The contribution of this thesis is a foundational study on how DHIS2 can be applied to a child care-specific context. Furthermore, it argues that a standards-based approach to achieving interoperability can decrease the fragmentation of actors and data, as well as the workload on social workers. This in turn could result in a higher degree of visibility of vulnerable children by positively impacting data management and decisions made on higher organizational and political levels.

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Acronyms

AC Alternative Care. 11, 45, 54, 65, 73

ANSI American National Standards Institute. 91

API Application Programming Interface. iii, 17, 23, 24, 26, 28, 50, 51, 88, 90–92, 94, 97, 98, 101, 103

BoWaCA Bureau of Women and Children Affairs. 42, 53, 54, 56, 57

CA Core Assessment. 45, 47, 78

CCMIS Child Care Management Information System. iii, 4, 6, 7, 14, 15, 21, 81, 82, 95, 99

CSO Agency for Civil Society Organizations. 32, 38, 40, 53, 54, 57, 58, 61, 62

DHIS District Health Information Software. 15, 60, 69, 97

DHIS2 District Health Information Software 2. i, iii, xi, xii, 3–7, 13–15, 17–21, 23, 26–28, 31, 34, 48, 50, 53, 58–60, 63, 65, 69–71, 74, 77–79, 81–89, 91–97, 99–101, 103

DoH Department of Health. 69–71, 74

DSD Department of Social Development. 32, 39, 42, 66, 68–73, 79, 84, 93, 101

EPCH Eastern Province Child and Youth Care Centre. v, 39, 68

ESAF Eastern and Southern Africa. 47, 53, 65

FHIR Fast Healthcare Interoperability Resources. xi, 90–92, 98

FS Family Strengthening. 11, 45, 54, 65, 66, 73

HIM Health Information Mediator. xi, 90, 98

HIS Health Information System. 88

HISP Health Information Systems Program. v, 3, 13–15, 17, 32, 38, 39, 58–60, 69–71, 74, 81, 87, 93, 96, 101

HL7 Health Level Seven International. 91

HMIS Health Management Information Software. 60, 63, 69, 74

HMIS Health Management Information System. iii, 3, 4, 6, 7, 14, 15, 17, 27, 58, 60, 81, 87–89, 93, 96, 101

HTTP Hypertext Transfer Protocol. 24

INSA Information Network Security Agency. 57, 58

IS Information Systems. 3, 4, 27, 63, 77

MERA Monitoring, Evaluation, Reporting and Analysis. 38, 40, 47, 50, 51, 54, 62, 63

MoH Ministry of Health. 15, 28, 32, 38, 40, 53, 58–60, 63, 65, 70, 93, 96

MoWaCA Ministry of Women and Children Affairs. 38, 40, 53, 54, 56, 61, 62, 84, 98, 101

NGO Non-Governmental Organization. iii, 3, 4, 32, 34, 43, 56–58, 60–62, 66, 68, 70–72, 74, 84, 93, 95, 98, 99, 102, 103

NISPIS National Integrated Social Protection Information System. 68, 69, 74, 84, 90, 93

NSO National Statistics Office. 65, 69, 101

PD Program Director. 32, 37–39, 41, 47, 50, 53, 54, 57, 61, 62, 65, 66, 73, 74, 77, 78

PDB Program Database. iii, xi, xii, 4, 6, 12, 28, 32, 34, 39, 41, 42, 45, 47–52, 61–63, 65, 66, 72–74, 77–79, 81, 82, 84–89, 91, 94–97, 99–102

PDB2 Program Database 2. 47–49, 51, 62, 78, 79, 84, 96, 97

PDC Program Development Coordinator. 47, 66

REST Representational State Transfer. iii, 26, 50, 51, 88, 94, 97, 98, 103

SDMX-HD Statistical Data and Metadata Exchange Health Domain. 91, 98

SOS SOS Children's Villages. i, iii, v, xi–xiii, 3–7, 11–13, 27, 28, 31, 32, 34, 38–41, 43, 45–58, 60–63, 65–69, 71–74, 77–79, 81–91, 93–103

TLC The Love of Christ. v, 39, 68

UI User Interface. 48, 57, 77, 78, 91, 92, 97

UiO University of Oslo. i, 3

WHO World Health Organization. 91

XML Extensible Markup Language. 91

Part I

Introduction

Chapter 1

Research Outline

1.1   Description of Thesis Parts

This thesis is structured into four parts, each part consisting of chapters. The different parts and their structural purposes are:

- Part I: Provides an outline of the research. This includes the research motivation, goals, conclusion, limitations, and contributions. The work conducted for this research is also shortly summarized.

- Part II: Provides background information for later discussion and support for the conclusion.

- Part III: Describes the research conducted by presenting the methodology, and presents the findings from our data collection. This part addresses the *first research goal*.

- Part IV: Discusses the findings from Part III whilst drawing elements from Part II to provide a thesis conclusion. Furthermore, this part provides pointers for future work for whomever it should concern. The remaining three research goals are addressed in this part.

1.2   Research Motivation

The Information Systems group at the University of Oslo analyzes *"the relationships between digital platforms, global public health, and broader development processes through interventionist, action research methods, what we call Digital Platforms for Development (P4D)"*(*University of Oslo website - Information Systems Group at the Department of Informatics*). This group is the research unit of the Health Information Systems Program, which is responsible for the core development of the generic software package District Health Information Software 2 (DHIS2). DHIS2 is currently mainly used as a Health Management Information System (HMIS), and will be further discussed in Part II.

An initiative was put forth by representatives from SOS Children's Villages Norway. SOS is an international Non-Governmental Organization that mainly provides support for vulnerable children and when appropriate, their families. The representatives approached the Information Systems group proposing to assess the potential of utilizing DHIS2 to handle child care information. This thesis is written for the Information Systems group and contributes to their field of research.

> *"The Sustainable Development Goals (SDGs), adopted in September 2015 by the United Nations, envisage a world free of poverty, violence, and inequality, where everyone can fulfill their potential with dignity. To truly achieve this by 2030, children, especially the most disadvantaged, have to be at the center of this global agenda." - NO CHILD SHOULD GROW UP ALONE - SOS Children's Villages Strategy 2030*

The representatives expressed concern with the overall statistical visibility of vulnerable children. This concern is more thoroughly formulated in *CARE FOR CHILDREN IS CARE FOR DEVELOPMENT - How SOS Children's Villages supports the Sustainable Development Goals*, where it is stated that *"accessible and reliable data are key tools for measuring progress on SDGs among all children. Yet unacceptable data gaps remain when it comes to children without parental care and children living out of the household, who are still virtually invisible in statistics"*.

With support from the Information Systems group, SOS Children's Villages, and existing literature on DHIS2 and its impact on the health sector in various African countries, the main *motivation* for this research is, therefore, to assess how DHIS2 could be applied as a *Child Care Management Information System*, whereas it has primarily been used as a Health Management Information System.

1.3   Research Goals

The core *objective* of this research is to demonstrate how DHIS2 can become interoperable with SOS Children's Villages' primary data warehouse - the Program Database. Through this demonstration, it further proposes DHIS2 to be implemented as a Child Care Management Information System on a governmental level, and for interoperability to be achieved between it and digital systems used by various Non-Governmental Organizations tasked with the care of vulnerable children to improve data management in child care information ecosystems.

Being an international organization, SOS Children's Villages is naturally an actor in various information systems in the respective countries in which they operate. As such, these information systems will be addressed with the countries Ethiopia and South Africa as the chosen research sites. One side of the coin is SOS' *internal* information system, and the other side would be the *external* information systems that they partake in. After outlining these information systems, a discussion on the possibility of introducing DHIS2 to these information systems can commence.

The impact of digital systems for data management on the African continent has been widely researched, and DHIS2 has played a large role in the health sector of various African countries. DHIS2 and similar systems have had a significant impact on data accuracy, completeness, and timeliness. Interoperability between digital systems has also been proven to ease the workload on social workers at health facilities by eliminating steps of paper-based data reporting.

Thus, there are two main sides to this research. Firstly, the child care ecosystems themselves; which actors that partake in them and how data flows between them. In other words, a more socio-technical side that encompasses organizations, governments, policies, and infrastructure. Secondly, the digital systems, most particularly DHIS2 and SOS Children's Villages' Program Database; which aspects that could be improved by introducing DHIS2 to these ecosystems - demonstrated through an

interoperability study between the two - and complications that could arise from it. This is the more technical side.

To be specific, the research objective is broken down into *four research goals*:

1. Present aspects from a holistic view of the information systems used by SOS Children's Villages and government entities tasked with child care in Ethiopia and South Africa, including digital systems, requirements, constraining and enabling factors and future intentions and development.

2. Discuss how DHIS2 can be introduced to this context; by interoperability, integration, or as a replacement of current digital systems.

3. Discuss consequences from introducing DHIS2 to the respective child care information systems, and use this discussion to propose a high-level solution.

4. Combine the solution with related literature to detail how the introduction of DHIS2 can be implemented on a syntactic/technical, semantic, and an organizational/political level.

1.4   Work Done

The work performed to reach the conclusion presented in this thesis can be summarized in the following points:

1. Literature on DHIS2, digital health initiatives on the African continent, standardization, interoperability, integration, and complexity were studied.

2. An attempted holistic view of the information flow within the Ethiopian and South African child care ecosystems was formed through a data collection conducted through a six-week-long field study and later digital interviews. Aspects of particular relevance to the research objective were identified. These aspects mostly revolve around information flow, digital capabilities and functionalities, constraining factors, and enabling factors.

3. Drafts of two different high-level solutions describing interoperability between SOS Children's Villages' Program Database and DHIS2 as a Child Care Management Information System at the governmental level was presented to and discussed with the main development team behind the Program Database.

4. Using one of the solution drafts and relevant literature, a strategy on *how* to achieve interoperability between the Program Database and DHIS2 was developed.

5. An assessment of how this strategy and its implications could benefit other organizations and government entities tasked with the care of vulnerable children was conducted.

1.5   Research Conclusion

The conclusion of this thesis can be summarized in three points:

1. Constraining and enabling factors of the child care ecosystems in Ethiopia and South Africa as nations, and in SOS Children's Villages as an organization was found. The factors of particular relevance to the research objective are presented in this thesis.

2. Using these constraining factors along with existing and relevant literature, a high-level solution to the introduction of DHIS2 to these child care ecosystems were presented. In short, this solution places DHIS2 at the governmental level as a national Child Care Management Information System, similar to its current position as a Health Management Information System in both Ethiopia and South Africa, and for interoperability to be achieved between DHIS2 and SOS Children's Villages' Program Database.

3. It is proposed that interoperability can partly be achieved through a standards-based approach. The benefits of such an approach are argued to be two-fold. Firstly, it achieves semantic interoperability. Secondly, the development and adoption of a child care information exchange standard could help to further standardize child care information exchange and as such decrease the impact of the most prominent constraining factors identified in this thesis.

1.6   Research Contributions

The most important contribution of this thesis is that it provides a strategy for interoperability between child care organizations and governments, and the future standardization of child care information exchange. Parallels are drawn between constraining factors found in child care information systems and health information systems, and lessons from the literature on the latter are applied to address the constraining factors of the former.

Based on this, I would propose for this thesis to partake as the basis of future work related to:

- Expanding DHIS2 use cases by introducing it as a Child Care Management Information System, whereas it has primarily been used as a Health Management Information System.

- Further integrate information systems employed by different actors tasked with caring and supporting vulnerable children.

- Improve management of data on vulnerable children and developing a standard for child care information exchange.

Further study and work related to these points could in turn improve the visibility of vulnerable children and result in more informative decisions being made from decision-makers at higher organizational and governmental levels.

1.7   Research Limitations

The solution presented in this thesis does not have any testing or piloting to lean on. This solution is described in Part IV and is illustrated by figure 13.1. Without adequate testing or piloting, I cannot prove the effectiveness of this solution. Instead, the overall idea behind the solution - illustrated by figure 11.2 - was presented to and discussed with the main digital development team at SOS Children's Villages. This discussion and their views on this solution are also described in Part IV. Furthermore, the solution and other parts of the conclusion which are based on *four research goals* (1.3) is backed by existing literature and conclusions drawn from the data collected during a six-week-long field study. Therefore, the results from this thesis is more so a foundation built by a summation of constraining factors related to existing child care information ecosystems and proposed solutions to some of the more prevalent of these issues.

This thesis suggests a standards-based approach when attempting to achieve the interoperability discussed in Part IV. This suggestion is also drawn from a combination of existing literature and the constraining factors found during our data collection. It is acknowledged that a child care information exchange standard should either be created or implemented by augmenting existing standards. A few information exchange standards used in the health sector are named as candidates to draw inspiration from. However, the particular design of such a standard is not presented in this thesis.

Lastly, while several data elements, indicators, forms, and reports are discussed in Part III, this thesis does not compare any of these with the intent of identifying data

similarities, differences, or overlap. Solution B (figure 11.2) relies on a separation of data elements and indicators, as well as the identification of its recipients. While this is not necessarily a limitation of this study, it certainly falls outside of the research scope.

Part II

Research Context

Chapter 2

SOS Children's Villages

2.1 Introduction

This chapter will provide a brief overview of SOS Children's Villages and establish some key terms that will be used throughout this thesis.

2.2 Overview

SOS Children's Villages is an independent non-governmental, nonprofit international development organization with a headquarter in Innsbruck, Austria. They are active in 136 countries and territories around the world (*SOS Children's Villages - Where We Help*). The organization works with communities and state partners to provide alternative care for children without adequate parental care. This care primarily involves two programs:

1. **Family Strengthening (FS):** Families experiencing crises or extreme hardship may have difficulty caring adequately for their children. The FS program provides support for these families in several ways, including coaching in parenting and household management skills, providing family counselling and access to health services and education, as well as training and equipping parents to earn an income and create a stable home. In this program, the children will still live with or be in the direct care of their own biological family.

2. **Alternative Care (AC):** Children of different ages and backgrounds live together in a house in a community commonly referred to as a "village" or a "program location" with a full-time substitute parent. There are usually 6 to 15 houses in each village, and children are provided with access to a whole range of programs including subsidized kindergartens, primary and secondary schools, youth facilities, social and medical centers and emergency response relief operations. In this program, the children will not live with and be in the direct care of their own biological family.

2.3 Terminology

The physical locations where employees that are directly working on these programs at the lowest organizational levels are often referred to as *"SOS Villages"* or *"SOS program locations"*. In this thesis, the term *program location* will be used to encompass these city/community-based physical locations that encompasses all programs delivered and all the locations they are delivered to.

They routinely collect a wide range of data on their beneficiaries from all programs, including health information. This data is stored in a database referred to as the *Program Database (PDB)*, which serves as SOS' primary data warehouse.

2.4 Summary

This chapter has served as a brief introduction to and overview of SOS Children's Villages. The most important aspects related to the organization and information flow will be further presented and discussed in Parts III and IV.

Chapter 3

Research Countries

3.1 Introduction

The majority of our data collection took place in the sub-Saharan African countries Ethiopia and South Africa, both of which are countries in which SOS Children's Villages operates. Additional reasons as to why these countries were selected were because of their vast cultural and economic differences and because they are reached by the HISP-network, which includes local teams in place and student exchange programs in both countries.

This chapter provides relevant background information on the two chosen countries, focusing on infrastructure as well as telecommunication- and DHIS2 implementation status quo, in addition to technical features of DHIS2 that are deemed to be of particular relevance.

As illustrated in figure 3.1, there is a significant overlap between African countries in which SOS Children's Villages operates and DHIS2 is implemented, both on a national scale and as a pilot program. This includes Ethiopia and South Africa.
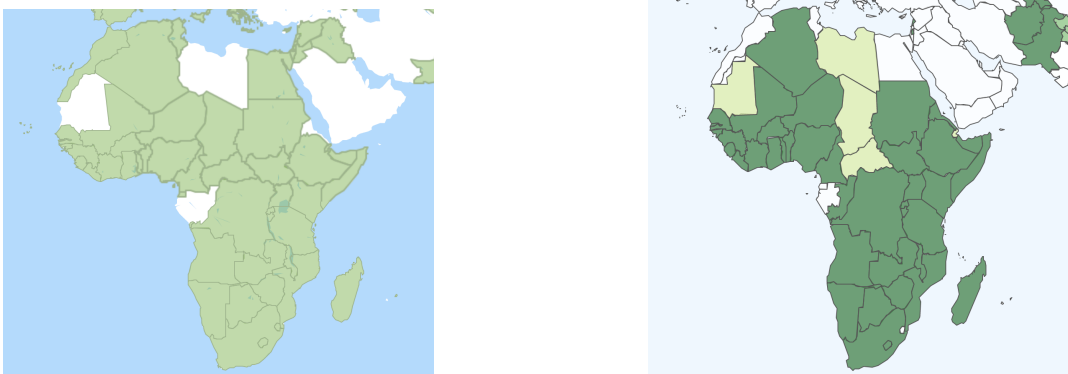
FIGURE 3.1: Left: African countries in which SOS Children's Villages operates (marked green), screenshot from *SOS Children's Villages - Where We Help: Africa*. Right: African countries where DHIS2 has been implemented, either on a pilot scale (marked light-green) or on a national scale (marked dark-green), screenshot from *DHIS2 In Action*.

3.2   Ethiopia

Ethiopia is a landlocked country in Eastern Africa. With an estimated population of 108 million, it is the most populous landlocked country in the world and the second-most populous country in Africa, according to *Ethiopia - Total population, by The World Bank*. Its capital and largest city is Addis Ababa (Ibid.).

According to *The World Factbook by the Central Intelligence Agency*, while infant, child, and maternal mortality are still heavy matters of concern, they have fallen sharply over the past decade. Ethiopia's high population and rapid population growth are putting increasing pressure on national resources. Ethiopia has the lowest level of income-inequality in Africa with a Gini coefficient comparable to that of the Scandinavian countries, as well as the largest economy by GDP in East Africa (Ibid.). Despite these positive economic indicators, Ethiopia has poor infrastructure and remains one of the poorest countries in the world (Ibid.). It is also a fairly rural country with only 21,7 percent of its population living in urban areas (Ibid.).

3.2.1   Ethiopian communications, electricity, and DHIS2

According to *The World Factbook by the Central Intelligence Agency*, Ethiopia is a one-party state and the state is heavily engaged in the economy. Ongoing infrastructure projects include power production and distribution, roads, rails, airports, and industrial parks. State-driven *Ethio Telecom* has a monopoly over telecommunication services - including mobile broadband services (Ibid.) - and power outages and network downtime are frequent occurrences. Only an estimated 15,4 percent of the Ethiopian population were internet users, per July 2016 (Ibid.). The number of mobile cellular subscriptions, however, is comparatively better than most other countries with 59 subscriptions per 100 inhabitants (Ibid.). Health records are often kept as paper copies locally at health facilities.

The Ethiopian government has implemented DHIS2 as a national HMIS and is currently training end-users and building capacity. For instance, the University of Gondar with the support of HISP hosted the nation's first-ever DHIS2 Academy in November 2019. DHIS2 is not currently implemented by the Ethiopian government as a Child Care Management Information System.

3.3   South Africa

South Africa is the southernmost country in Africa. According to *The World Factbook by the Central Intelligence Agency*, it has an estimated population of 56 million and is the fifth most populated country in Africa (Ibid.). Its capital is Pretoria and its largest city is Johannesburg (Ibid.). According to *PWC Transportation Logistics - South Africa*, South Africa has the largest economy in Africa and is the most developed country in sub-Saharan Africa. Despite this, 23 percent of the country's population still live below the national poverty line, according to *SOS Children's Villages Home Page - Where We Help/South Africa*.

Even though the proportion of working-age South Africans has grown relative to the children and elderly, South Africa has been unable to achieve a demographic dividend because persistent high unemployment and the prevalence of HIV/AIDS have created a larger-than-normal dependent population (*The World Factbook by the Central Intelligence Agency*). While the average life expectancy of South Africans has

increased over the years, HIV/AIDS continues to be a serious public health threat (Ibid.). Crime and illnesses are still particularly prevalent in the previously racially segregated Townships that remain from *Apartheid*. It is a fairly urban country with close to 70 percent of its population living in urban areas (Ibid.).

3.3.1   South African communications, electricity, and DHIS2

An estimated 54 percent of the population are internet users and mobile Internet accounts for 95 percent of total Internet connections in the country, according to *The World Factbook by the Central Intelligence Agency*. South Africa has the best developed and modern telephone system in Africa (Ibid.).

Despite this, South Africa is currently experiencing an energy crisis. Supply has fallen behind demand, and scheduled power outages are daily occurrences to meet the demand as evenly as possible. In 2019, the chief operating officer of the government-owned national power generator *Eskom* stated that the reason for this energy crisis was primarily due to a lack of maintenance, neglect, and weather conditions:

> *"The main cause of the loadshedding was not sabotage or rain or whatever. After 12 years of neglecting our power stations, our system is unpredictable and unreliable. I'm not talking about putting on a band aid, I mean that real, deep maintenance is required. And then on top of that the Good Lord sent us rain. At more than ten units unplanned interruptions led to the first loadshedding. Five of them were as a result of boiler leaks, which take between four to six days to repair." - excerpt from the article 'Eskom is captured': Jan Oberholzer on wet coal, sabotage and stage 6 desperation.*

We experienced this loadshedding daily, even to a point where it would impact field study observations negatively.

The original District Health Information Software (DHIS) was introduced to South Africa in 1996, and extended to the entire country as a national HMIS by 2001, as stated by Titlestad, Staring, and Braa, 2009. It is currently in full use by the South African Ministry of Health with support from HISP. DHIS2 is not currently implemented by the South African government as a Child Care Management Information System.

3.4   Summary

There are notable infrastructural challenges in both countries. While the number of mobile subscriptions in Ethiopia is comparatively better than most countries, the percentage of Ethiopian internet users is low. South Africa is reported to have the best developed and modern telephone system in Africa but struggles with an ongoing energy crisis. Health-related issues are prevalent in both countries.

While both of these countries have implemented DHIS2 as a national HMIS, the respective government ministries and departments tasked with the care of vulnerable children have not. The systems they do use and their capabilities will be explored later in this thesis.

Chapter 4

The District Health Information System 2

4.1 Introduction

This chapter will provide a brief overview of the District Health Information Software 2 (DHIS2) and describe a selection of features that are of particular relevance to this study using the DHIS2 user manual.

4.2 Overview

District Health Information Software 2 (DHIS2) is an open-source, web-based health management information platform, according to *DHIS2 About*. Being used by 67 low and middle-income countries worldwide, it is the world's largest HMIS platform (Ibid.). The core DHIS2 software development is managed by the Health Information Systems Program (HISP), which is a global network comprised of 11 in-country and regional organizations providing direct support to ministries and local implementers of DHIS2 (Ibid.).

The DHIS2 platform provides data warehousing, the possibility to generate analyses from live data in real-time, and visualization features (Ibid.). Each country that has implemented DHIS2 has its own instance or instances of the platform with full ownership of the application and data. The HISP network provides guidance, but according to their site (Ibid.) a *crucial aspect of the implementation of DHIS2 is that data ownership rests with each user institution*. HISP is continuously building the capacity necessary for the institutions to maintain their instance and DHIS2 by graduating Ph.D. students within HISP. Regional HISP organizations also arrange gatherings and training of regional HISP active members. Such a gathering is referred to as a DHIS2 Academy.

DHIS2 has a modular, layered architecture with a strong and open Application Programming Interface (API) (Ibid.). This means that DHIS2 serves as a data warehouse for applications to pull data from or push data to. It is also possible to export data from and import data as local files, for instance using the JSON format. (Ibid.)

4.3   Hierarchy

4.3.1   Organization units

Data in a geographical context is represented as organizational units in DHIS2. These organizational units are located in a hierarchy constructed using parent-child relations, which represents the administrative structure and its levels. Typically, these levels are the national, province, district, and facility levels (*DHIS2 User Manual - Chapter 22: Configure metadata*). These levels are illustrated by figure 4.1.
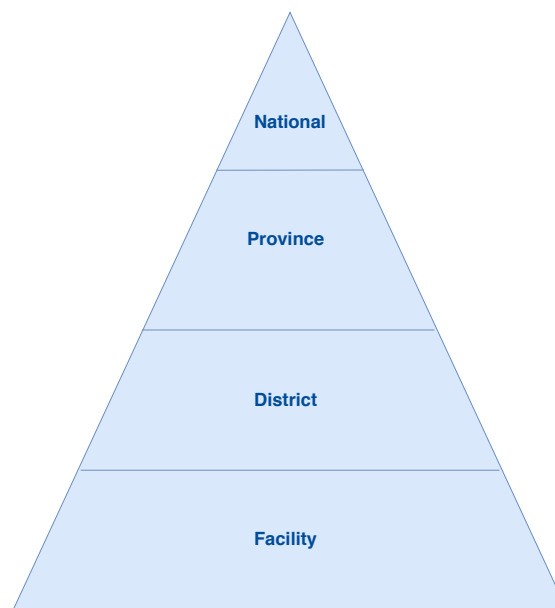
FIGURE 4.1: Default DHIS2 organization unit hierarchy.

4.3.2   Organisation unit groups

Organization unit groups *"allow you to classify related organization units into a common theme"*. An example from the manual would be to create a *hospital* group for all organization units that are hospitals. (Ibid.)

4.3.3   Organization unit group set

Organization unit group sets *"allows you to create additional classifications of organisation units"* (Ibid.). The sets are used to *"create new dimensions so that you can make a more detailed data analysis. You can easily filter, organise or aggregate data by groups within a group set"* (Ibid.).

DHIS2 User Manual - Chapter 22: Configure metadata lists the following rules related to organization units and hierarchy:
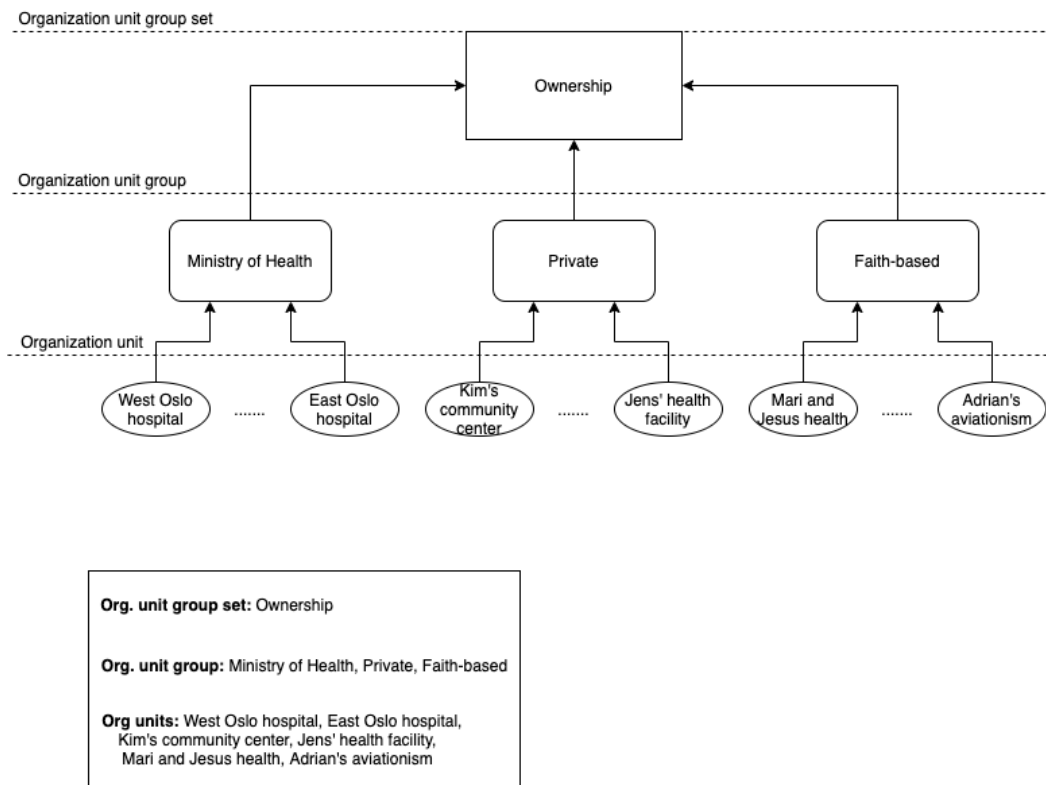
FIGURE 4.2: Example organization unit, group, and group set set-up.

- You cannot have more than one organization hierarchy at the same time

- A hierarchy can have *any* number of levels (national organization hierarchies in public health typically have four to six levels)

- Additional classifications can be created using organization groups and organization group sets

- Organization groups are recommended to be used for creating a non-geographical hierarchy

- A given organization unit cannot be a member of more than one organization unit group within an organization unit group set

- A given organization unit group can be part of multiple group sets

- The organization unit hierarchy is the main force behind geographical data aggregation

Organization units, groups, and sets are highly customizable and can be created, edited, and deleted using the *Maintenance* app in DHIS2. Data sets and data entry forms can also be created and edited in the *Maintenance* app.

4.4 Data elements and indicators

Data elements *"define what is actually recorded in the system, for example number of immunizations or number of cases of malaria"*. It is also possible to for instance break the *number of cases of malaria* data element into age groups.

An indicator is a *"formula that can consist of multiple data elements, constants, organization unit group counts and mathematical operators"*. An indicator typically consists of a numerator and denominator. An example of this could, for instance, be *number of cases of malaria per 100 000 inhabitants*, where the data element *number of cases of malaria* is the numerator and *per 100 000 inhabitants* is the denominator.
Data elements and indicators can be created and edited using the *Maintenance* app in DHIS2.

4.5 Offline capabilities

Data is typically entered in to DHIS2 using the *Data Entry* app. This app has offline capabilities and as such functions even without a stable internet connection. If the internet connection should happen to be unavailable during data capture, the data will be stored locally on the device and can be uploaded to the server when internet connectivity has been re-established (*DHIS2 User Manual - Chapter 6: Using the Data Entry app*).

4.6 Data visualization tools

DHIS2 has a wide range of data visualization tools that take advantage of the structure of for instance data elements, indicators, and organization units. Users can also freely customize dashboards by selection already made graphs, tables, and other tools. Data presentations can be created using the *Data Visualizer* app.
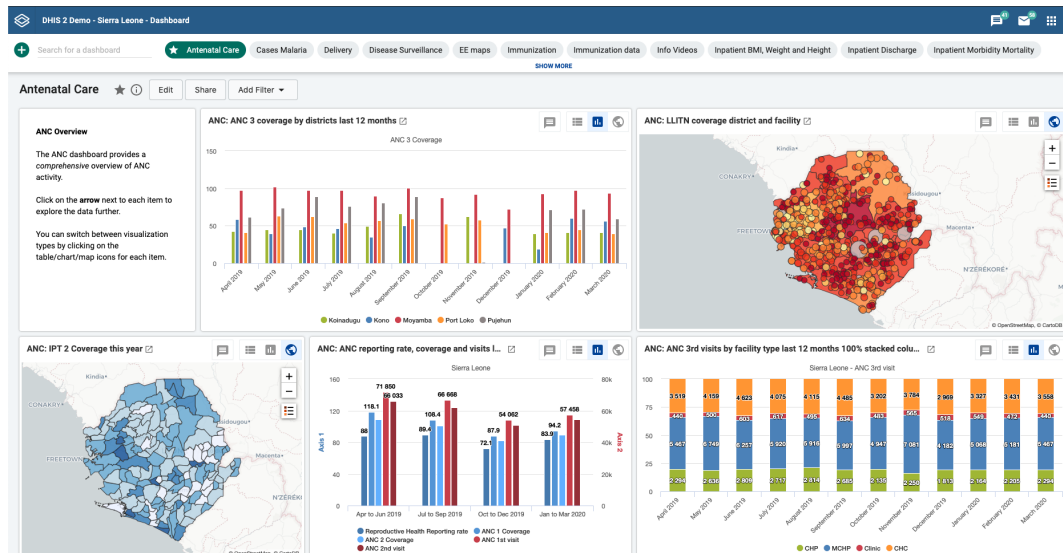
FIGURE 4.3: Example of a dashboard displaying various DHIS2 data presentation tools. Screenshot taken from *play.dhis2.org* using version 2.32.4.

4.7 Summary

The customizability of hierarchies, as well as data elements and indicators, is a very important point as to why DHIS2 is proposed to be used as a Child Care Management Information System. As initially stated, DHIS2 has been utilized in numerous health-related initiatives on the African continent. Some examples and their implications will be discussed in Chapter 5.

Chapter 5

Related Literature

5.1 Introduction

This chapter presents the key concepts and technologies used in this thesis. This includes work and research related to *integration, interoperability, standardization, ecosystems, complexity, scalability* and *APIs*. It will for the most part serve as a presentation rather than an in-depth explanation and discussion on these topics. Furthermore, existing work and literature on DHIS2 implementation cases will be presented to display some of the associated challenges and successes.

5.2 Integration and Interoperability

While there are numerous technical, political, and socio-technical considerations to take into account in this research, it is at its core a study of integration, interoperability, and standardization. In this section, the definitions of integration and interoperability to be used in this thesis will be established.

The term *integration* can be defined in a number of ways depending on the context the term is applied to. Braa and Sahay, 2012 presented a specific case of integration and interoperability between three different applications, namely *DHIS2*, the open-source human resource management software called *iHRIS*, and the medical record application *OpenMRS*. Applied to that context, Braa and Sahay, 2012, (pp.60-61) defined integration as the process of making multiple subsystems appear as a whole system. Both iHRIS and OpenMRS utilized DHIS2 as a data warehouse, being able to import and export information from the platform. This triangle of applications formed a whole system. OpenMRS and iHRIS were not directly linked with capabilities of information exchange between each other, but were integrated due to their common *interoperability* with DHIS2. Interoperability, in turn, is easier to define. Braa and Sahay, 2012, (pp.60-61) defines interoperability as *the ability to exchange data between two or more systems*.

5.3 Standardization

Standardization is key to achieving interoperability, according to Kotzé et al., 2013. There is currently no consensus on the levels of interoperability. Some authors have for instance defined three, four, and seven levels in their works (Ibid.). For this thesis, I will use the three levels defined by Braa and Sahay, 2012, (p.67), namely technical, semantic, and organizational. Figure 5.2 illustrates these three levels. Note that Kotzé et al., 2013 specifically uses the term *interoperability* when referring to
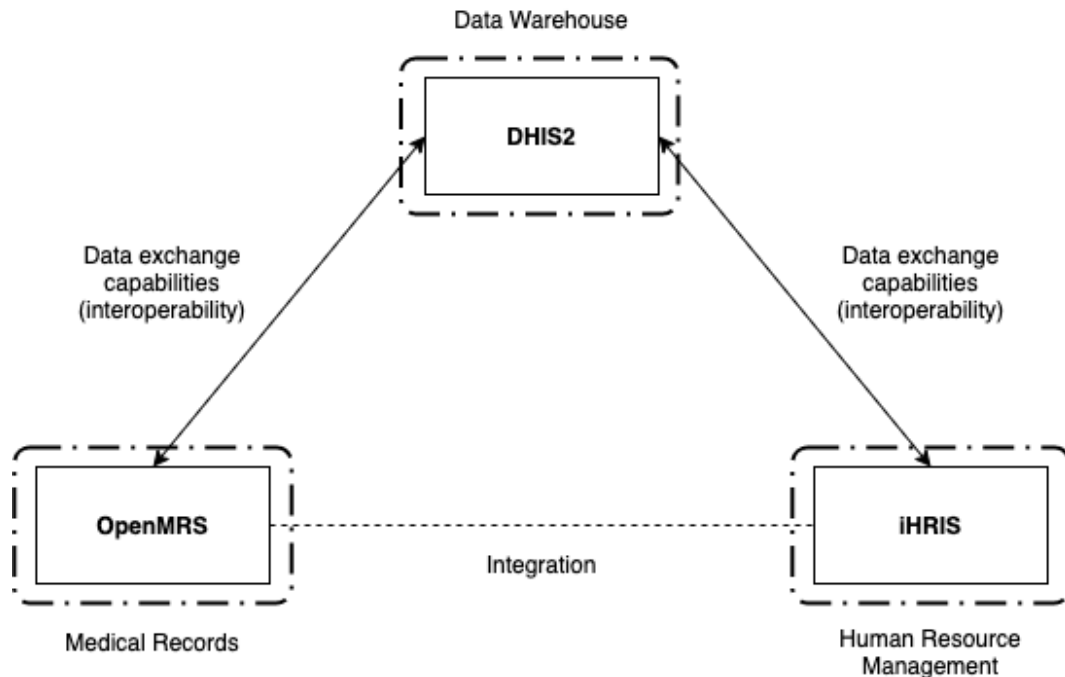
FIGURE 5.1: Example of integration and interoperability, courtesy of
Braa and Sahay, 2012, (p.61).

four similar levels, while Braa and Sahay, 2012 uses the term *standardization* when
referring to their three levels. For this thesis, I will refer to these as the three levels
of *standardization*.

Braa and Sahay, 2012, (p.66) states that the alternative to shared standards is custom
gateways between systems. An increasing number of such custom connections leads
to increased complexity within an ecosystem. In an ecosystem where all connections
between systems are custom and lack standardization, new systems will have to be
able to establish up to n(n-1)/2 individual connections and all of these connections
would of course have to be maintained (Ibid.).

5.3.1   Syntactic/technical

At the syntactic/technical level, the meaning of the data is not a topic of discussion.
This level hosts the process of *"agreeing on a shared grammar"*, as Braa and Sahay,
2012, (p.68) puts it, which for instance could apply to a shared protocol that allows
for technical ability to transfer data and information. The most famous example of
this is likely the Hypertext Transfer Protocol (HTTP), which is used to transfer the
resources of the World Wide Web (Fielding et al., 1999). Application Programming
Interfaces are also commonly used to for syntactic/technical data exchange.

5.3.2   Semantic

With *interoperability* being defined as the ability to exchange data between two or
more systems, *semantic interoperability* ensures that exchanges between the two sys-
tems make sense. For this to be the case, there has to be an agreement between the
different sides on the *"meaning"* of the data that is being exchanged. For example,
if you want a system used to sell cars to be semantically interoperable with a sys-
tem that is being used to sell motorcycles, there needs to be a clear understanding of
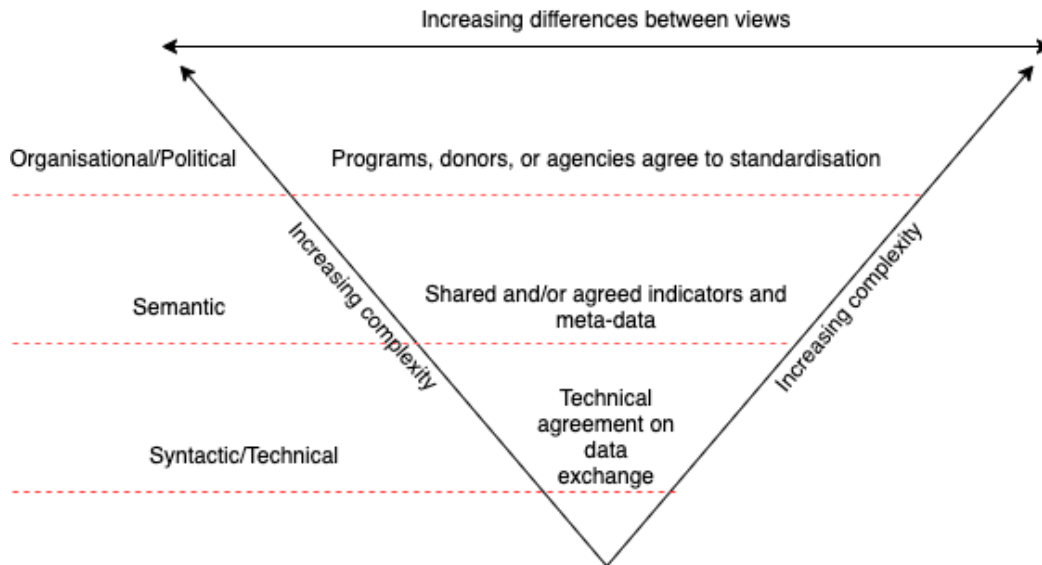
FIGURE 5.2: Three levels of standardisation, according to Braa and Sahay, 2012, (p.67).

what both systems define a *"vehicle"* as. The former system might simply define a vehicle as a car, and the latter might define a vehicle as a motorcycle when they both could define *vehicle* as a super-class of which *car* and *motorcycle* are sub-classes. Semantic interoperability can, according to Heiler, 1995, be difficult to achieve due to the following factors:

1. Human intelligence and judgment have to be applied to discover semantic information and fix mismatches.

2. There are few tools available for assistance, except tools for identifying name matches.

3. Large organizations can have legacy procedures and data elements in the thousands, and documenting the semantics behind all of this can be a gigantic task.

4. Semantic information is often context-based, and documenters might need documentation specifying the semantics of the information to fully understand it.

5. Semantics might change over time. Heiler, 1995 presents the example of how a change in countries can affect the meaning of country statistics, such as when the Soviet Union disbanded and the meaning behind their population and GNP changed dramatically.

6. The resulting metadata will require similar semantical agreements.

We can see that while semantic interoperability can be boiled down to all relevant parties agreeing on the meaning behind the data they want to exchange, which in itself is a simple enough concept, there are several associated challenges that elevate semantic interoperability to a more difficult task than one might expect.

5.3.3   Organisational/political

This level is referred to by Braa and Sahay, 2012, (pp.68-69) as *"the level of decision-making"*. Factors such as procedures, mandates, responsibilities, and job-description come in to play here, and decisions regarding sharing information across organizational boundaries are often made by decision-making actors. We can see from figure 5.2 that complexity and differences between views are likely higher than that of the semantic and syntactic/technical level, and as such, the organizational/political level might often be the biggest hurdle to jump in order to achieve standardization which interoperability depends on.

5.4   Application Programming Interface (API)

For applications to be able to exchange data with a platform, there needs to be a technical mechanism for doing so. A dominant way of doing so is through Application Programming Interface (API)s, which according to Tiwana, 2013, (p.112) is a *"standardized interface designed to accept a broad class of apps (or add-ons/extensions/modules"*. APIs can include support and specifications for a large variety of data including functions and variables.

5.4.1   Representational State Transfer (REST)

Representational State Transfer (REST) is according to Fielding and Taylor, 2000 a *"coordinated set of architectural constraints that attempt to minimize latency and network communication while at the same time maximizing the independence and scalability of component implementations"*. A REST-based API is thus an API that adheres to these architectural constraints.

According to *DHIS2 Developer Manual - Chapter 1: Introduction*, the DHIS2 Web API adheres many of the REST-based architectural principles. The developer manual goes on to mention *"a few and important ones"* among these principles. They are directly quoted, although shortened, here:

1. The fundamental building blocks are referred to as resources. A resource can be anything exposed to the Web, from a document to a business process - anything a client might want to interact with.

2. All resources can be uniquely identified by a URI (also referred to as URL).

3. Interactions with the API requires the correct use of HTTP methods or verbs. This implies that for a resource you must issue a GET request when you want to retrieve it, POST request when you want to create one, PUT when you want to update it, and DELETE when you want to remove it.

4. Resource representations are linkable, meaning that representations advertise other resources that are relevant to the current one by embedding links into itself.

5.5 Ecosystems

This thesis utilizes the term *ecosystem* for describing the ICT ecosystems - as it relates to child care information - in Ethiopia and South Africa. As an organization that partakes in child care information handling and sharing in these countries, SOS Children's Villages is considered an actor and a part of these ecosystems.
A definition by Kaplan et al., 2005, (p.3) states that an *"ICT ecosystem encompasses the policies, strategies, processes, information, technologies, applications and stakeholders that together make up a technology environment for a country government or an enterprise"*. Furthermore, the definition specifies that an ICT ecosystem most importantly *"includes people - diverse individuals who create, buy, sell, regulate, manage, and use technology"* (Ibid.).

5.6 Complexity and Scalability

Sahay and Walsham, 2010 states that *scalability* is a basic requirement for successful development of Information Systems (IS) in developing countries. The meaning of *scale* and *scaling* in this thesis is borrowed from Sahay and Walsham, 2010. In the context of Information Systems, *scale* can *refer to the scope of the IS* (Ibid.). An example of this scope could be how many users are served (Ibid). *Scaling*, in the same context, can *"imply the expansion of this system in scope and size"* (Ibid.). An example of such an expansion is increasing the system's functionalities (Ibid.).

Multiple policies, organizations, governmental entities, digital systems, and so forth can form *complex systems*, where all aspects of this system can affect other parts to a certain degree. Eoyang, 1996 stated that when all aspects of an IS are considered together, *"these players comprise a highly complex, nonlinear, open system"*. When discussing how such systems can be managed, she stated:

> *"Such a complex system cannot be constrained by the control-based mechanisms of the past. Practitioners must find new approaches to adapt dynamically and still maintain some semblance of control over the quality and efficiency of their products and their development processes."* (Ibid.)

Scaling, as argued by Braa et al., 2007, is *"a central concern in complexity science"*. The relationship between complex systems and scalability is an important point for later discussion in Part IV.

5.7 Previous cases of DHIS2 Implementation

The introduction of DHIS2 to information systems in Africa and Asia has been found to improve data completeness, accuracy, and timeliness.

In an assessment of the ability of health information systems in hospitals to support evidence-informed decisions in Kenya, it was found that although there had been increased adoption of electronic health information systems, there was still a lack of adequate data exchange between systems (Kihuba et al., 2014). Not a single instance of a local HMIS system was found to be linked to the national health information reporting architecture, which was DHIS2. Building on this, another study by Kariuki et al., 2016 sought to perform an interoperability field test in Kenya by automating indicator reporting from a custom version of OpenMRS - the KenyaEMR - to an

instance of DHIS2 intended for testing. The data elements used by the Kenyan Ministry of Health's DHIS2 instance was mimicked in the field test DHIS2 instance, and SQL queries were used to export data from the KenyaEMR to the field test DHIS2 instance. The results from the study indicate that *"it is feasible and beneficial to automate indicator data reporting from EMRs to aggregate data systems"* (Ibid.). Furthermore, the results supported the assumption that automating reporting reduced the workload on the health facility's employees by eliminating manual data entry.

DHIS2 was at one point customized for maternal and child health information management in Sri Lanka. Manoj et al., 2013 created a system that *"was designed to cater to data needs at different administrative levels"* and utilized the DHIS2 application in a centralized server. This system was *"evaluated for its correctness and performance"* (Ibid.). Furthermore, an interview was conducted with the key officer in the Ministry of Health office, who had *"perceived a significant reduction of workload after the intervention"* (Ibid.).

Introducing DHIS2 to different countries has also been associated with challenges. Dehnavieh et al., 2018 stated in a literature review from 11 countries where DHIS2 had been implemented that *"challenges identified from the experiences of other countries have demonstrated that these challenges are mainly infrastructure and system related"*.

5.8 Summary

This chapter has established the levels of standardization to be used in this thesis. It has also established the definition of an ICT ecosystem, which is used in this thesis to encompass all relevant aspects of the Ethiopian and South African child care information systems. The concept of APIs was presented due to its importance in a later discussion of interoperability between DHIS2 and SOS Children's Villages' Program Database. Complexity and scalability are important aspects of this thesis, and the relationship between them will be further discussed later. The impact of DHIS2 in Kenya and Sri Lanka was also illustrated by two cases, with the intent of providing examples of how DHIS2 has been applied to a context to address issues with data and workload on staff managing the data. A literature review describing challenges faced from implementing DHIS2 in 11 countries concluded that these challenges were mainly infrastructure or system related.

Part III

Findings

Chapter 6

Methodology

6.1 Introduction

This chapter describes the research methodology - including research method, design, participant sampling, data collection methods, and data analysis methods.

6.2 Research method

As previously discussed, in order to assess how DHIS2 can be applied to a child care information ecosystem, the ecosystem itself needs to be sufficiently investigated. The Ethiopian and South African child care ecosystems include actors such as SOS Children's Villages. In order to get a holistic view of these ecosystems, we opted for a *qualitative research method*. According to Creswell, 2013, (pp.39-40), a qualitative research method is suitable for exploring an issue where there is a need to study a group or population or identify variables that can then be measured. It is also useful when there is a need for a thorough and complex understanding of the issue at hand (Ibid.). This can be accomplished by visiting and interacting with people at their place of work (Ibid.).

6.3 Research Design

A case study, according to Creswell, 2013, (p.73), *"involves the study of an issue explored through one or more cases within a bounded system (i.e., a setting, a context)"*. With the information flow related to child care data from SOS to the Ethiopian and South African governments being the basis for our research, the case study was fitting and as such chosen as our research strategy. Yin, 2003, (p.2) states that *"the distinctive need for case studies arises out of the desire to understand complex social phenomena."*. He goes on to argue that the case study allows for a holistic view of real-life events, such as *"individual life cycles, organizational and managerial processes"* (Ibid.).

6.4 Sampling

Our data sources cover a variety of people that possess roles within SOS, the Ethiopian government, and the South African government with the goal of getting a holistic view on child care information flow from A to Z and back again. We interviewed individuals not associated with SOS or the governments as well to get a third-party view and deeper context.

Our contact points at SOS Children's Villages gave an initial introduction and established contact between us and our sources from SOS in Ethiopia and South Africa. We came in contact with team members of HISP and representatives from the Ministry of Health in the Amhara region, Ethiopia, through our supervisor Jens Johan Kaasbøll. External actors, i.e. other NGOs caring for vulnerable children and a board member of the company behind the software package *Soweto Care System*, were initially approached by us via email or Facebook. We were referred to a South African database developer by a member of HISP South Africa, and he in turn put us in touch with representatives from the Department of Social Development. This sampling of data sources can in other words be described as *snowball sampling*, which according to Biernacki and Waldorf, 1981, *"yields a study sample through referrals made among people who share or know of others who possess some characteristics that are of research interest"*. We approached representatives from the Agency for Civil Society Organizations in Ethiopia by showing up at their offices with a request to interview and observe, to which they happily obliged.

The goal was to use these sources to form a complete view and provide evidence of the complex ecosystems that involves SOS Children's Villages, Ethiopia, and South Africa when dealing with information on vulnerable children. The *Information Cycle*, illustrated by figure 6.1 was used as a frame for mapping out the different roles related to SOS' handling of data and their function within the ecosystems.

6.4.1   The Information Cycle

The Information Cycle is, according to Heywood and Rohde, 2001, (p.21), *"a diagrammatic way of looking at information and enables you to see the links between the different phases of collecting, processing, analysing, presenting, interpreting and using information"*. Each of these phases has sub-phases that further describe what tasks a phase consists of (Ibid.). This cycle is illustrated in figure 6.1. The sampling of data sources was centered around this model.

To illustrate by using some of our data sources as examples: a data clerk working at SOS is responsible for entering data on SOS' beneficiaries, collected by the use of paper forms, into the Program Database. This task fits into the *collect phase*. A Program Director working at SOS uses aggregated data and statistics to interpret reports, a task which fits into the *interpret phase,* but they also provide feedback and take action based on reported data, which fits in the *use phase*. A role can as such have responsibilities and tasks that fit in multiple phases.

6.4.2   Triangulation

Data-, investigator-, and methodological triangulation has been used for this research. Triangulation *"refers to using more than one particular approach when doing research in order to get richer, fuller data and/or to help confirm the result of the research"* (Wilson, 2014, p.75).

- **Data triangulation:** using different sources of data. Sources can in this context mean different times, places, and people (Ibid.).

- **Investigator triangulation:** data gathering and analysis processes are performed by more than one person (Ibid.).

- **Methodological triangulation:** utilizing more than one method of collecting data (Ibid.).
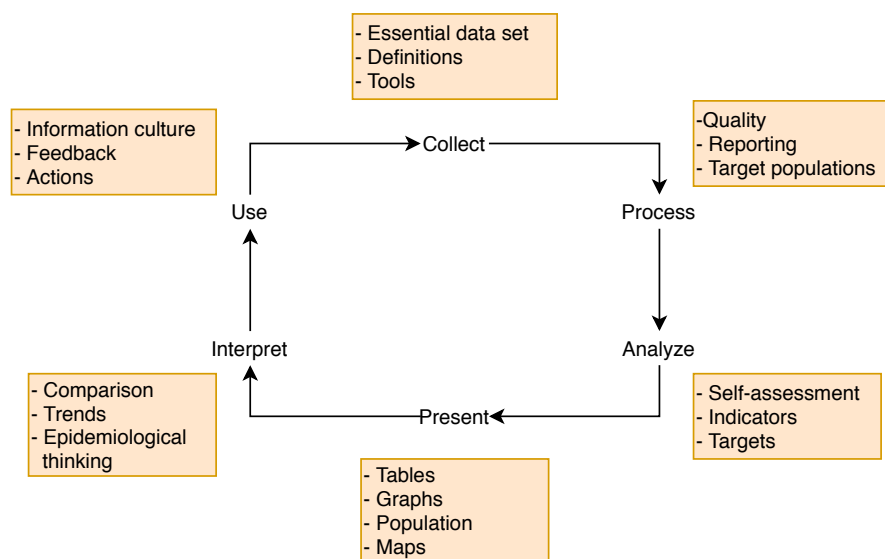
FIGURE 6.1: The Information Cycle, according to Heywood and Rohde, 2001.

6.5   Data Collection Methods

The data collection methods used in this study are interviews, observations, a group discussion, and documentation. These sources were intended to provide a holistic view of child care information handling in Ethiopia and South Africa, with SOS Children's Villages serving as the example of a third-party NGO with responsibilities to its beneficiaries and to the governments of the respective nations in which they operate. Additionally, these sources also give technical insight into DHIS2 and SOS' Program Database and aims to assert the technical possibility of interoperability. External actors also served as data sources to gather information on relevant third-party organizations and systems.

Sensitive data related to the participants were not collected to ensure anonymity. Sensitive data related to children and presented by participants for the purpose of illustration and demonstration were also not collected for the same purpose. Professional background and education were collected in some instances to better understand the participant's response and views, and job titles and responsibilities were collected to better map out the systems they are part of. Verbal consent to the researchers gathering information from interviews, discussions, observations, and documentation was given by the participants after being informed on the terms of participation by the researchers. Apart from documentation, all data were collected either by screen recording during a Skype interview, voice recordings, hand-written notes, notes written down on laptops, or a combination of them.

Data collection methods		
Method	Description	Purpose
Interview	To use interview guides with a combination of open- and closed-ended questions to interview individuals in the target participant group.	To provide insight into the reporting ecosystems the interviewee participates in, the tasks they perform, and their general opinions of the reporting status quo.
Direct Observation	To study people tasked with data collection and reporting perform related tasks in their work environment.	To get a first-hand impression on how the respective systems and the people tasked with using them for their daily work tasks function in practice.
Group Discussion	To use interview guides with a combination of open- and closed-ended questions to interview a participant group.	To provide insight into the reporting ecosystems the interviewee participates in, the tasks they perform, and their general opinions of the reporting status quo, in a group context.
Documentation	Technical documents, reports, system presentations, and data collection forms.	To map data elements used and reported, and system functionalities. Additionally, to get further background information.

TABLE 6.1: Data collection methods used for this research

6.5.1   Sites

Prior to the field study, the research team spent two weeks in Port Elizabeth where we met our first research contact in Africa and her team working at the Nelson Mandela University. Apart from establishing initial contacts in one of our later sites for field research, we were also fortunate to experience South African culture. We collected data from three different locations in Ethiopia and four different locations in South Africa for variety and being able to draw parallels between interviewees in different geographical locations. The locations are highlighted with red circles in maps 6.2 and 6.3. The maps were created using Google Maps.

Ethiopian sites

Data was collected in Ethiopia over a three-week-long field study. We spent the first half of the first week in Gondar and the second half in Bahir Dar. The following two weeks were spent in the Ethiopian capital, Addis Ababa.

FIGURE 6.2: The three locations visited in Ethiopia, marked by red dots.

South African sites

Data was collected in South Africa as well during the three weeks that followed our stay in Ethiopia. We spent the first week collecting data in Johannesburg and Mamelodi township near the capital Pretoria, the second week in Port Elizabeth, and the third week in Cape Town.

FIGURE 6.3: The four locations visited in South Africa, marked by red dots.

6.5.2 Interviews

Yin, 2003, (p.92) stated that interviews are *"an essential source of case study evidence because most case studies are about human affairs or actions"*. Our interviews can be described as *shorter case study interviews* with a combination of open-ended and focused questions (Ibid.). We conducted more than one interview per role - particularly within SOS - when possible to increase validity and to draw parallels between the views of for instance a Program Director in Addis Ababa and a Program Director in Cape Town. Tables 6.2 provides an overview of our selected interviewees from Ethiopia and 6.3 does the same for our selected interviewees from South Africa.

Interviewees were sent interview guides if requested but were mostly unaware of the contents of the guides prior to the interview. Although we kept a consistent line of inquiry, we made multiple iterations of our guides: they were tailored to fit the role of the interviewee and we altered the questions as our knowledge on the topics

increased. Our interview case study interviews were as such fluid. Key questions and topics necessary to make cross-comparisons were kept in all iterations.

A selection of the interview guides we used is attached as appendices. This selection includes nine interview guides that are exemplary of the interview guides we used for most of our interviewees, with variations depending on role, organization, and level. These interview guides are included in this document as Appendix D.

Interviews - Ethiopia			
Role	Organization	Quantity	Duration (minutes)
Program Director	SOS Children's Villages	2	54, 76
MERA Team Leader	SOS Children's Villages	1	73
MERA Officer	SOS Children's Villages	2	59, 31
Data Clerk	SOS Children's Villages	2	60 (approx.), 60 (approx.)
Administrator / Coordinator	SOS Children's Villages	3	60 (approx.), 60 (approx.), 60 (approx.)
Graphic Designer	Agency for Civil Society Organizations	1	60 (approx.)
Deputy Manager - Amhara region	Ministry of Health	1	60 (approx.)
Child Care, Support, and Protection Expert	Ministry of Women and Children Affairs	1	60 (approx.)
Child Right Expert	Ministry of Women and Children Affairs	1	60 (approx.)
Team Member	HISP Ethiopia	1	60 (approx.)
Leader	eHealthLab Ethiopia	1	40

TABLE 6.2: Overview of interviews conducted in Ethiopia.

Interviews - South Africa			
Role	Organization	Quantity	Duration (minutes)
Program Director	SOS Children's Villages	3	89, 127, 18
Social Worker	SOS Children's Villages	4	60 (approx.), 60 (approx.), 40 (approx.)
Coordinator	SOS Children's Villages	6	63, 49, 60 (approx.), 40 (approx.), 60 (approx.), 60 (approx.)
Deputy Director	Department of Social Development	1	64
Informatics Specialist	Department of Social Development	1	email
Database Developer	Apps4D	1	40
Manager	Thusanang HIV/AIDS Relief Project	1	60 (approx.)
Manager	Masifunde Changemaker Academy	1	60 (approx.)
Program Director	Eastern Province Child and Youth Care Centre	1	20
Financial Manager	Eastern Province Child and Youth Care Centre	1	40
Social Worker	Eastern Province Child and Youth Care Centre	1	20 (approx.)
Manager	The Love of Christ	1	97
Board Member	Soweto Care System	1	82
Team Member	HISP SA	1	40
Manager	HISP SA	1	38

TABLE 6.3: Overview of interviews conducted in South Africa.

Interviews - International			
Role	Organization	Quantity	Duration (minutes)
PDB Team Member	SOS Children's Villages	3	70, 84
International Program Coordinator	SOS Children's Villages	1	64

TABLE 6.4: Overview of interviews conducted outside of Ethiopia and South Africa.

6.5.3 Direct Observations

By visiting the geographical sites in person, we were able to conduct *Direct Observations.* Yin, 2003, (p.93) argues that observational evidence is often useful in providing additional information about the topic being studied, in that they can help the interviewer understand the actual uses of the task at hand and any problems being encountered. We chose to make observations of people tasked with data entry, monitoring, evaluation, reporting, and editing. We wanted to witness first-hand how people with these responsibilities performed their tasks to get a broader picture of complications and the quality of data handling. This also gave insight into the nature of the digital systems in question; how they performed, how they looked, and what purpose they were used for. In order to increase the reliability of our observational evidence, we made sure that the observations were made by all three researchers in all cases except one, where the observation was done by two researchers. Table 6.5 provides an overview of observations made in Ethiopia and table 6.6 provides an overview of observations made in South Africa.

Observations - Ethiopia		
Role	Organization	Quantity
Data Clerk	SOS Children's Villages	2
MERA Officer	SOS Children's Villages	1
Data Clerk	Ministry of Health	1
Database Team Leader	Ministry of Women and Children Affairs	1
Database Warehouse Manager	Agency for Civil Society Organizations	1

TABLE 6.5: Observations made in Ethiopia.

Observations - South Africa		
Role	Organization	Quantity
Coordinator	SOS Children's Villages	1
Social Worker	SOS Children's Villages	1
Board Member	Soweto Care System	1
Data Clerk	Thusanang HIV/AIDS Relief Project	1

TABLE 6.6: Observations made in South Africa.

6.5.4 Group Discussion

What we did, in this case, was very similar to a *focus group*. *Focus groups* can be seen as the group version of an interview with a single interviewee. The interviewer would then moderate a discussion about some aspect of the case study. We use the term *group discussion* here instead of *focus group* because they are not strictly the same. When Yin, 2011, (p.141) describes focus groups, he specifically uses the word sample as if the interviewer is in control of the selection of focus groups participants. When we arrived at the SOS Children's Villages program location, a group of employees was waiting for us and a lengthy group discussion occurred naturally. Because we were not in control of the participant selection, the term *group discussion* is more applicable. We conducted a group discussion in the SOS Children's Village in Port Elizabeth, South Africa. The roles and quantity of participants is displayed in table 6.7

Group Discussion - SOS, Port Elizabeth	
Role	Quantity
Program Director	1
Coordinator (PDB)	2
Social Worker	1

TABLE 6.7: Group discussion participants in SOS, Port Elizabeth.

6.5.5 Documentation

Documentation was gathered online and shared with us by our data sources, including SOS staff, government representatives, and external actors. Yin, 2003, (p.87) states that *"for case study research, the most important use of documents is to corroborate and augment evidence from other sources"*. Our collection includes technical system documentation, organization presentations on relevant topics, performance reports, data collection forms, and data element and indicator lists.

6.5.6 Data Analysis and Dissemination

Thematic analysis is a method for identifying, organizing, describing, analyzing, and reporting themes found within a data set, according to Braun and Clarke, 2006, (p.6). Nowell et al., 2017, (p.2) argued that an advantage to thematic analysis is that it *"provides a highly flexible approach that can be modified for the needs of many studies, providing a rich and detailed, yet complex account of data"*. It was thus chosen as our method for analyzing data gathered from interviews, observations, and group discussions.

Furthermore, we used *document analysis* to analyze the variety of documentation we were provided with. Document analysis entails, according to Bowen, 2009, (p.28), *"finding, selecting, appraising, and synthesising data found in documents"*. This form of analysis can split documents into parts, which are then organized into *"themes, categories, and case examples specifically through content analysis"* (Ibid.).

Using a combination of written notes and voice recordings, we transcribed all interviews and systematized the contents into categories, which in turn consisted of more specific points or sub-categories. For example, we had the *data collection and sharing* category which consisted of:

- Interviewee's primary work

- Does the interviewee collect data? (yes or no)

- Does the interviewee share data? (yes or no)

- Constraining factors related to data collection/sharing

- Enabling factors related to data collection/sharing

- Data transportation methods

- Needs

- Governmental relationship

- Literacy

Another example is the *digital solutions and data processing* category which consisted of:

- Available technology/tools/features

- Data sets (forms) used by the interviewee as a part of his/her job

- Primary digital system used for data processing

- System interoperability (if any)

- General information flow (in the context of the forms used by the interviewee)

- Is data collection digital or paper-based?

- Is data sharing digital or paper-based?

Data collection spreadsheet - Example				
Place of work	Role	Sharing data with	Digital/Paper-based	Digital system
SOS CV - Cape Town	Social Worker	Department of Social Development	Paper	Program Database
SOS CV - Bahir Dar	Data Clerk	Bureau of Women and Children Affairs	Paper	Program Database

TABLE 6.8: Data collection spreadsheet example - note that only a selection of data fields is represented.

The different answers to these categories and points were in turn generalized and will be further discussed and described in Part III. Additional relevant information was also noted. In total, there were 36 sub-themes among six theme groups.

6.6 Summary

This chapter outlined the research sites, method, design, and sampling, as well as data collection methods, analysis, and dissemination. In summation, different methods of qualitative data collection were utilized in three different sites in Ethiopia and four different sites in South Africa. Digital interviews were also conducted. All data collection was conducted by two or three researchers. The Ethiopian and South African governments, SOS Children's Villages, other child care NGOs, and initiatives, as well as individuals with relevant knowledge and experience were sampled. Thematic and document analysis was used to analyze the collected data.

Chapter 7

SOS Children's Villages

7.1 Introduction

Although SOS Children's Villages as an international organization operates as uniformly as possible across national borders, they do have to conform to the respective governments of the countries they operate in. This conformity applies particularly to what information SOS is required to report and to which government organ.

Their main data warehouse is the Program Database (PDB). It is used to collect and aggregate data, as well as providing data for presentations and visualizations using other tools. The PDB and other digital solutions used by SOS will be discussed in further detail in section 7.4. Before that, we will look at the information flow within SOS.

7.2 Information Flow

SOS collects various information on its beneficiaries. Generally speaking - although it might vary from country to country - SOS will be approached by government organs or representatives, relatives, or other entities with a request of admission into one of SOS' programs.

7.2.1 Pre-admission: Initial Assessment

An *initial assessment* containing information on the status of the potential beneficiary and the circumstances surrounding him or her is then conducted and filled out on a paper form. If the initial assessment concludes that the child or youth is suitable and SOS has the capacity, he/she is admitted into the applicable program.

7.2.2 Post-admission: Core Assessment, Development plans, and more

After admitting the beneficiary, SOS will conduct a *Core Assessment (CA)*. The Core Assessment will either be suited to the Family Strengthening program or the Alternative Care program. The CA forms are attached as appendices A and B. They contain a wide array of data elements, including personal data related to health. The CA forms are typically filled out by *social workers* who are either working voluntarily or is employed by SOS. The content from the forms are then fed into the Program Database either by the social worker or another employee tasked with PDB input. Figure 7.1 displays a complete overview of the processes that take place and the forms that are used during a child/youth/family's time as beneficiaries of SOS:
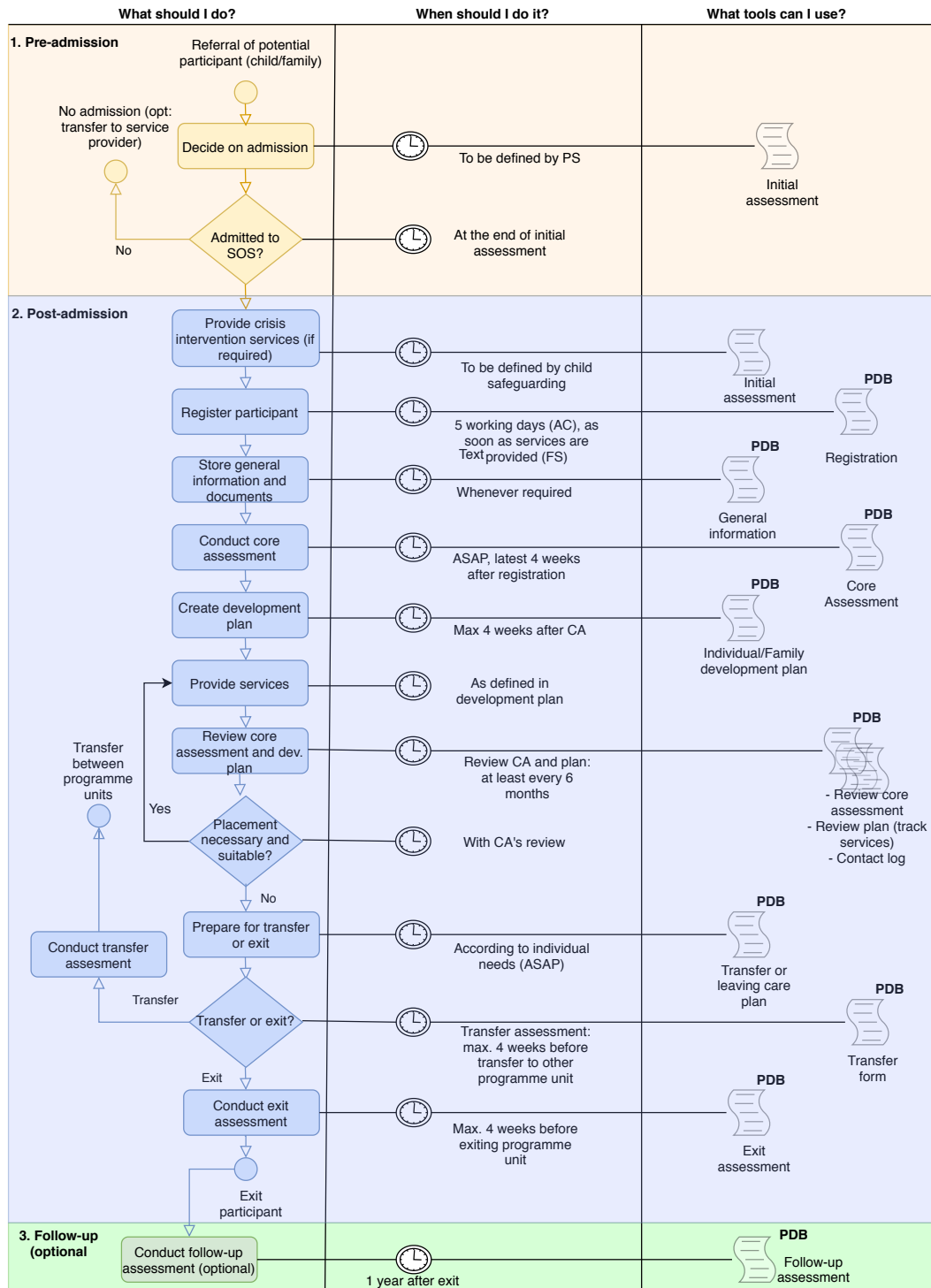
FIGURE 7.1: Overview of processes and forms related to beneficiaries of SOS.

We can see that a number of forms other than the Core Assessment forms are filled out and have their contents fed into the PDB.

Disaggregated data is visible vertically in the organization, but not horizontally. This means that the national office can see disaggregated data from a program location X, and another program location Y can generally only see aggregated data from program location X. Although some forms and practices are uniform for SOS regardless of country, program locations will often have their own internal reports and practices with the intention of enhancing their own work-flow and overview of tasks, responsibilities, and beneficiaries. These practices are also sometimes intended to streamline their workflow when they have to deal with demands and requirements from their respective governments, but this will also be discussed further in the following sections of this chapter.

In Ethiopia, PDB access was restricted to data clerks, MERA officers, the Program Director and the Program Development Coordinator. Social workers had no access to nor used the PDB. Social workers and coordinators did, however, have PDB access in South Africa. The explanation for this, given to us by a member of the PDB team, is that it varies between nations in the Eastern and Southern Africa region. In other words, social workers will sometimes have the responsibility of using the PDB directly, although that was not the case in the program locations we visited - apart from one. High-level presentations of the PDB2 provided to us by the PDB team in Austria shows that PDB2 is structured to be more social worker-friendly. The PDB2 is the newest version of the PDB, and is currently under development. It is further discussed in section 7.4, but the fact that it will have offline capabilities and can be used on mobile android tablets indicate that it is intended to be used by social workers. This means that instead of social workers filling out forms whose contents will be fed into the PDB by data clerks, the social worker will instead feed the contents of these forms directly into the PDB2 upon data capture.

7.3 General challenges

Challenges faced by SOS generally revolve around infrastructural issues, such as network and electricity, as well as high work-load for social workers and issues related to dealing with the respective governments. I will present the specific challenges related to data handling and reporting faced by SOS in Ethiopia in Chapter 8 and in South Africa in Chapter 9.

7.4 SOS Children's Villages' Digital Solutions

This section outlines SOS' digital ecosystem with a particular focus on the PDB, with information based on our talks with the development team as well as interviews and observations of SOS employees tasked with using the PDB.

The team tasked with the development and maintenance of the Program Database (PDB) and many of SOS' digital solutions are located in SOS' main international office in Austria. We were fortunate enough to talk to them on two separate occasions using Skype. Our first talk was structured as an interview; we presented our research and cleared up some questions by the PDB team initially before moving on to a structured interview where they either answered questions verbally or by demonstration through Skype's screen-sharing feature. Our second talk was a

presentation of a high-level draft describing one solution to introducing DHIS2 to the child care ecosystems in Ethiopia and South Africa. A discussion on that presentation followed, and is further detailed in Part IV. The development team is a *"Microsoft-oriented group"* and many of the digital solutions they use in their ecosystem are either implemented by the development team using Microsoft tools or created by Microsoft.

7.4.1 The Program Database (PDB)

The Program Database (PDB) is SOS Children's Villages' primary data warehouse. In addition to storing data collected using forms by SOS Village employees (discussed in 7.2.2), it is also used for data aggregation, to provide data for presentation, as well as import and export.

It has a front-end User Interface (UI) that can be accessed using Internet Explorer. Internet connection is required. Using this UI, SOS employees tasked with using the PDB can view, input, edit and export data to Excel. From our observations, reports would be created by employees tasked with using the PDB at the program locations by exporting data sets, elements, and indicators to Excel.

Challenges with the PDB

A member of the PDB team listed the following challenges related to the original PDB:

1. Not all SOS staff are sufficiently trained in usage of the PDB, a problem that is amplified by high turnover.

2. The UI is not friendly.

3. PDB only runs in the browser Internet Explorer.

4. Silverlight (an application framework) is required for the PDB to be able to run

5. Performance issues (none specifically named).

6. There is no support for mobile data collection.

7. Lack of flexibility - associations cannot add their own local data field.

The newest version: PDB2

The Program Database 2 (PDB2) is the newest version of the Program Database (PDB). It was under development at the time of our data collection, and was scheduled to be deployed worldwide by the year 2021. The original PDB and PDB2 are in practice currently two separate systems although they are linked. Users (i.e. SOS employees) have access to both. When asked if and how the challenges with the PDB are being addressed in PDB2, the PDB team member listed the following:

1. PDB2 features a new UI.

2. Silverlight is not required for PDB2 to run.

3. PDB2 runs in the browser Google Chrome.

4. PDB2 runs on mobile Android devices.

5. Increased global training of staff, however not all staff can be reached.

Additionally, they are also working on *offline capabilities* and improved functionality for prohibiting *data quality issues*.

Offline capabilities

Offline capabilities for the PDB2 are a work-in-progress which is further supported by the fact that the PDB2 can run on mobile Android devices, which will make data capturing in rural areas lacking network connectivity more streamlined and timely.

According to the PDB team member, *"a third of the applications works offline."* Users can work for 14 days without an internet connection, then they must sync the data to the server. The first pilots of the offline data collection were conducted in Kenya, Malawi and Gambia, with a goal to reach 100 member associations (read: nations where SOS operates) by the first quarter of 2020. The mobile data collection was, per November 2019, ready to use in 100 member associations, and was used by 25 percent of the member associations.

The team leader behind the PDB stated that they aim for the PDB2 to be a useful tool for social workers. High-level presentation slides provided to us by the team leader also indicate functionality intended for social workers. This aligns well with PDB2 having offline capabilities and being able to run on mobile Android devices. Social workers would be able to directly input data they would otherwise collect on forms into the PDB2 without having to deliver forms to data clerks for data input.

Prohibiting data quality issues

The PDB team has developed logical checks *"that are either used to validate rules in the user interface or in the data quality monitoring."* Examples of data quality issues they are addressing with PDB2 that can be found in the original PDB include:

1. **Accuracy**: With the original PDB, it is possible to enter a date of birth in the future, i.e. at a later date than today's date. We were also told during one of our observation that it is possible to enter beneficiary ages up to three-digits, even if the beneficiary is defined as a youth.

2. **Completeness**: they have introduced mandatory data fields in the registration of beneficiaries.

3. **Consistency**: validity checks with existing data. For instance, they are identifying records where a beneficiary has completed secondary school while currently being enrolled in primary school.

7.4.2 SOS Compass

In the past SOS had created reporting silos and had different health-relation methods and different business rules in different types of reports. This caused them to create a global reporting layer on a high level where they collect the most prominent reporting entities, their relationships, and their respective business rules. This is what they call the *SOS Compass*. The PDB is a main source of information in SOS Compass and is well integrated there. The goal is to provide an overview of federation-wide

data by collecting program data, fund-raising data, and finance- and HR data. The SOS Compass is used for reporting and "data analytical purposes".

From our observations of data clerks and MERA officers, it does not seem like SOS Compass is used in their daily tasks. As such, it seems it is mostly used in higher levels of the organization where high-level aggregated data is more important and not at the village levels where disaggregated data is most important.

7.4.3 Data Visualization

Data visualization, such as graphs and tables, are created using Power BI by Microsoft, or presented in the SOS Compass. These data visualization tools can for instance draw data from the PDB.

We asked data clerks, MERA officers, and Program Directors if they found the data visualization tools within the SOS digital ecosystem to be satisfactory. At the program locations, all participants found the data visualization tools at their disposal to be satisfactory and they did not miss any particular tools or functionalities. The Program Director at the national office in South Africa did however express dissatisfaction with aggregate data presentation in the Program Database.

7.4.4 Data Import and Export

During our findings, we discovered that there is a substantial amount of duplicate work within SOS villages in terms of reporting, where there often will be significant overlap between data reported internally vertically within the organization and data reported to the respective governments. When discussing the potential interoperability between the PDB and DHIS2, we specifically discussed how that could improve the information flow between SOS and the respective governments they operate in, if these government would in some shape or form utilize DHIS2 as a tool for vulnerable children data capturing.

The back-end of SOS' digital solutions is built using Microsoft .NET and they use REST-based APIs. The interfaces they have in place is currently for internal use. They have built microservices hosted by their back-end for the software *Salesforce* in India and Latin-America. A member of the team noted that they have different kinds of interfaces in place *"however granular or real-time you need them to be"*. The team member went on to point out that while technically the possibility of exchanging data is present, they have a focus on developing *"a few generic interfaces"* for the consumer. The team member believes that technically it is not very sophisticated to simply query between REST-based services in order to get access to SOS' system, and that's why they have and want interfaces for translation of events.

As such, interfaces would have to be developed if the PDB were to be interoperable with DHIS2. The team member went on to state the following regarding the potential development of an interface for DHIS2:

> *"The overlap of PDB countries and DHIS2 countries is very high and we can think about a standard interface to DHIS2. The current point of view is that the PDB has to consider requirements to hundred-something member associations and we will not be able with our team to provide each and every to whatever*

kind of system. But, from an architectural point of view we are open to provide standard interfaces, REST-based interfaces, whatever you need. We think that if there are very specific things it might be easily feasible to provide from a local partner a data exchange interface, based on the PDB to the local system. If we could have an interface where the PDB sends data to a system and the government does not have to request the data separately, this would be better (compared to the current situation) and we would consider providing an interface."

Furthermore, the PDB team believed that Ethiopia and South Africa would be suitable countries to pilot such a project given the background information our research would provide and the fact that SOS operates in both countries. Ethiopia was particularly interesting to them due to the sheer amount of beneficiaries they have there. In addition to interfaces and API functionalities, PDB data can be exported to Excel by SOS employees tasked with using the PDB.

7.4.5 Data Flexibility

As a database at its core, the PDB has a set of data. While the PDB team naturally has the technical ability to change the contents of the database, other parts of the organization do not have that ability directly. The contents of the PDB are as such uniform and static to the majority of the organization worldwide. This means that it cannot be tailored or customized to a particular context exclusively. If for instance an SOS Village in Ethiopia would have a need to capture something that the PDB does not cover, it would not immediately have the possibility to do so.

The PDB team acknowledges that there is a high need by national associations to add data fields in the PDB2, but so far the team has prioritized global alignment of data elements. In other words, the lack of flexibility is by design and aligns well with the aforementioned will to standardize data within the organization to prevent an unlimited degree of complexity within the system. When we asked people at the SOS program locations and national offices tasked with data capture, input, and evaluation whether they would like to add or remove particular data elements to the PDB, they uniformly answered either no or that they could not think of anything of importance that is not covered.

7.4.6 SOS employees' usage of the PDB

With PDB2 being under development as of when we performed our data collection, it was rarely if ever used by employees tasked with using the PDB in the program locations we visited. The original PDB is still used primarily by these employees according to our observations, although they did have access to the PDB2 in the SOS program locations in Ethiopia. The data clerk there gave us a demo of PDB2, but performed his/her daily tasks using the original PDB.

All data clerks and MERA officers we observed appeared to be competent in their usage of the PDB. They were aware of the challenges listed above and actively worked around them. Although data quality issues would occur regularly, MERA officers at the village level as well as the MERA team at the national level actively check reports and PDB data and provides feedback to the responsible actor if they suspect that something is wrong. These suspected issues will then be either explained by the actor if the particular input was intentional or corrected if it was not.

7.5   Summary

SOS Children's Villages collects a wide array of data on its beneficiaries, and program locations also compile operational and financial reports. Some of the data is directly shared with higher levels by email, some of it is shared with governmental actors they are required to report to, and some of it is indirectly shared with other parts of the organization through the Program Database. The current version of the Program Database does not play well with some of the more prevalent issues in Ethiopia and South Africa, which will be discussed in the following chapters. Overall, SOS Children's Villages' internal information system was found to be relatively strong when viewed in isolation. The Program Database, although lacking in its current version, was well-established and utilized in all program locations, and the development team in Austria were working continuously on new features and data quality improvements.

Chapter 8

Ethiopia

8.1   Introduction

This chapter will provide an overview of Ethiopian government entities related to vulnerable child care, their functions, and digital solutions. It will also discuss these government entities' relations to SOS Children's Villages, including funding and financial support, reporting requirements and habits, as well as the constraining and enabling factors of the cooperation between these government entities and SOS. The Ethiopian Ministry of Health (MoH) and its usage of DHIS2 will also be presented.

8.2   Reporting - SOS National Office

According to the Program Director, the government requires the *"plan, bi-annual and annual reports"* from SOS Children's Villages' Ethiopian national office. The recipient of these plans and reports vary from project to project. The national Program Director named examples such as health projects (which would be reported to the Ministry of Health) and education projects (which would be reported to the Ministry of Education). Even though they might report to the Ministry of Education, for instance, the national SOS office will, according to the national Program Director, keep the MoWaCA *"in the loop"* by copying them in email exchanges and sending them copies of the reports and other documentation. While not explicitly stated by the Program Director at the national office, reports from SOS' Ethiopian national office to the *Federal Charities and Societies Agency* - which was later named the *Agency for Civil Society Organizations* - indicate an annual submission of an operational plan and report.

We learned from the Program Director at the national office that SOS' relevant *regional* office, namely the Eastern and Southern Africa (ESAF) region of which Ethiopia is a part of, has access to *"a workspace"* to which the national office will upload reports. The regional office will then aggregate those reports and forward them to the international office. the regional office will also provide feedback to the Ethiopian national office. The specifics regarding reporting requirements and feedback frequency were not discussed.

8.3   Reporting - SOS Program Locations

SOS program locations are required to report on a quarterly, bi-annual and annual basis to the regional Bureau of Women and Children Affairs (BoWaCA). The formats are specified and provided by the governments. These reports are paper-based

and delivered by postal, and the MERA officer is responsible for dispatching these reports. The BoWaCA does not accept reporting by email.

SOS program locations are required to report annually to the Agency for Civil Society Organizations (CSO) on financial and operational matters. Similarly to the Bureau of Women and Children Affairs, the Agency for Civil Society Organizations require SOS program locations to report and submit paper-based reports by mail.

SOS program locations also report financial matters to the Bureau of Finance at the regional level. They are required to report by a government-defined form on a quarterly, bi-annual, and annual basis.

According to the Program Director of the national office, all SOS program locations report monthly and quarterly operational data to the national office bi-annually. The national office had advisors for the Family Strengthening and Alternative Care programs who would evaluate and provide comments on those reports and forward the product to the Monitoring and Evaluation department. The reports from all the program locations would then be compiled and the compiled report would be the topic of a review of plan achievements, final expenditure, and quality. This review would in turn serve as the foundation of the feedback the national office provides to the program locations.

8.4   Reporting - Informal

Ethiopians generally seemed to prefer discussion by dialogue, often choosing to talk to us on the phone or in person rather than by email. This impression was strengthened by both witnessing and being told by SOS representatives that informal, in-person meetings would take place regularly between actors. An example of this is when we were invited back to one of the program locations after interviewing the data clerk there for the opportunity to be introduced to representatives from the Ministry of Women and Children Affairs after their meeting with the Program Director at the program location. This allowed us to get in touch with the MoWaCA and establish the link we needed to conduct an interview and an observation at their offices. The Program Director in another program location told us that informal, in-person meetings between representatives from different SOS program locations was a regular occurrence. When we asked the Program Director at the national office whether the Program Director was aware of these channels of informal information exchange at lower organizational levels, the Program Director replied *"yes, we know there is informal information exchange and we also encourage them to do that"*.
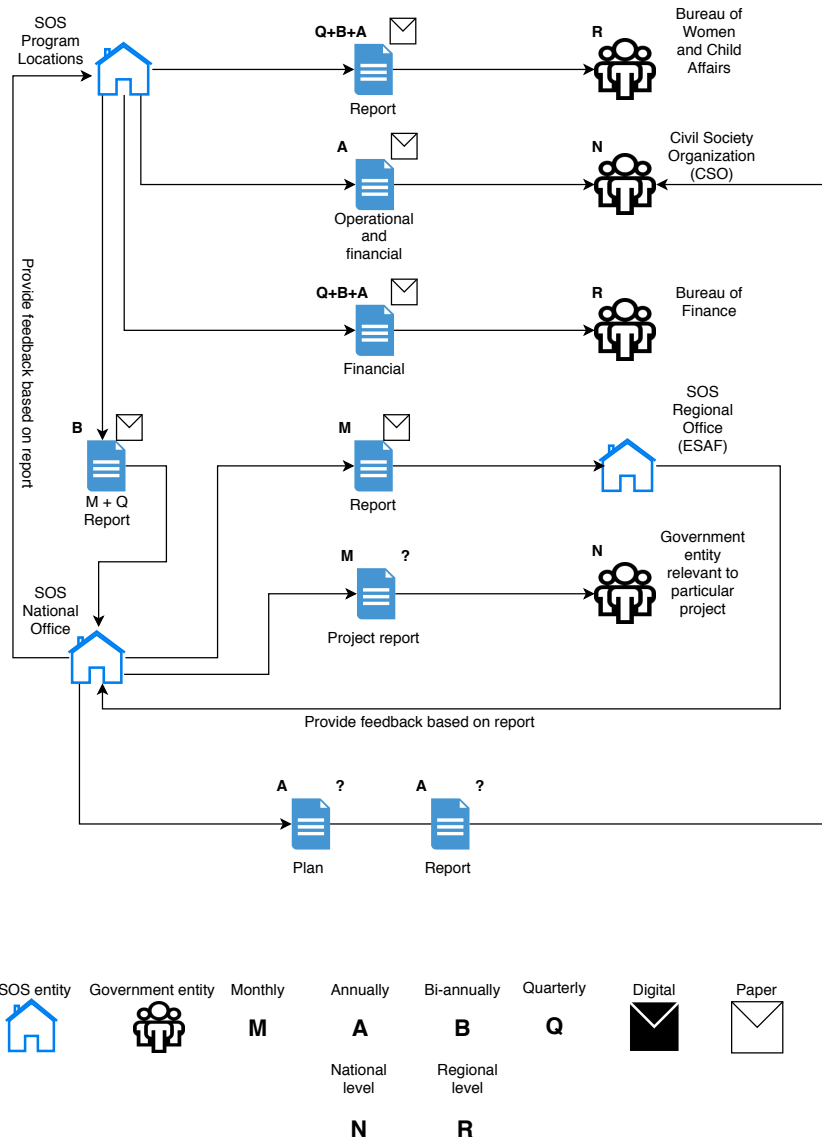
FIGURE 8.1: Overview of reporting between SOS Children's Villages and the Ethiopian government.

8.5   The Ministry of Women and Children Affairs

The Ministry of Women and Children Affairs (MoWaCA) is the government organ in Ethiopia that is responsible for children. According to *About the Ministry of Women and Children Affairs*, their mission is *"ensuring women's equal participation in and benefit from development, good governance and democratization; promoting gender equality and protecting the right and well-being of children."* On the same site they list ten things that Ministry of Women and Children Affairs have the power and duty to, the ninth of which is to *"coordinate all stakeholders to protect the rights and well-being of children."*

We were fortunate enough to visit the national offices of the Ministry of Women and Children Affairs and conduct an interview with a Child Care, Support, and Protection Expert and a Child Rights Expert, as well as observe the leader of the database team there and the system they used.

8.5.1   Digital systems

SOS program locations report to the Bureau of Women and Children Affairs (BoWaCA), which is at the *regional* level. Ethiopian regions can have a very large number of inhabitants. For instance, there are roughly 20 million people living in the Amhara region, of which the cities of Bahir Dar and Gondar are part of, and roughly 3.2 million people live in the Addis Ababa region (*City Population - Ethiopia*). I say this to say that there is a huge amount of personal information being handled from the community levels up to the regional levels, and then up to the national level. This information is often paper-based, especially at the lower levels.

As stated initially, we were able to interview two representatives and observe the leader of the database team at the *national* level. This means that we, unfortunately, were not in contact with any *regional* offices, which SOS program locations report to. With that being said, we believe that our experiences and observations at the national office are likely indicative of the digital capacity and constraining factors at the regional offices.

The national office did have a database with 79 indicators ranging from *"total number of children living in Ethiopia"* to *"total amount of money invested in highly vulnerable children"*. That database was not functioning at the time due to a high level of turnover of technical people within the ministry, as well as a general lack of input from NGOs and government ministries. One of the Experts went on to state: *"the way they (MoWaCA) address reporting is not systematic and not supported with IT."* Experts such as themselves were supposed to enter data from hard copies received by NGOs into the database but they were not doing so due to capacity issues namely a high work burden and a lack of financial resources.

In conclusion, the level of digitization within the Ministry of Women and Children Affairs appeared to be low. They did have a database with a rather comprehensive set of data indicators in place as well as an IT team tasked with maintaining and developing the database in place. The Experts we interviewed appeared to be knowledgeable and well aware of challenges related to the reporting system both internally in the ministry and externally to and from third-parties such as the NGOs. Despite this, the database was allegedly not functioning (at the national level) and

all reporting from SOS program locations to the Bureau of Women and Children Affairs (at the regional level) was paper-based.

8.6 The Agency for Civil Society Organizations

The Agency for Civil Society Organizations (CSO) is a government agency that, according to *Agency for Civil Society Organizations - Home Page*, *"is working to strengthen the role of Civil Society Organizations (CSOs) in shaping strategies with a view to improving local ownership of development processes"*. From our understanding, they function as the government organ responsible for the oversight and administration of *"Civil Society Organizations"*, which they define as *"non-state, not-for-profit, voluntary entities formed by people in the social sphere that are separate from the state and the market"* (Ibid.). The term Agency for Civil Society Organizations in this case includes Non-Governmental Organization (NGO)s, such as SOS. The CSO was described by the Program Director of the national office in Ethiopia as *"an umbrella organization for NGOs."* In other words, they serve a function similar to a governmental partner to organizations such as SOS.

8.6.1 Digital systems

The CSO had a database with a UI that is accessible from a web browser. The database functions similarly to a file system where they have a "file" for each *civil organization* containing organization details, financial data, project proposals, etc.

As of the time we visited them in late 2019, they were working on converting all paper-based files and reports into the database. We got to observe the database and the conversion process. It is interesting to note that they did not manually copy all of the data from the paper files by entering them letter-by-letter and number-by-number into the database, instead opting for a solution where they would scan each and every page of the files and basically creating a collection of digital pictures of these pages. They will only accept soft copies of reports after they have completed this process.

During our interview with a graphic designer working there, we learned that the Ethiopian government is apparently in the process of developing a database *"for all government organs, it is going to be a shared database."* It is developed by Information Network Security Agency (INSA), an Ethiopian agency with the *"objective to protect the national interest through building a capacity that enables safeguard the country information and information infrastructure"* (*INSA Ethiopia - Vision and Mission*). Unfortunately, we did not get the chance to learn more about this database. One of their motivations for moving all the paper files to a digital database was simply because they were about to run out of room for papers.

In conclusion, the level of digitization within the Agency for Civil Society Organizations appeared to be low. They kept paper-based files containing all necessary information on all NGOs they supported in Ethiopia, of which there were 3745 according to their Excel-based overview. They were in the process of moving the contents of those paper files into a database, although the copies of the data were done through scanning instead of manually entering data from the forms by keyboard into the database. This would for instance mean that they cannot change a data element or edit information without filling out an entire paper page, scan it, and replace the

page that was there to begin with. Alternatively they could use some editing software. Either way, I would argue that their approach to transfer data from paper to computers will take a lot less time, though it will not be an actual database representation of an NGO where individual data elements could be easily edited or even accessed. With that being said, the database was meant as a temporary solution to clear up some physical space, and they did state that the database developed by INSA would at some point in the future be used by the CSO. We did not ask how they intend to move the scanned images from their temporary database in to the INSA-developed database.

8.7   Bureau of Finance

SOS program locations also report financial matters to the Bureau of Finance at the regional level. They are required to report by a government-defined form on a quarterly, bi-annual, and annual basis.
We did not have the chance to get in touch with the Bureau of Finance and therefore cannot state anything about their digital systems, or lack thereof. The only information we have is the rate of required reporting from SOS.

8.8   Ministry of Health

The Ethiopian Ministry of Health (MoH) is the government ministry that is responsible for public health. According to their website - *Ministry of Health, Ethiopia - Mission, Vision & Objectives* - their mission is to *"promote health and well-being of Ethiopians through providing and regulating a comprehensive package of promotive, preventive, curative and rehabilitative health services of the highest possible quality in an equitable manner."*

We were fortunate to interview a regional Deputy Manager and observe one of the data clerks at the regional office working with the national health system, DHIS2. We also interviewed a member of the Ethiopian Health Information Systems Program (HISP) team, which works to support the MoH.

8.8.1   Information flow and DHIS2

The Ethiopian Ministry of Health use the District Health Information Software 2 (DHIS2) as their national Health Management Information System. It was piloted in 2016 and has since 2019 been embraced as the national HMIS. The rollout and nation-wide implementation of DHIS2 was in its early stages at the time of our visit to Ethiopia, and the days we spent in Gondar were just a week before the University of Gondar hosted Ethiopia's first-ever DHIS2 academy, as mentioned in section 3.2.1.

SOS program locations do not report to the Ethiopian Ministry of Health regularly. SOS' national office, however, might report to the MoH on a project-to-project basis. The information flow here is related to health information instead of child care information and is not directly relevant to SOS' information flow in relation to the Ethiopian government. However, the MoH is to our knowledge the only government entity in Ethiopia that uses DHIS2 as its digital information system. The health information flow is as such relevant here not to shed light on child care data handling in Ethiopia, but to shed light on the use of DHIS2 in Ethiopia.

Disaggregated health data is gathered on paper by health facilities/centers at the community level or hospitals. The sheer amount of paper-records can be quite high. We visited a hospital in a city in the same region the Deputy Manager worked in and got to see a storage room filled with paper-based medical records (8.2). If and when they have the capacity to do so, facilities will enter health data in to DHIS2 or create Excel-based reports and email them to the regional level. If they do not have the capacity (mostly due to a lack of electricity, network connectivity, or necessary hardware), the disaggregated health information will be shipped to the regional office either in its original form or as files on hard drives, and data clerks at the regional offices will then enter the information in to DHIS2 and create reports.
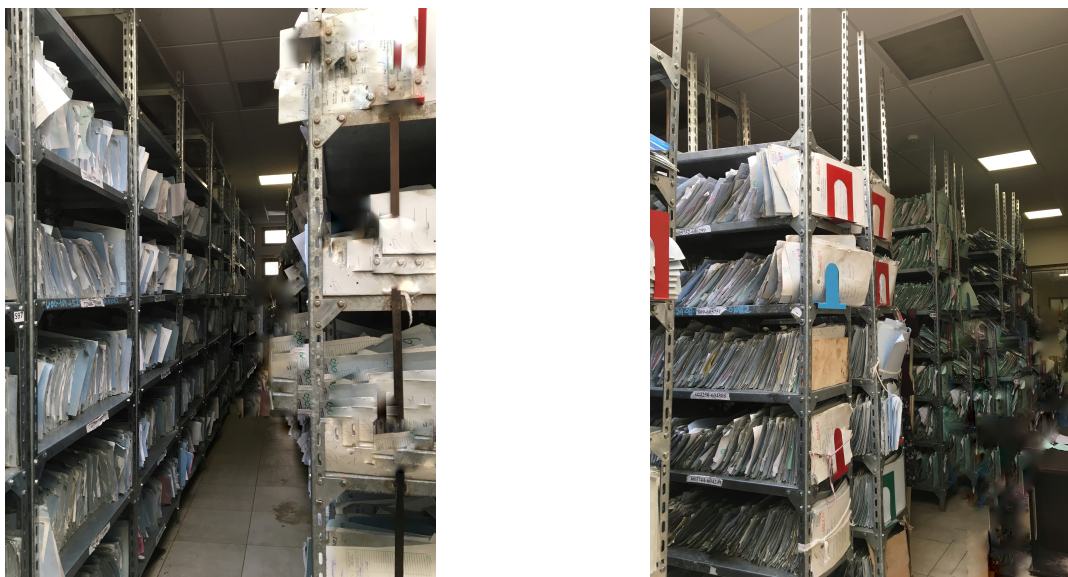

FIGURE 8.2: Storage room filled with paper-based medical records in a local hospital in the Amhara region. The photographs have been edited to censor personal information and people originally present.

The national DHIS2 instance runs on a single server located in Addis Ababa and although the hardware is good, according to the HISP team member, regional levels do not always have access to the server due to network and electricity issues. The data clerk we observed gave a very rough estimate of the server being inaccessible for whatever reason *"50 percent of the time"*. This rough estimate was supported by the HISP team member. This caused the data clerks at regional levels to run local, offline instances of DHIS2 where they were able to input data at any time and then upload it whenever they had access to the national server. This workaround causes complications. According to the HISP team member, local instances of DHIS2 being used by different data clerks in different locations often results in a variety of versions of DHIS2 being used. This in turn causes complications related to version and specification alignment. Another workaround data clerks used when they did not have access to the server was simply to enter data into their local DHIS2 instances, export the data into a JSON file, and email it upwards to the national offices so that they could enter it in to the national DHIS2 instance and/or create reports. The MoH was at the time, according to the data clerk we observed, in talks with Ethio Telecom to expand network coverage to all health facilities. If possible, data clerks would occasionally use mobile 3G dongles to utilize the cellular network for work if they lacked access to the internet.

8.8.2 On DHIS2 interoperability with other systems

We discussed the possibility of introducing DHIS2 to the child care ecosystem in Ethiopia with the HISP team member, including technical and architectural challenges, as well as the political and socio-technical aspects.

If the Ethiopian government were to adopt DHIS2 as their national child care information software in a similar manner to how it has become their national Health Management Information Software, the team member believed that technically and architecturally, it would not be challenging to set up the necessary data elements the Ethiopian government require from SOS and fitting SOS into the DHIS2 hierarchy.

If SOS were to use DHIS2 directly or indirectly and have it be integrated or interoperable with the digital systems possibly used by the relevant government organs, the team member believed that would be rather difficult. His advice would in that case be for SOS' system with DHIS2 added to be a *"larger, more standalone system"*, basically meaning that DHIS2 would just be used to improve the information flow internally in SOS.

In conclusion, the level of digitization within the Ministry of Health was higher than that of the other government entities discussed in this section, although it was hindered by certain factors. DHIS2 was described as *"better than the old system in pretty much every aspect"* and to have *"excellent analytics functionality"* by the regional Deputy Manager and the HISP team member. My impression was that the Ethiopian government and its partners working with DHIS implementation and capacity building were very optimistic and well-aware of the challenges related to rolling out a new HMIS system with the infrastructural challenges and high population of Ethiopia. The most notable challenges include the transition from a paper-based system that was still prevalent at the time, network and electricity downtime, and capacity building both.

8.9 Constraining factors related to child care information flow

We asked most of our interviewees to list constraining factors related to child care information flow in Ethiopia.

8.9.1 National

Constraining factors related to infrastructure in Ethiopia impacting the information flow for the government, SOS program locations and SOS' national office.

- Electricity: power outages are frequent and occurred more or less daily during the three weeks we spent in Ethiopia.

- Network connectivity: internet connection in Ethiopia is not very strong and connectivity can often not be found at all. When we asked IT representatives from both the government and SOS about a rough estimate of network downtime, they seemed to agree that somewhere around 50 percent was more or less accurate. This should, of course, be taken with a grain of salt but is nonetheless very indicative of network downtime in Ethiopia.

- Capacity: a lack of or insufficient capacity was reported by government and NGO representatives to be one of the main constraining factors impacting the

child care information flow. Capacity can in this case mean an insufficient number of employees, lack of trained employees, or lack of funding or financial strength to support a sufficient number of employees.

8.9.2 Government

Constraining factors expressed by government representatives, generalized.

- Alignment: alignment and engagement between government ministries were described as *"not strong"*. This misalignment was explained to be partly caused by a high level of staff turnover within the government.

- High level of turnover: representatives from both SOS and the Ethiopian government told us that there is a high level of turnover within the government which makes it hard to keep long-term plans and changes between the government and NGOs.

- Silo-based systems: government ministries generally operate with silo-based systems and there are few formal or systematic ways of information exchange horizontally throughout government entities. The Program Director at SOS' national office named at least five government entities they were required to share information with be it by frequent reporting or on a project basis. This effectively means that there are at least five parallel streams of information going from the national SOS office to the government.

- Individually developed databases: in the case of the Ministry of Women and Children Affairs and Agency for Civil Society Organizations, databases would be specifically created for a single ministry, resulting in multiple different digital systems. The database that the MoWaCA (at the national level) had in place - although it was not operational - was reportedly different than what the bureaus at the regional levels would have. Some databases would be developed by governmental IT teams, and some database development projects would be outsourced to private companies.

- Data element alignment: data elements would often be defined differently between governmental levels.

8.9.3 SOS Program Locations

Constraining factors expressed by representatives from SOS program locations, generalized.

- Timeliness of data: impacted by frequent loss of and/or slow network connectivity and power outages. Also impacted by reporting mostly being done by paper, which has to be physically delivered by employees or the post office which can result in transportation delays. There would generally be one employee at each program location tasked with entering data from various forms into the PDB and the time required to get that work done would, of course, be impacted by the number of forms, but could also be delayed if that employee were unable to show up to work.

- Miscommunications with the government: interviewees named a high level of turnover in the Ethiopian government as a key reason for frequent miscommunications between SOS program locations and government entities.

- Transition to PDB2: data clerks had access to both PDB and PDB2 and expressed confusion regarding the transition from the former to the latter.

- Little information regarding PDB2: data clerks generally expressed confusion related to being provided little information about the PDB2 and at the time seemed to prefer using PDB in their daily task, which could complicate the transition toward PDB2.

- Connectivity: SOS employees tasked with using the PDB will frequently either lack access to network connectivity due to power outages or unstable network bandwidth.

8.9.4 SOS National Office

Constraining factors expressed by representatives from SOS' national office in Ethiopia.

- Turnover: a high level of turnover among key staff members.

- Lack of strong statistics: while representatives from the national office generally expressed satisfaction with the PDB and other tools for creating statistics and data visualization, they did not feel that statistics provided by the government and national statistics were strong.

- Data quality issues: data quality issues happened, according to the national Program Director, *"from time to time"*.

- Timeliness of data: similarly to the SOS program locations, paper-based reporting would occasionally impact the timeliness of data due to transportation delays.

- Lack of standardized information exchange between NGOs: although NGOs in Ethiopia, such as SOS are gathered under the Agency for Civil Society Organizations (CSO), there was reportedly no direct standardized data exchange between NGOs.

- PDB information flow sometimes too slow: a member of the MERA office expressed that the entire information flow from paper to the PDB sometimes would be to slow, which would cause them to use Excel and email to get certain data immediately. For instance, the team member named *"seeing how many children are in a project, number of caregivers, which community-based organization they are working with"* as examples of such cases.

- PDB "incompleteness": the same team member told us that while the PDB is comprehensive enough for information SOS wants and needs, it does not cover some data they are required to report to the government. The team member did not list any examples.

8.10   Summary

SOS Children's Villages program locations in Ethiopia are required to report to at least three different government organs, and the national office will report to an unknown number of government organs on a project-to-project basis. The main government entity tasked with child care is the Ministry of Women and Children Affairs, which SOS program locations report to by paper quarterly, bi-annually, and annually.

The digital systems used by the government entities that we got to witness were generally not of very high quality. The Ministry of Health's use of DHIS2 appeared to be the most promising, although the full potential of that Information Systems, along with all other digital solutions we witnessed, was hindered by infrastructural challenges such as network connectivity and electricity, as well as social and political challenges such as capacity issues and a high level of turnover.

The digital systems used within SOS appeared to be of high quality, and the staff tasked with using them were trained and knowledgeable. The issues were more so related once again to infrastructure, but also the paper-based nature of the required government reporting, duplication of work, and a high work-load for social workers, data clerks, and MERA officers.

DHIS2 is used as a national Health Management Information Software, and we experienced no lack of optimism or initiative related to expanding DHIS2 usage and user competence. However, the initiative is hindered by infrastructural challenges such as network connectivity and electricity, as well as a prevalence of paper-based medical records and a high level of turnover of trained staff. DHIS2 interoperability with other systems such as SOS Children's Villages' Program Database was argued to not be of technical nor architectural difficulty, but more so difficult in terms of capacity and a lack of strong digital systems within the government.

Chapter 9

South Africa

9.1 Introduction

This chapter will provide an overview of the South African government entity related to vulnerable child care, its functions and digital solutions. It will also discuss the government's relation to SOS Children's Villages, including funding and financial support, reporting requirements and habits, as well as the constraining and enabling factors of the cooperation between this government entity and SOS. The South African Ministry of Health (MoH) and its usage of DHIS2 will also be presented.

9.2 Reporting - SOS National Office

The South African national office reports to and receives feedback from the relevant *regional* SOS office, namely the Eastern and Southern Africa (ESAF) regional office. The specifics regarding reporting requirements and feedback frequency were not discussed. These reports are submitted to the regional office by mail. In terms of reporting to government entities, the national office does not report directly to the South African government to a large extent. The only government entity they report to according to the national Program Director is to the National Statistics Office (NSO), to which they will report *"surveys"* annually. According to the national Program Director, neither the reports to the government from SOS' national office nor their program locations includes information on a child's well-being. Information on "beneficiary numbers", such as number of beneficiaries in a program location, and finances are mostly in focus.

The national office uses a *master list* and a *control list* to get an overview of certain data.

- Master list: a list of all intended beneficiaries in the Family Strengthening program.

- Control list: a list for all intended beneficiaries in the Alternative Care program.

These lists are sent by program locations to the national office, and was to our knowledge not used by the national office in Ethiopia. The Program Director expressed that the information on the master and control list should be easily accessed through the PDB, but alas.

9.3   Reporting - SOS Program Locations

According to one program location Program Director, that SOS program location was required to report to the Department of Social Development (DSD) monthly. The Program Development Coordinator (PDC) of one of the program locations we visited described the reports as statistics, the content of which includes how many beneficiaries are currently admitted in the program location, how much money has been spent on each program and if children have been moved to other care options. The format of the reports is pre-determined by the Department of Social Development (DSD). The PDC in another program location in another province stated that they report to the Department of Social Development on both a monthly and quarterly basis. We learned that provincial government entities are rather autonomous, meaning that the Department of Social Development in KwaZulu-Natal province might operate differently from Department of Social Development in Northern Cape province. Either way, the Department of Social Development is the only governmental entity SOS program locations are *required* to report to. The reporting is done both by paper and digitally through emails and the reason why both are used is, according to multiple SOS employees we interviewed, because the Department of Social Development might misplace either the paper-based report or the email and as such use the other as back-up.

As stated in section 9.2, reports from both the national level and program locations to the Department of Social Development mostly consists of beneficiary numbers and finances. We learned that the South African government through the Department of Social Development provides funding to SOS program locations per supported child. Not all children admitted in a program location is supported though. For a child or an NGO taking care of the child, to be financially supported by the South African government a court order has to be issued, stating that the child qualifies for government financial support. This court order is valid for two years, and one requirement for this court order is, according to multiple SOS employees we interviewed, that the child is a South African national. One of the participants in our group discussion in the SOS program location in Port Elizabeth stated that the Department of Social Development *"does not ask for information on beneficiaries in communities (admitted in the Family Strengthening program) because they (the Department of Social Development) does not provide funding for them"*. This group of beneficiaries are as such a black box to the South African government.

SOS program locations does, according to the national Program Director, not directly use the Program Database to report to the national office. That is instead done mainly by mail.

9.4   Reporting - Informal

To our knowledge, there is little informal ways of reporting between SOS national office or program locations and the South African government.
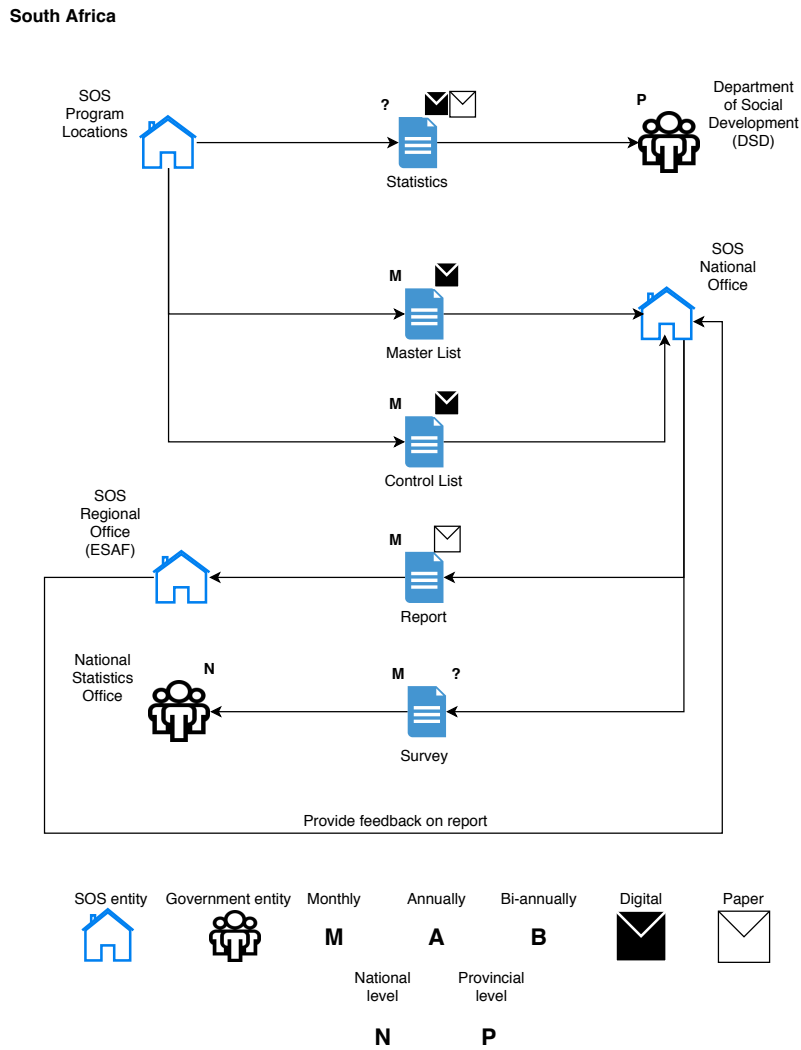
South Africa

FIGURE 9.1: Overview of reporting between SOS Children's Villages
and the South African government.

9.5   Department of Social Development

The Department of Social Development (DSD), formerly the Department of Welfare, is the government department responsible for providing and overseeing social services to the public. According to *Department of Social Development, South Africa - About Us*, they *"endeavour to create a better life for the poor, vulnerable and excluded people in our (the South African) society."* They also *"conduct research that develops the social indicators necessary for programme implementation and public accountability."* (Ibid.).

From what we learned during our data collection, the Department of Social Development is the primary government organ tasked with collaborating with and overseeing NGOs in South Africa. All SOS program locations as well as other comparable NGOs, such as Eastern Province Child and Youth Care Centre (EPCH), The Love of Christ (TLC), and Thusanang HIV/Aids Relief Project were required to report to the Department of Social Development.

We were fortunate to interview a Deputy Director at the national level of the Department of Social Development who in turn introduced us to someone the Deputy Director describes as an *"Informatics Specialist in Social Development Systems."* It was admittedly not easy to form a full picture on the Department of Social Development, but thanks to the information provided by the Department of Social Development Deputy Director, the Informatics Specialist, and various employees from different child-care NGOs (including SOS), we are able to shed some light on the inner workings of the Department of Social Development and their digital systems.

9.5.1   Digital Systems

The following information on the National Integrated Social Protection Information System (NISPIS) is gathered from documentation provided to us by the Deputy Manager at the DSD. NISPIS is an intended *"electronic integrated data management system, which will promote the sharing of data and uniform reporting throughout government"*. In layman's terms, it is intended to become a system to which all silo-systems within the Department of Social Development will be integrated into to *"promote the sharing of data and uniform reporting throughout government to enhance services to poor and vulnerable communities and families"*. An audit of the development and implementation of NISPIS from July 2019 was provided to us by the Deputy Manager. The audit expresses that the current situation is characterized by a multitude of independent silo-systems and limited sharing of information between programs:

> *"Currently, services targeting vulnerable individuals and families delivered by the different government departments and agencies are not coordinated and information on the beneficiaries resides in different silo databases. The lack of mechanisms for integrating and sharing data across government makes it difficult to identify vulnerable individuals and families that might be falling through the cracks and not being reached with social protection services that they need."*

Braa and Sahay, 2012, (p.63), argues that too much *vertical integration* (meaning a silo-based integration and data sharing) is *"often seen as the main reason for the fragmented HIS in the health sector"*. This is evidently also the case for the only child care government entity in South Africa. Furthermore, this causes duplication of data, as NGOs

might be approached by government representatives from different programs requesting overlapping information. This in turn makes for an increased work burden for beneficiaries. There are over a dozen different silo-based systems being used by different directorates within the Department of Social Development.

The audit also mentions how the Department of Social Development generally capture data. It states that data is collected at the service delivery level by using a *"a wide range of tools provided by provincial departments as well as municipalities"*. This could for instance be the forms used by SOS program locations for reporting back to the Department of Social Development. Furthermore, the audit also states that data are, in most cases, gathered using paper-based tools and the information is subsequently extracted and entered into the different databases used by departments.

In conclusion, the digitization within the Department of Social Development appears to currently be fragmented with necessary infrastructure in place, although there are certainly pieces in place for it to improve vastly. As stated by the report, the *status quo* of digital systems used by the directorates of the Department of Social Development are not currently integrated nor coordinated. This causes difficulties with overall coverage of vulnerable individuals and families and causes existing beneficiaries to report duplicate information to the same governmental department. The initiative behind the institutionalisation of NISPIS seems to be well-informed and well-meaning, and seems highly likely to improve on these areas should the initiative prove to be successful.

9.6 National Statistics Office

SOS' national office reports annual surveys to the National Statistics Office (NSO). We did not have the chance to get in touch with the National Statistics Office and therefore cannot state anything about their digital systems, or lack thereof. The only information we have is the rate of required reporting from SOS' national office.

9.7 Department of Health

The Department of Health (DoH) is the executive department of the South African government that is assigned to matters related to health. Their mission, according to *Department of Health, South Africa - Vision and Mission*, is to *"improve the health status through the prevention of illnesses and the promotion of healthy lifestyles and to consistently improve the healthcare delivery system by focusing on access, equity, efficiency, quality and sustainability."*.

9.7.1 DHIS2 usage by the Department of Health

The original DHIS and its successor, DHIS2 has been the national HMIS in South Africa since the early 2000s, according to Braa and Sahay, 2017. It is the official reporting system of the Department of Health, who manage all of their basic reporting, monitoring, and planning on DHIS2 data. We were fortunate to interview a member of the South African HISP team, who supports the South African DoH with configuring and managing DHIS2. This subsection will therefore provide information on the only governmental use of DHIS2 in South Africa.

The MoH has around forty different instances of DHIS2. There is a national DHIS2 instance and one instance for each of the nine provinces in South Africa. Those are essentially the same in the sense that they collect routine aggregated data from a national indicator data set, which is all the information the ministry uses for planning, monitoring, evaluation and reporting. There are a number of other instances which are more specialized. One is used as a patient satisfaction survey, one is used in human-relations where doctors and interns can apply to the place of their choice within the MoH. DHIS2 Tracker is used for many of these specialized cases.

In addition to the MoH, there are a number of NGOs that have used DHIS2 mainly for monitoring their training interventions, according to the HISP member. Examples of such cases includes monitoring attendance of support group interventions and *"certain training sessions"*. Another example is a *"very advanced application"*, developed by HISP using DHIS2 that could pull data from the ministry to do certain overlays of data from surveys to find HIV hotspots and to then monitor interventions around those.

The DoH is not completely autonomous in their use of DHIS2. HISP South Africa is very much involved in assisting the department in managing these systems partially due to a problem with staff capacity and specifically staff with the skills required to manage the DHIS2 instances correctly. The HISP team member told us that an analysis of data integrity error comparisons between countries was presented at a DHIS2 conference in 2018 and it was found that the South African instances had basically no integrity errors and managed better than most. Reflecting on this, the team member evaluated that it *"was a good thing, but it is also due to the fact that HISP South Africa, with the advanced skills we have, are basically doing it on behalf of the ministry"*. HISP South Africa was working on building capacity in the ministry in order to shift such routine work more towards them.

9.7.2   On DHIS2 and the child care information system in South Africa

We discussed the current state of DHIS2 interoperability in South Africa and the possibility of introducing DHIS2 to the child care ecosystem in South Africa with the HISP team member, including technical challenges, as well as political and socio-technical aspects.

When asked about the technical difficulty related to having DHIS2 be interoperable with other systems, the team member stated that they are working a lot in that field. For instance, they were establishing interoperability with university systems (none named), which according to the team member are usually Oracle-based systems. Currently they are following more of a solution revolving the file format CSV which DHIS2 can both export data to and import data from. They are planning on working with the universities on pulling data from *"system to system"* without files or email correspondence being necessary. The team member stated that the success of the interoperability depends on the quality of the data *"because obviously if you want to push data you have to know that data is in the format you want to push it"*.

The team member stated that DHIS2 lends into itself interoperability, and so HISP South Africa does not have large problems with getting DHIS2 to be interoperable with other systems. With that being said, the team member believes the challenge of for instance having the Department of Social Development utilize DHIS2 in some shape or form is more of a political one than a technical one. The team member

stated that a kind of nepotism, related to South Africa's history of corruption, has previously been prevalent in the government. The team member went on to say that if *"you were to present them (government) with a solution, it is seen with a level of concern. Like, why are you pushing this solution?"* and that if you were to push something like that it might be better to wait for it to be *"advertised in a sense, then respond to that, and push it from an internal point of view"*. The team member believe that it needs to be advertised by someone who does not represent the organization developing the product, or else it is seen as *"something under the table"*. In an article describing the challenges and opportunities of implementing DHIS2 in Sri Lanka, Manoj et al., 2013 concluded that the it is essential to overcome the challenge of obtaining the highest level of endorsement for DHIS2 implementation.

In conclusion, the level of digitization within the Department of Health seems to be very high. This is particularly due to HISP being a very close key partner to them, even going as far as to handle routine data on behalf of the department. This has an upside and a downside: the upside is that they have very few data integrity errors compared to other countries using DHIS2, but the downside is that the workload associated with routine data handling should, according to HISP South Africa, be shifted more towards the department. One key reason why HISP has to manage this on behalf of the department is because of a lack of staff in general and staff trained in using DHIS2 specifically. HISP South Africa has experience in working on making DHIS2 interoperable and believes that it is a system that - at least on a technical level - leans into interoperability.

9.8 Constraining factors related to child care information flow

We asked most of our interviewees to list constraining factors related to child care information flow in South Africa.

9.8.1 National

Constraining factors related to infrastructure in South Africa impacting the information flow for the government, SOS program locations and SOS' national office.

- Electricity: load shedding (described in 3.3) causes electricity to be unavailable in scheduled areas at scheduled times. We experienced this frequently in all three provinces we stayed in, including during our visit to two out of three SOS program locations.

- Network connectivity: although the network infrastructure and connectivity in South Africa is comparatively better than Ethiopia's, the aforementioned issues with electricity causes frequent network downtime.

9.8.2 Government

Constraining factors expressed by the Deputy Manager at the Department of Social Development, the documentation the Deputy Manager provided to us, and by representatives from child care NGOs we talked to.

- Silo-based systems: the Department of Social Development has, according to an internal audit from 2019, over a dozen different silo-based systems being used by different directorates within the Department of Social Development.

Data is rarely, if ever, shared between the different systems, which frequently causes SOS and the other child care NGOs we visited to report duplicate data.

- Lack of dedication: representatives from two different NGOs stated that the Department of Social Development can be seen as a stepping stone for people building their careers within the government, and that these people might have little interest in making sustainable change. It is important to note however, that this concern was only brought to us by NGOs that are required to work with and report to the Department of Social Development, and not by any representatives from the Department of Social Development.

- High level of turnover: multiple representatives from child care NGOs told us that there is a high level of turnover within the Department of Social Development which makes it hard to keep long-term plans and changes alive as far as their relationship with these NGOs goes.

9.8.3   SOS Program Locations

Constraining factors expressed by representatives from SOS program locations, generalized.

- Miscommunications with the government: interviewees named a high level of turnover in the South African government, specifically the Department of Social Development, as a key reason for frequent miscommunications between SOS program locations and government entities.

- Duplicate reporting: interviewees from all NGOs represented in this research expressed frustration with having to report the same data elements more than once. For example, a program location might have overlap of data reported to the national office or entered in to the PDB and data that is reported to the Department of Social Development. The same reports are occasionally required to be reported both by paper and by email.

- Connectivity: SOS employees tasked with using the PDB will frequently either lack access to network connectivity due to electricity load shedding in South Africa, or the connection to the PDB might be slow due to high traffic at particular hours of the day.

- Capacity: a general lack of social workers and/or high work-load for the social workers and other people tasked with using the PDB were observed at all program locations we visited.

- Increase in data intervention criteria: while capacity is a prevalent concern for program locations, there is an increase in data intervention criteria. For example, the *Individual Development Plan* - which is one of the forms with data that is fed in to the PDB - needed to be updated once a year previously, but is now required to be updated twice a year. A representative from the PDB team also stated that the *Core Assessment* data of a beneficiary should be updated at least once a year, but from our experience was generally only updated twice per beneficiary: once upon admission and once upon exiting a program location.

- Discrepancies between PDB and forms: one data clerk stated that there are discrepancies between the data elements in the PDB and data elements in the forms used to collect data that goes in to the pdb. According to the data clerk, the PDB is updated regularly and the forms are not updated as frequently.

- Insufficient funding: according to representatives from SOS program locations, the funding they receive - which is based on the number of beneficiaries supported by the government - is insufficient. Representatives from one program locations stated that the program location will arrange its own ways of funding, for example by hosting events.

- Alignment of governmental and SOS social workers: social workers from the SOS program locations stated that they often find it difficult to communicate, collaborate and align with government-employed social workers.

9.8.4 SOS National Office

Constraining factors expressed by the Program Director at SOS' national office in South Africa.

- Internal information flow: The Program Director of the national office believed monitoring, evaluation and general information flow to be very weak within SOS member associations.

- Irregular feedback: Feedback given from higher organizational levels such as the national office to the program locations are trigger-based. Triggers can for instance be obvious data errors, such as a youth with a three-digit age.

- Data presentation tools: The Program Director of the national office did not find the data presentation tools at his/her disposition in the Program Database to be satisfactory. The Program Director stated that they need to do *"sophisticated excel work"* to get meaningful information. The same Program Director also used custom lists to get aggregate data on the Alternative Care and Family Strengthening programs.

- Fragmentation of information: SOS' national office require program locations to submit master and control lists, which are specific forms developed by the South African office to suit their particular reporting needs. The Program Director of the national office wish for a portal where all necessary information, including reporting, is at his/her fingertips instead of having to rely on paper-based forms or excel sheets.

- Government relationship: The Program Director of the national office believe that more information related to a beneficiary's well-being should be exchanged between SOS and the Department of Social Development as opposed to the current data which is mostly based around finances and statistics. The Program Director referred to the nature of reporting from SOS to the Department of Social Development as a *"numbers and money game"*.

9.9 Summary

The Department of Social Development is the primary government organ that SOS program locations are required to report to and receive funding from. Their digital systems appears to be in-place and functioning, although they are fragmented and silo-based. This means that data is often duplicated by directories in the same department, and this is reflected in the reports that SOS program locations are required submit. In addition to duplication of reports, other factors mentioned above contribute to a high workload for social workers and difficulties with communications

between program locations and the government. The South African government is reportedly aware of some of these challenges and is working on the National Integrated Social Protection Information System (NISPIS), which will be a government-wide system that among other things should reduce complexity and data duplication.

SOS Children's Villages in South Africa appeared to be functioning well for the most part, although there were challenges present. In addition to the challenges related to dealing with the government - of which there were many - the internal information flow was not optimal. The national Program Director for instance expressed dissatisfaction with the level of data overview provided by the current version of the PDB, and expressed concerns with feedback from the national level to the program locations being trigger-based rather than based on some sort of frequency. A high workload for social workers, including some tasked with using the PDB was prevalent in all program locations we visited.

DHIS2 is used as a national Health Management Information Software and has been since the early 2000s. DHIS2 is used by some NGOs, but is only used by the Department of Health as far as governmental usage goes. The maintenance and use of the forty-some DHIS2 instances in the Department of Health is strongly supported by HISP South Africa, which keeps instance integrity errors to a minimum but also means that HISP carries the workload of a lot of routine work. This is due to a lack of capacity within the Department of Health and HISP was at the time working on building capacity within the department. DHIS2 interoperability with other systems such as SOS Children's Villages' Program Database was argued to not be of technical difficulty, but more so difficult in terms of politics and capacity.

Part IV

Discussion and Conclusion

Chapter 10

SOS Children's Villages' Information System and DHIS2

10.1   Introduction

At the beginning of this research I sought to identify a baseline of high-level areas of SOS Children's Villages' Information Systems that could benefit from interacting with DHIS2, either by interoperability, integration or as a total replacement. The first interview conducted for this research, where we interviewed a representative from SOS Norway, helped to establish a set of areas that the interviewee believed to be potential areas of improvement. These areas were kept as common denominators throughout most of our interviews in order to either dismiss or validate a need for improvement by introducing DHIS2, according to our data sources. These areas will be discussed in this chapter while preserving the individual contexts of both Ethiopia and South Africa.

10.2   Data Presentation

Data presentation tools in the current version of the Program Database appeared to be lacking from our observations, and this assessment was supported by the Program Director at SOS Children's Villages' South African national office and a Program Coordinator at SOS Children's Villages' Norwegian national office.

Although SOS employees tasked with using the Program Database at both the Ethiopian and South African program locations would view data directly through the web-based Program Database User Interface, presentations would be created by exporting to Microsoft Excel and either leave the data as tables or use Excel tools to create graphs. All interviewees tasked with using the Program Database at the program locations as well as the Program Director at the Ethiopian national office expressed satisfaction with the built-in data presentation functionalities in the Program Database.

As discussed in section 9, the Program Director at South African office expressed dissatisfaction with the data presentation tools available in the current version of the Program Database and stated that they need to do *"sophisticated excel work"* to get meaningful information. The Program Director used custom lists - the *master list* and *control list* - to get necessary information from program locations because this information according to the Program Director was not easily accessible in the Program Database. The Program Director at Ethiopian national office also stated that

data would either be viewed directly in the PDB or exported to Excel for instance in the event that you would want to make a comparative analysis.

Thus, it appears to be a divide between program locations and national offices in regards to the satisfaction of the data presentation tools in the current version of the Program Database. This divide can be explained by how the data presentation tools are used. The SOS employees at program locations can rather easily create tables for reporting, and view disaggregated data directly in the Program Database UI. This was, in our experience, almost exclusively the full scope of their required use of the available data presentation tools, and it worked well for them. Apart from when performing data evaluation and monitoring, aggregated data appeared to be most prominent at the national offices however. Easily accessible aggregated data was desired at that level, and we did not witness a *"dashboard"* functionality akin to the one in DHIS2 in the Program Database, which would likely suit the needs of the Program Director at the South African national office.

10.3   Data Flexibility

The Program Database is at its core a database. Data elements collected by paper-based forms and subsequently fed into the Program Database are set, and individual program locations do not have the possibility of adding or removing data elements. With SOS Children's Villages being an international organization with program locations in cities and communities in 136 countries as of the time this was written, one of our initial questions was whether there was a need for the Program Database to be customizable to fit countless local contexts.

We learned that this lack of customization is by design and ensures that all SOS program locations are aligned in terms of data they collect for the Program Database. The Program Database team in Austria stated that up to the point in time of our data collection, the team had prioritized global alignment over the *"high need by national associations to add data fields in PDB2, which are requested by governments"*. This high need for customization is not strongly supported by our data. We asked most of our SOS-employed interviewees if they felt there was a need to add or remove data elements from the Program Database and in nearly all cases the answer was negative. The interviewee that was positive about there being a need for removal or addition of data elements was the Program Coordinator at SOS Children's Villages' Norwegian national office, who suggested that the question about whether a beneficiary is an alcoholic or not from the Core Assessment forms were redundant due to it being unlikely that beneficiaries would answer truthfully if they, in fact, were an alcoholic.

10.4   Data Quality

Data quality issues are occasional occurrences both in the current version of the Program Database and in DHIS2, and I do not have the evidence to state whether DHIS2 would fare better than the PDB in this regard or not.

10.5   Data Exchange

The most prominent common denominator in terms of challenges expressed by employees at SOS program locations was the duplication of work. In all program

locations we visited, both in Ethiopia and South Africa, various government organs required the program locations to report multiple times a year. These reports would have overlapping data elements, sometimes between reports to different government entities, and sometimes between reports to the government and upwards within the organization.

Reports required by the government from SOS program locations were exclusively paper-based in Ethiopia and mostly paper-based in South Africa, where program locations occasionally would have to submit reports *both* by paper and by email. This was reported by some program locations to impact the timeliness of the data and - in the case of South Africa - misplacement of data where program locations would occasionally be asked to submit reports to the Department of Social Development by email due to misplacement of papers, or the other way around.

With this in mind, it seemed that the most obvious point of improvement that could be achieved by fitting DHIS2 into this complex child care puzzle, would be to enable digital and automatic data exchange between SOS Children's Villages and the respective governments.

10.6 Offline Capabilities

A lack of offline capabilities in the current version of the Program Database is an obvious point that could be improved due to data often being captured in areas with poor internet connectivity or stable electricity. DHIS2 was built with this in mind, and offline data capture is entirely possible. SOS Children's Villages is however already addressing this issue with the development and rollout of the Program Database 2 which will support offline data capture and be able to run on mobile android devices.

10.7 Summary

While the current version of the Program Database did not fare well in terms of the points discussed above, the Program Database 2 will address some of them. A lack of offline data collection capabilities would frequently hinder work upon network issues or power outages during data collection. There was no support for mobile data collection which means that data collection on forms and input into the Program Database needs to happen in those two steps, whereas it could be accomplished in one if data were collected and uploaded on mobile devices. The newest version of the Program Database - the Program Database 2 - will be addressing these issues. It will have offline capabilities and be runnable on mobile devices. Other factors such as data quality issues and the addition of data elements are things that are continuously being evaluated and worked on by the Program Database team in Austria.

Chapter 11

Fitting DHIS2 into the child care ecosystems

11.1   Introduction

Based on the points discussed thus far in this thesis, I will discuss the prospects of fitting DHIS2 into this child care puzzle: whether it should replace the Program Database, or whether interoperability and/or integration should come in to play.

11.2   DHIS2 as a replacement

An important thing to consider is the continuous efforts made by SOS Children's Villages and the Program Database team to further develop and maintain SOS' digital systems, as presented in section 7.4. Offline capability is an upcoming feature of the Program Database. Data quality issues are continuously being identified and addressed, and work is being put into preventing them from occurring to an extent that is feasible. SOS' internal information system, when viewed as a silo-based system, appeared to be relatively solid on a technical and reporting-based level. Therefore, replacing the Program Database with DHIS2 would not be a viable solution. The data presentation tools of DHIS2 would likely be an improvement to that of SOS' digital solutions, but this alone would not balance out the sheer effort both in terms of capacity building of SOS employees world-wide, technical development, and financial expenditures that would be required to fully replace the Program Database with DHIS2.

11.3   DHIS2 interoperability/integration

Providing a better way of data exchange between SOS Children's Villages and governments appear to be the most valuable ability that DHIS2 could provide. By presenting the extent of DHIS2 implementation in Ethiopia and South Africa as their national Health Management Information Systems, I sought to establish a pre-existing connection between these respective governments and the Health Information Systems Program group through DHIS2 in this thesis. I would argue that this connection is evidence of the Ethiopian and South African government's ability to embrace and implement a system like DHIS2 and that therefore it is reasonable to expand that connection by implementing DHIS2 as a Child Care Management Information System.

We presented a fictional scenario where DHIS2 was fully implemented as a Child Care Management Information System by the relevant government entities in Ethiopia and South Africa to representatives from the Program Database team and discussed the prospects of information exchange between the Program Database on SOS' end and DHIS2 on the government's end. The problem in question was how to distinguish and upload *"SOS data"* and *"government data"* digitally. Specifically, I presented a high-level draft (figure 11.1) where SOS employees would use both the PDB and DHIS2 in their daily tasks; the PDB would be used to report information internally in SOS, and DHIS2 would be used to report information externally to the government.
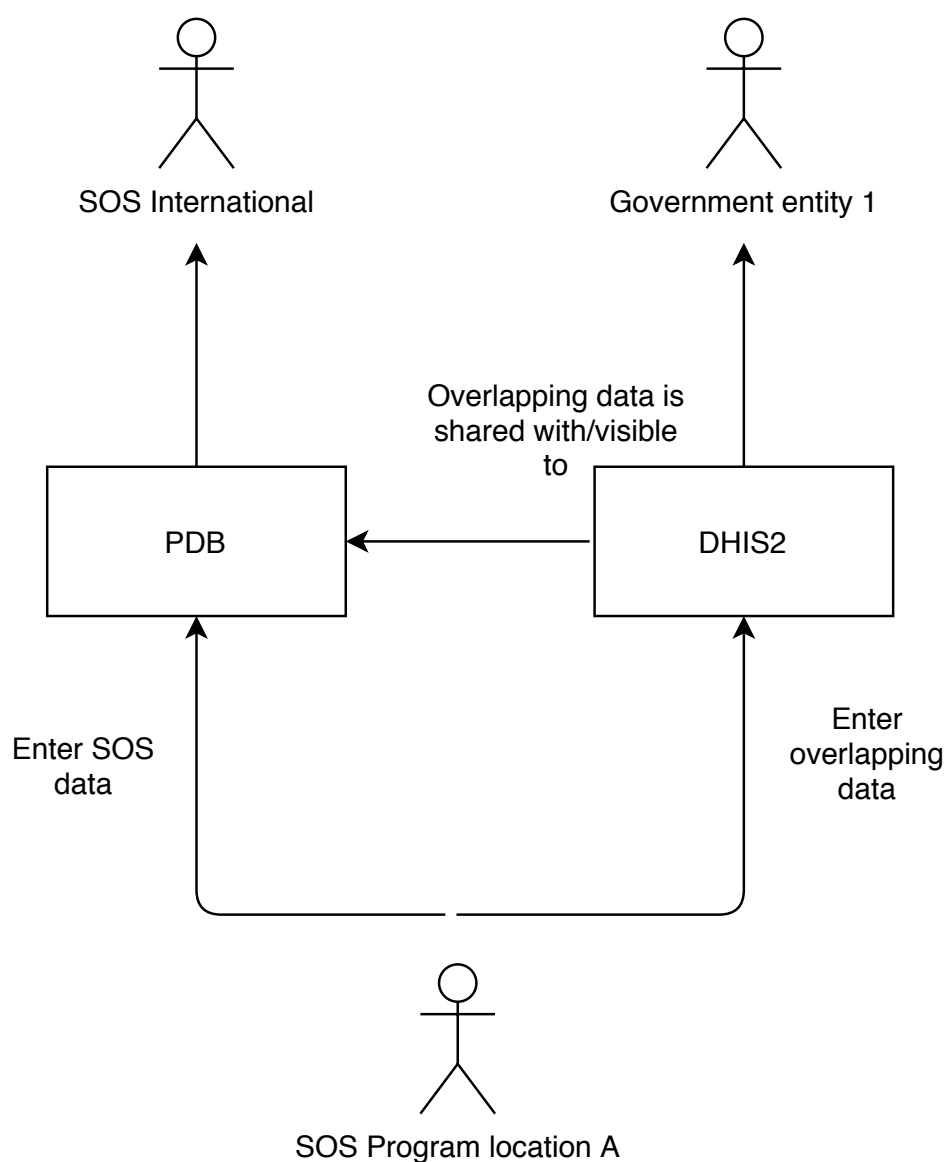
FIGURE 11.1: Solution A: A high level draft illustrating the proposed information flow with DHIS2 instances implemented both at SOS program locations and government offices.

This solution was not of interest to the PDB team due to the fact that there would be two systems for SOS employees to learn and use. With an already heavy workload on these employees, adding another system would only further complicate matters and the Program Database team deemed Solution A to be *"out of question"*.

Another solution presented to them was one that would decrease the amount of work for SOS employees with reporting tasks. In this solution, it would be required to have a mechanism that separated what data was supposed to be forwarded internally in SOS and what data was supposed to be forwarded externally to the government. This could for instance be an interface with a pre-defined library by either mapping *"SOS data"* to SOS, *"government data"* to the government, or overlapping data to both SOS and government entities. Similarly to figure 11.1, this solution was presented as a high level draft (Solution B, illustrated by figure 11.2).

Solution B was deemed to be the better approach due to it freeing SOS employees from having to do duplicate work, but also because it would be less technically challenging to develop an interface that could import and export data to and from DHIS2 compared to implementing and maintaining DHIS2 instances. Hearkening back to Braa and Sahay, 2012, (pp.60-61) definitions of interoperability and integration, Solution B would make the Program Database *interoperable* with DHIS2 and not integrated. The combination of the Program Database 2's mobile and offline functionalities and digital data reporting to DHIS2 through interoperability could improve data completeness, accuracy, and timeliness as was seen in the case of automating indicator reporting from health facilities to national levels in Kenya (Kariuki et al., 2016).

In Ethiopia especially, DHIS2 could be implemented as a digital reporting system and warehouse for child care information at the Ministry of Women and Children Affairs, and possibly also for other government organs that SOS and other Non-Governmental Organizations report to. The digital solutions employed by the government actors that SOS program locations are required to report to, with the Ministry of Women and Children Affairs as the primary government organ tasked with child care, were either non-existent or not up to par and could greatly benefit from a system like DHIS2 provided that it was implemented correctly and that there were resources available for staff training and for the implementation itself. Data could also be shared between these different DHIS2 instances if need be, which would further integrate the information flow between Ethiopian government entities.

South Africa appeared to be a sensible candidate for Solution B as well, particularly due to the fact that SOS and other comparable Non-Governmental Organizations only report to one government entity, namely the Department of Social Development. However, the ongoing development of National Integrated Social Protection Information System (NISPIS) and a lack of information regarding its import and export functionalities makes it difficult to state whether Solution B would be viable in a South African child care information system with NISPIS fully up and running.

While Solution B would reduce the workload of SOS employees at lower organizational levels, it would naturally include a significant amount of work do be done by technically-oriented SOS employees, most likely the Program Database team. Solution B would also require a lot of coordination between SOS Children's Villages and government entities, who in the contexts presented in this research, are already operating in a fragmented environment. Representatives from the Program Database
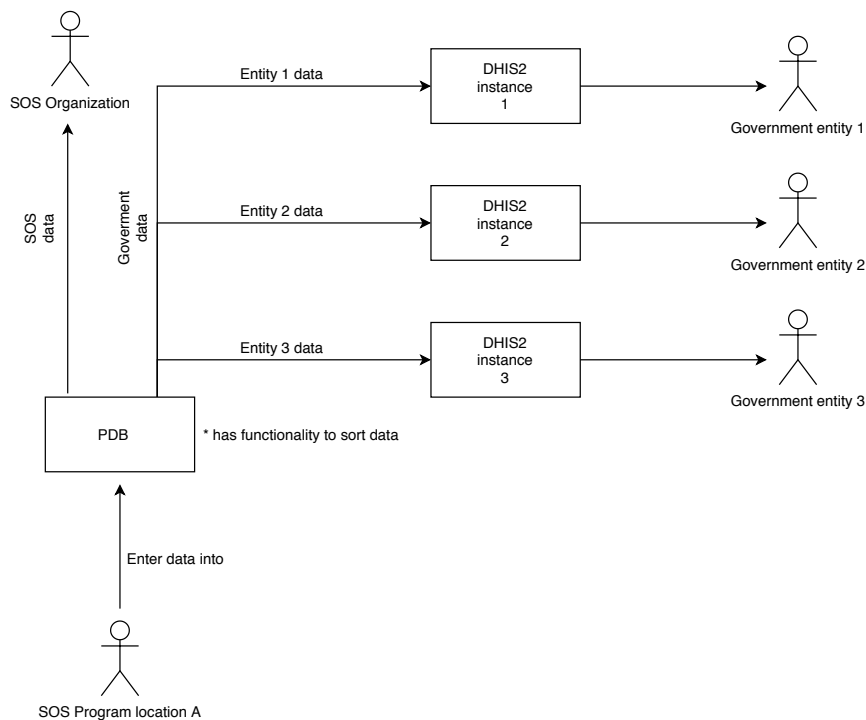
FIGURE 11.2: Solution B: A high level draft illustrating the proposed information flow with DHIS2 instances implemented only at government office, and the PDB having the ability to interface with said instances.

team acknowledged and agreed with this assessment, but deemed it to be promising nonetheless. They stated that if Solution B were to be successfully applied to the Ethiopian context alone, it would likely be *"worth it"* due to the sheer amount of beneficiaries SOS Children's Villages supports there. They also expressed optimism in handling the technical workload of implementing a solution to interface with DHIS2.

11.4   Summary

Key qualities or future qualities of the Program Database swiftly made it clear that having DHIS2 replace the PDB as SOS Children's Villages' main data warehouse would not be a viable solution. This is simply due to the assessment that the few positive aspects DHIS2 could bring would be overshadowed by the effort and resources that would go into implementing it and training staff on DHIS2 usage. Instead, the idea of implementing DHIS2 as the data warehouse to be used by government entities tasked with child care appeared to be a more viable solution. By doing so, paper-based reporting could be eliminated, and the information flow between child care organizations and the government could be streamlined. This would alleviate the high workload on social workers that was found to be a common denominator throughout our field study, an assessment that was supported by the Program Database team. A possible side effect of having DHIS2 implemented as a child care information warehouse by one government entity is that other entities that organizations like SOS report to could follow suit, paving the way for further integration of systems within the government.

The overall idea behind Solution B was met with acknowledgment and enthusiasm by the Program Database team and serves as the closest thing to a pilot in this thesis. Implementing this idea in practice would require *interoperability* between digital systems used by reporting organizations and DHIS2 at the government level. How such interoperability can be achieved will be discussed in the following chapter with SOS Children's Villages' Program Database and DHIS2 as examples.

Chapter 12

Achieving Interoperability

12.1 Introduction

The findings and empirical evidence discussed up to this point strongly indicate that *interoperability* would be the better approach to introducing DHIS2 to the child care ecosystems in Ethiopia and South Africa. This approach would enable SOS' Program Database to exchange data digitally with government entities they are required to report to through interoperability with DHIS2. This section will detail how this interoperability can be achieved, using the *three levels of standardisation* which was illustrated by figure 5.2 and related interoperability literature in the field of Health Management Information System as the basis.

Regardless of the approach taken in order to achieve interoperability between SOS and DHIS2, the correct data model has to be set up in the instances of DHIS2 to be used, in addition to mapping out the flow of data elements and indicators; which of them flows internally in the organization and which of them are to be reported to government actors. The nature of the data is also of significance. Data reported by SOS Children's Villages to the government entities described in this thesis was mostly, if not fully, aggregated. However, we did learn from the member of HISP in Ethiopia that *"the government wants more disaggregated data"*, but simply lacks the capacity and infrastructure to do so. If this were to be the case, and SOS were to report disaggregated personal data on its beneficiaries to the government, a standard for reporting of this nature could be utilized by SOS and subsequently other actors in child care ecosystems. With that being said, I am not aware of such a standard and neither were our contacts at SOS Children's Villages Norway. Where there is an apparent lack of standardized data exchange in the case of child care information management, there is more research to be found describing standards related to Health Management Information System and I believe this research can be used as a basis for the future development of child care information exchange standards.

12.2 Complexity

The notion that everyone should have access to health care has been strongly supported since the 1970s and the remaining part of the twenty-first century was a particularly extreme age for global health (Farmer et al., 2013, (p.74)). Governments and international institutions and organizations have been working to address health concerns in various countries where primary health concerns are prevalent. These concerns combined with the age of digitization has brought a surge of digital solutions to the African continent. Referring to sections 3.2 and 3.3, we can see that

serious public health threats are prevalent in both South Africa and Ethiopia, and DHIS2 has been implemented as a national HIS in both countries.

Internet and mobile infrastructures have developed dramatically and have paved the way for an increased number of HIS solutions. Farmer et al., 2013 argues that while these infrastructures provide opportunities, they also come with challenges in terms of management and synchronization, which leads to an exponential enhancement of the complexity of the systems. To paraphrase their analogy, a city planner has to sufficiently orchestrate the different pieces that make up a city for it to function properly. Likewise, health authorities should create an architecture for their HIS to be understandable in terms of how the different aspects of the system work together and its ability to evolve.

While child care information is not necessarily strictly health-oriented, this scenario of the multitude of digital solutions causing fragmentation and increased complexity within the Health Management Information Systems in African countries serves as a cautionary tale for this discussion of preliminary work to improve the information flow in child care information ecosystems. As presented in Part III, complexity and fragmentation are constraining factors of the child care ecosystems in Ethiopia and South Africa as well. Thus, the introduction of DHIS2 to these ecosystems should minimize its impact on the complexity and decrease fragmentation.

12.3 Syntactic/technical interoperability

To reiterate, *syntactic/technical interoperability* can be described as agreeing on a shared language or grammar. In this case, we need to know what technology/technologies to use for data exchange.

DHIS2 can import and export data through API calls, as well as by means of uploading and downloading certain file formats such as JSON or CSV. Data can also be entered directly via the *Data Entry* app. The back-end of SOS Children's Villages' digital solutions utilize REST-based APIs for data import and export. Technical interoperability between SOS and DHIS2 can therefore be accomplished by exchanging data via REST-based APIs available in both SOS' back-end and DHIS2. REST-based APIs are commonly used by a variety of different systems, which makes it likely that other organizations could achieve this kind of interoperability. While this is simple enough, matters become more complex when moving on to the issue of achieving *semantic interoperability*, in alignment with figure 5.2.

12.4 Semantic interoperability

To reiterate, *semantic interoperability* ensures that the exchange between two systems make sense and that there is a shared understanding of what the meaning of the data in question is.

DHIS2 deals for the most part with aggregate data, and there have been developed modules for facilitating aggregate data migration. I propose three solutions to achieving semantic interoperability between SOS' Program Database and DHIS2, with varying degrees of complexity and further research required:

1. **By use of custom interface:** implementing an interface and functionality in the .NET-based back-end of SOS' digital solutions could rather easily query data back and forth between DHIS2. These interfaces would be custom-made for each connection based on the information need in that particular context.

2. **By use of a mediator:** implementing a mediator component that facilitates information exchange between two systems.

3. **By use of standards:** implementing an interface that adheres to a data exchange standard. There is a multitude of health data exchange standards worldwide and in the apparent absence of a specific child care data exchange standard, the possibility of applying parts of these health data exchange standards should be considered due to them being inherently tuned towards personal data handling.

12.4.1 By use of a custom interface between SOS Children's Villages and DHIS2

This approach would require the development of functionality for separating the data according to how they are mapped; which data is supposed to be forwarded internally through the Program Database and which data is supposed to be forwarded to government actor's DHIS2 instances. It would also require an interface for querying "external data" to these DHIS2 instances. It is roughly drafted in figure 11.2 and described as *Solution B*.

This approach to achieving interoperability between SOS Children's Villages and DHIS2 would be less complicated and likely require fewer resources than achieving interoperability by standards or by use of a mediator. The downside to this approach however, is that this custom interface would be exclusive to SOS and would not contribute to the overarching goal of standardizing child care data reporting that was initially expressed to us by representatives from SOS Children's Villages Norway. Hearkening back to section 5.3, this approach would be an example of what Braa and Sahay, 2012, (p.66) deemed to be the alternative to standardization and would, in other words, do little to fulfill the benefits of standards, such as decreasing fragmentation and complexity. Fragmentation and complexity are also some of the more prominent issues found in the child care ecosystems in Ethiopia and South Africa.

12.4.2 By use of a mediator

Developing a component acting as a mediator between digital systems used by government entities and reporting parties such as SOS Children's Villages could, as demonstrated in the case of data exchange in the Rwandan HMIS by Crichton et al., 2013, ease the burden of implementing interoperability. If the respective governments were to develop mediator components that reporting actors like SOS would only have to connect to and that could handle exposing an interface as well as monitoring and executing transactions, the problem of having to report to multiple parallel government entities would perish. Such a mediator could also decrease fragmentation within the governments themselves, provided that the development and adoption were successful.

This approach would be rather complex, and would likely have to be developed by the governments themselves. With a general lack of functioning digital systems for

reporting and human resource capacity already being prevalent issues in Ethiopia and with the ongoing development of the National Integrated Social Protection Information System in South Africa, the mediator approach appears to be less likely to come to fruition in these two countries than the other two approaches.

12.4.3   Example of interoperability through the use of a mediator

A paper published by Crichton et al., 2013 describes the key requirements and design architecture for supporting interoperability between health information systems in use at that time in Rwanda. Their approach to overcoming interoperability requirements was to develop a component called the Health Information Mediator (HIM). The architecture of the HIM in turn consisted of three components:

1. Interface component: containing a Application Programming Interface that allows systems and applications to make requests.

2. Persistence component: receives authorized service requests from the interface component, and subsequently initiates and monitors the transaction required to fulfill the request.

3. Mediation component: executes transactions, with main functions being orchestration and message translation.
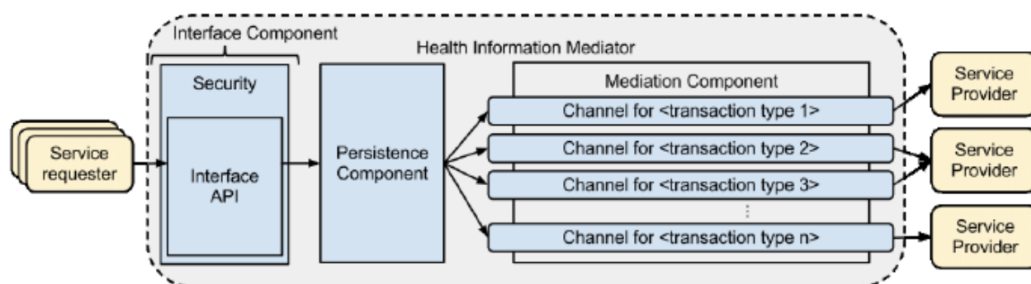
FIGURE 12.1: Overview of components in the HIM architecture, screenshot taken from Crichton et al., 2013.

Crichton et al., 2013 argued that one of the major benefits of the HIM architecture is that it *"does not prescribe the use of a particular data exchange format"*. There are many standards for exchanging disaggregated health data, such as the Fast Healthcare Interoperability Resources standard described in 12.4.5. A module for ensuring semantic interoperability akin to the HIM could be of great benefit to SOS Children's Villages as an international organization that would likely have to adhere to various standards depending on the countries that this interoperability study would apply to. With that being said, Crichton et al., 2013 also presented some criticism directed at the architecture, some of which included the security architecture was not *"expanded upon greatly"* and that the architecture does not *"draw a clear line between parts of the system that are implementation-specific and parts that can be part of a more general interoperability framework"*.

12.4.4   By use of standards

Standardization is considered a key aspect of interoperability according to Kotzé et al., 2013 and Braa and Sahay, 2012, (p.66). By following an approach where a

standard for child care data exchange would be developed, SOS Children's Villages could lay the foundation for decreasing the complexity and lack of coordination that has been a common theme throughout our data collection. This is however a more complex task than that of achieving interoperability simply by use of a custom interface. Through their review of interoperability standards in electronic health (e-health) in Africa, Kotzé et al., 2013 concluded that significant barriers were halting the wide-spread adoption of standards in e-health. These barriers include a lack of understanding of standards and their importance at higher levels, a lack of fundamental infrastructure, and limited resources for developing and accessing standards, both in terms of monetary resources and human capacity.

I am not aware of a standard for exchanging *aggregated* child care or health-related data that specifically achieves semantic interoperability. With that being said however, there are standards used in the health sector for exchanging aggregate health data that are not strictly related to semantics and API technology. The Statistical Data and Metadata Exchange Health Domain (SDMX-HD) is, according to Kotzé et al., 2013, a *"specification for the exchange of health indicator definitions, aggregate data and metadata in the healthcare sector"*. It is an implementation of the XML-based SDMX standard, made by the World Health Organization (WHO) (Ibid.). SDMX-HD has been tried and tested for the purpose of exchanging data with DHIS2. The exchange of aggregated HIV-testing data - among others - between DHIS2 and OpenMRS was according to Braa et al., 2010 the first implementation of the SDMX-HD standard. It was used to produce a monthly summary report at a pilot facility which DHIS2 then was able to read and write into the database. This was a process *"which would otherwise consist of staff at the facility completing a paper form which would be entered manually at the district level"* (Ibid.), which is similar to how data is being transferred from forms to the Program Database at SOS program locations.

While this is promising, there are two things to mind. The first is that the SDMX-HD standard is XML-based. While DHIS2 supports data exchange by use of XML, the Program Database may not. It was never mentioned as a possibility during our interviews with the Program Database team. The second is that, according to Kotzé et al., 2013, the SDMX-HD addresses the *syntactic* level of interoperability and not the *semantic*. The syntactic level is not represented as a standalone level in this thesis, where it would is portrayed as a part of the syntactic/technical level.

12.4.5 Example of interoperability through the use of a standard for dis-aggregated data

The Fast Healthcare Interoperability Resources standard was created by the Health Level Seven International (HL7), a non-profit, American National Standards Institute (ANSI) that develops standards for the exchange of clinical and administrative data among heterogeneous healthcare applications (Kotzé et al., 2013). The FHIR standard was created for the purpose of exchanging healthcare information electronically (Ibid.).

A paper detailing the process of implementing HL7 FHIR based interoperability was published by Baskaya et al., 2019. The paper *"provides insights into how mHealth4Afrika is leveraging HL7 FHIR to support standards-based data exchange and interoperability between Electronic Medical Records and DHIS2"* (Ibid.). mHealth4Afrika developed a custom platform with a User Interface which interacts with a data model set up in

DHIS2 via the DHIS2 WebAPI for use in medical facilities. This platform was developed because DHIS2 and the Tracker application, which is used for disaggregated data, had *"several limitations"*. The team set up a two-way data mapping between the DHIS2 data model and FHIR resources that was required to support import and export capabilities. Examples of this mapping included:

- DHIS2 Organisation Unit represented healthcare facilities

- DHIS2 TrackedEntityInstance represented patients

- DHIS2 event represented patient visits corresponding to a program stage

At this time, there exists a DHIS2 FHIR adapter. From what I could gather, the documentation for it is available in two subfolders of the DHIS2 repository on Github; one that describing general documentation along with the adapter source code (*DHIS2 FHIR Adapter*) and one that serves as a guide for *"administration and mapping"* (*DHIS2 FHIR Adapter API Guide for Administration and Mapping*). The initial scope of the adapter according to the source code documentation was *"the import of FHIR Resources into DHIS2 Tracker by using FHIR subscriptions"*.
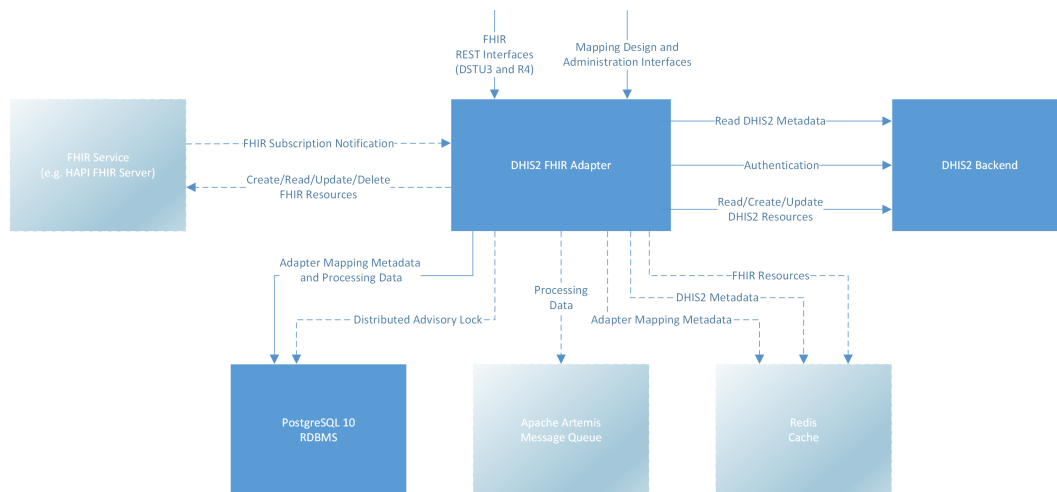
FIGURE 12.2: High level architecture of the DHIS2 FHIR adapter, screenshotted from *DHIS2 FHIR Adapter*.

There are a number of standards that can be used to achieve interoperability between systems, as presented by Kotzé et al., 2013. This particular FHIR based example shows that while DHIS2 was not at that time inherently built for handling disaggregated patient (or beneficiary) data, it was possible to set up data models that adhere to specific standards. It did however require a significant portion of the development, as this particular team had developed a custom platform with a UI in addition to setting up import/export functionalities and the necessary data model in DHIS2. It is also important to note that the import/export functionality was being tested in the field at the time the paper was published and that I as such cannot attest to the results of that particular functionality. In later years however, the DHIS2 FHIR Adapter was developed. If this standards-based approach were to be taken and either FHIR or a new child care specific standard based on FHIR were to be chosen, the already existing DHIS2 FHIR Adapter would likely be a good place to start.

12.5 Organisational interoperability

Once again aligning with figure 5.2, this level of interoperability/standardization will be more complex to achieve than the technical and semantic layer. As presented in Chapter 5, we can see that there are a multitude of actors with their own policies and agenda that would have to align in order to achieve organisational interoperability. This issue would only increase in complexity if we were to add other countries than Ethiopia and South Africa and other NGOs than SOS Children's Villages to the equation.

As presented, SOS program locations reports to multiple government entities in Ethiopia. These entities were described as fragmented by interviewees from both SOS and the government. Alignment between the relevant Ethiopian government entities should be the first step. Capacity and frequent staff turnover was also reported to be prevalent issues within the Ethiopian government. As previously stated in this research, the Ministry of Health is using DHIS2 as a national Health Management Information System and is currently working on capacity building and DHIS2 training in collaboration with at least one Ethiopian university. The Ministry of Health with he support of HISP Ethiopia would, therefore, be the obvious choice for potentially taking on roles as facilitators, educators, and mediators between child care-related government entities in the event that DHIS2 were to be implemented as the digital system to use for child care data reporting and handling. With that in place, SOS Children's Villages and these child care-related government entities could align on an organizational level and the work of achieving technical and semantic interoperability could commence.

As presented, SOS Children's Villages and other comparable NGOs only reports regularly to a single government entity in South Africa - the Department of Social Development. Alignment between SOS and the DSD would therefore likely be less complex than in Ethiopia. Internally, the DSD is reportedly working on aligning their internal directorates and their silo-based systems with the development of the National Integrated Social Protection Information System (NISPIS). The state of development and eventual success of this system is something I cannot attest to. If this development and subsequent alignment should prove to be successful however, then the next step would be to align the DSD with SOS and the other comparable NGOs in South Africa.

While I do acknowledge that aligning all relevant actors in one country is a very large task and that the complexity would only increase when transcending the national borders of Ethiopia and South Africa, I would however argue that the complexity of achieving organizational interoperability could decrease with some key pieces in place. Sæbø et al., 2011, argued - through a comparison of strategies to integrate health information systems in four African countries - that "attractors", i.e. *"technical solutions or standards that achieve a certain level of success and enable the building of momentum, are important in aligning the various political actors"*. In the context of this research, one could, therefore, view DHIS2 and a child care information exchange standard as attractors that could increase the likelihood of alignment between governmental and organizational actors. For this to be the case, however, the effectiveness and success of the solution proposed in this thesis would likely have to be proved through research and documentation.

12.6   Summary

Side effects of the different digital initiatives deployed in the African health sector over the years are a high degree of complexity and fragmentation. This in turn impacts the workload on people tasked with information handling to the community level where social workers handle the very basis of the information cycle through data gathering and input. This was also found to be the case for child care ecosystems in Ethiopia and South Africa. Decreasing complexity and fragmentation should as such be heavily noted when discussing the deployment of a new digital system and a new solution in a new context.

Using SOS Children's Villages' Program Database and DHIS2 as examples, the overall idea behind Solution B (figure 11.2), and the *three levels of standardization* (5.2) as a basis, a strategy to achieve interoperability between the two systems was presented and discussed.

Both systems utilize REST-based APIs, and thus the task of achieving syntactic/technical interoperability is a rather simple one. APIs are common ways of information exchange, and it is therefore argued that many organizations similar to SOS Children's Villages could be applied to the same formula.

Although there are many ways to achieve semantic interoperability - three of which are discussed in this thesis - a standards-based approach would highly likely be the best approach. While not the easiest to implement and develop, this approach would simultaneously achieve semantic interoperability and provide a standard that other governments and organizations could utilize, and in turn decrease complexity and fragmentation.

Aligning all relevant organizations and government entities would be a substantial task. Achieving organizational/political interoperability would likely be the most complex of the three levels, particularly when adding other countries and their specific child care ecosystems to the equation. It is argued, however, that certain technical solutions and standards are important to aligning actors. With DHIS2 at a governmental level and a child care information exchange standard developed, the possibility of aligning these actors would increase, thus reducing the complexity by having a few tried and tested key factors.

Chapter 13

Conclusion

The core *objective* of this research is to demonstrate how DHIS2 can become interoperable with SOS Children's Villages' primary data warehouse - the Program Database. Through this demonstration, it further proposes DHIS2 to be implemented as a Child Care Management Information System on a governmental level, and for interoperability to be achieved between it and digital systems used by various Non-Governmental Organizations tasked with the care of vulnerable children to improve data management in child care information ecosystems.

This objective was broken down into four specific research goals. This chapter will provide a summarized conclusion to these research goals along with pointers for future work. To reiterate, the four research goals are:

1. Present aspects from a holistic view of the information systems used by SOS Children's Villages and government entities tasked with child care in Ethiopia and South Africa, including digital systems, requirements, constraining and enabling factors and future intentions and development.

2. Discuss how DHIS2 can be introduced to this context; by interoperability, integration, or as a replacement of current digital systems.

3. Discuss consequences from introducing DHIS2 to the respective child care information systems, and use this discussion to propose a high-level solution.

4. Combine the solution with related literature to detail how the introduction of DHIS2 can be implemented on a syntactic/technical, semantic, and an organizational/political level.

13.1   Concluding the Research Goals

The first research goal was accomplished in Part III, where all relevant findings from our data collection in Ethiopia and South Africa were detailed. Included in that chapter was an outline of the information flow between SOS Children's Villages and government entities they were required to report information to in both countries, with reporting nature and constraining factors. It also presented SOS' digital solutions and prospects, as well as the digital solutions used by these government entities.

In summation, it was found that SOS Children's Villages operates for the most part similarly in both Ethiopia and South Africa. Interestingly, many of the constraining factors related to their required reporting to the respective governments were similar, even though these governments are structured differently. Generally, there

was reported to be a high workload on employees at SOS program locations. Duplicate reporting, misalignment with government representatives, and limitations to the current version of the Program Database were found to be the most common causes.

The same infrastructural challenges were constraining factors in the quality of the information flow between SOS Children's Villages and the respective governments, and the introduction of offline capabilities and the possibility of running the Program Database 2 on mobile devices will likely lessen the impact of the infrastructural factors. While the introduction of the Program Database 2 will likely improve the quality of the information flow within SOS as an organization, the issues related to data exchange with the government would remain.

As the national Health Management Information System in both Ethiopia and South Africa, DHIS2 bears some weight. In Ethiopia, efforts are being made to scale the system to further reaches of the country and to build human capacity to use and share knowledge on the system. In South Africa, HISP works closely with the Ministry of Health to ensure a low degree of data integrity errors in the governmental instances of DHIS2. Representatives from HISP in both Ethiopia and South Africa believed interoperability between SOS Children's Villages and governmental instances of DHIS2 to be more so difficult on an organizational level rather than a technical level.

The second and third research goal were accomplished in Part IV. By assessing five areas of SOS Children's Villages' Program Database, I concluded that replacing the Program Database with DHIS2 as SOS Children's Villages' primary data warehouse would not be beneficial. To reiterate these five points:

1. **Data presentation**: at program locations, data was mostly presented as tables made by drawing data from the Program Database. The available data presentation tools in the current version of the Program Database were satisfactory for data reporting and disaggregated data lookups at the program locations. Dissatisfaction was expressed at national offices, where there was an apparent lack of tools for easily accessing aggregated data. A feature akin to the DHIS2 dashboard could be a solution to the reported lack of tools for easily accessing aggregated data. This could be either developed as a feature in the Program Database 2 or addressed by using the SOS Compass, or Microsoft solutions such as Power BI, both of which would more than likely be preferable to replacing the Program Database with DHIS2 for the sole purpose of improving aggregate data presentation.

2. **Data flexibility**: the need for Program Database data elements to be flexible and customizable by lower organizational levels were non-existent among our sources at program locations and national offices in Ethiopia and South Africa. The Program Database team stated that there was a high need by national associations for this, however, though they had prioritized global alignment. Thus it is difficult to conclude whether the need for flexible data is large enough to warrant a replacement by DHIS2 or remodeling of SOS' data structure.

3. **Data quality**: data quality issues are occasional occurrences both in the current version of the Program Database and in DHIS2, and I do not have the evidence

to state whether DHIS would fare better than the Program Database in this regard or not.

4. **Data exchange**: assessed to be the area with the most potential for improvement. A lack of alignment between respective government entities and higher levels of SOS causes overlap of data to be reported by program locations, which increases the workload of SOS employees tasked with data collection and reporting. Replacing the Program Database with DHIS2 alone would not fix this, as most of the issues associated with this data reporting were more so associated with the government than with SOS.

5. **Offline capabilities**: DHIS2 has a strong focus on offline data capturing capabilities. Although there is a lack of offline capabilities in the current version of the Program Database, it will be a feature of the newest version - the Program Database 2.

Three out of five points - namely *data flexibility, data quality, and offline capabilities* - were as such not deemed to warrant a complete replacement of the Program Database by DHIS2. The DHIS2 dashboard could be a solution to the lack of easily accessible aggregate data lookups expressed by representatives at national levels, although this replacement would likely be more difficult and demanding than to simply develop such a solution in the Program Database or Program Database 2 UI. This left *data exchange* as the sole definitive area with a lot of potential improvement. The constraining factors related to data exchange between SOS and the respective governments discussed in this research were more so related to infrastructure and the governments themselves rather than SOS Children's Villages. Thus I concluded that implementing DHIS2 as a child care information system to be used by the government entities tasked with child care and achieving *interoperability* between SOS Children's Villages' Program Database and DHIS2 would be the best answer to these constraining factors related to data exchange.

Using previous experiences from health care initiatives in Africa, I made a point to keep the impending complexity related to introducing a new digital system into an existing information ecosystem in mind when attempting to accomplish the fourth research goal.

The fourth research goal was also accomplished in Part IV. From there I used the three levels of standardization defined by Braa and Sahay, 2012, (p.67) - which closely resembles the four levels of interoperability defined by Kotzé et al., 2013 - to provide pointers as to how interoperability could be achieved between SOS Children's Villages' Program Database and DHIS2.

It would likely relatively not be a very complex task at the syntactic/technical level, where interoperability can be achieved by the use of REST based APIs which are existent in both the Program Database and DHIS2. First of all, the necessary data model for child information reporting would have to be configured for the respective government instances of DHIS2. Secondly, the functionality to make the necessary API calls would have to be developed in the back-end of the Program Database.

With this approach to achieving technical interoperability in place, I discussed the task of achieving *semantic* interoperability. This would be a more complex task. I presented three approaches:

1. **By use of a custom interface**: With this approach, the semantics of the data to be exchanged between the different parties would be agreed upon and custom interfaces would be set up for the different government parties.

2. **By use of mediators**: With this approach, a mediator component with the capability to process and oversee data transactions would have to be developed. As with the case of the development of the Health Information Mediator, it would require a substantial amount of resources to develop, test, and implement.

3. **By use of standards**: With this approach, a standard for child care information reporting would have to be implemented and utilized in the REST based API exchange. I proposed that the Fast Healthcare Interoperability Resources standard, used for *disaggregated* patient data, could be considered as the basis for a new standard if a suitable existing child care information standard is absent. The SDMX-HD standard, although not quite as suitable to this context, could also be considered for augmentation to create a standard for exchange of *aggregated* child care data through APIs.

Because different government entities require child care-related NGOs such as SOS to report different kinds of data, there would more than likely be a need to develop a mechanism to distribute the correct data to the correct recipients. Therefore, having a single uniform interface would likely not be enough in all countries. For instance, data reported by SOS program locations vary from a government entity to a government entity. In South Africa however, SOS program locations only report to one government entity. The complexity related to whatever solution chosen will as such to a degree be affected by the reporting context in a given country; how many parallel reporting streams exist between for instance an SOS program location and the government and to what degree does the data in those reporting streams differ.

Ironically, while the *first approach* would likely be the least complex of the three, it would increase the complexity of a child care ecosystem. Developing a custom interface and achieving interoperability solely for, say information exchange between SOS program locations in Ethiopia and the Ministry of Women and Children Affairs could work well for that single information stream. However, if you then were to achieve similar interoperability between SOS and the primary child care government entity in another country, you would have to develop another custom connection. As stated by Braa and Sahay, 2012, (p.67), in an ecosystem where all connections between systems are custom and lack standardization, new systems would have to establish up to n(n-1)/2 individual connections. The complexity and requirements for developing and maintaining all these custom connections would be a near-impossible task for SOS Children's Villages and the respective governments.

The *second approach* might be preferable to the first approach. As with the case of the Health Information Mediator presented by Crichton et al., 2013, a mediator that can function with different data exchange formats could be very beneficial in a fragmented information ecosystem akin to the ones presented in this research. It would however require a lot of resources for development, testing, and deployment. Most importantly, however, is that this approach - similarly to the first approach - would also do little do address the lack of a standard for child care information exchange, which I believe should serve as the main goal for this interoperability study. Standardization can be key to decreasing fragmentation and complexity, both of which

are prominent issues in both the Ethiopian and South African child care information ecosystems.

This left the *third approach*. The data elements that flow between SOS Children's Villages and governments naturally vary from country-to-country. Achieving interoperability between SOS' Program Database and government instances of DHIS2 is a complex enough task in one country. SOS Children's Villages operates in more than 130 countries. By having a child care information exchange standard as a basis for interoperability, the work required to develop and maintain the interfaces used in the different national contexts would decrease, and the overall complexity of scaling this solution beyond the borders of Ethiopia and South Africa would be lessened. Governments and child care NGOs would then have to adhere to this standard and as such achieve semantic interoperability.

This of course ties into the third level of standardization, which is the organizational level. The aforementioned fragmentation of government organs presented in this research would increase the complexity of achieving organizational interoperability. However, with attractors such as an agreed-upon child care information standard, DHIS2 as a national Child Care Management Information System, and a strategy to achieve interoperability between DHIS2 and the digital systems used by child care-related organizations in place, I would argue that the difficulty of achieving organizational/political interoperability would decrease.

13.2 Conclusion

Based on the rough drafts of how information could be exchanged between SOS program locations, higher organizational levels of SOS, and government entities, figure 13.1 illustrates a high-level solution to achieving interoperability between SOS Children's Villages and DHIS2 instances at a governmental level. This solution is based on our data collection, discussions with the Program Database team, and existing literature on the aspects discussed up to this point. It is argued to alleviate the workflow of social workers, decrease fragmentation of digital systems used at the governmental level and therefore reduce the overall complexity of child care ecosystems similar to the ones described in this thesis. As seen in earlier, similar implementations of DHIS2 in other countries, this could in turn improve the data completeness, accuracy, and timeliness. When combining all of these effects, the visibility and presence of vulnerable children in statistics could increase, and decision-makers at higher national and international levels would have a more informed foundation to base their actions from.

SOS Program Location X

DHIS2 API Endpoint

DHIS2 instance 1

Government
Entity 1

Data from reports is
uploaded to the PDB

DHIS2 instance 2

Government
Entity 2

The Program Database (PDB)

Interface
describing
government-
relevant data

DHIS2 instance 3

Government
Entity 3

Access PDB

Data export adhering to a child
care information exchange
standard

SOS National Office Y

FIGURE 13.1: Final high level proposal describing data distribution
through interoperability between SOS Children's Villages' Program
Database and governmental instances of DHIS2 using a child care
information exchange standard.

Fitting SOS Children's Villages as an organization in the DHIS2 hierarchy could be a very simple matter from a government perspective. In Ethiopia and South Africa, we have seen that SOS national offices do not report specific child care information to the government; the Ethiopian national office will exchange infrequent project reports with whatever government entity that is relevant to that particular project, and the South African office reports annual surveys to the National Statistics Office. SOS program locations and national offices appear to be viewed as separate entities by these respective governments, and all information specifically related to child care stems from the program locations to our knowledge. As such, SOS program locations can simply be defined as a *facility* in the governmental DHIS2 instances, as there is no apparent need to take SOS' organizational hierarchy into account from a governmental perspective. If SOS' organisational structure were to be relevant in another context, the organizational levels should be cross-referenced with the DHIS2 hierarchy (figure 4.1) used in the respective country.

As the national Health Management Information System in both Ethiopia and South Africa, DHIS2 was considered as a candidate for usage as a digital system for child care information management. Due to its generic nature and existing infrastructure and support in a significant number of countries that SOS Children's Villages operates in (3.1), I consider it to be a strong candidate to be implemented as a child care information data warehouse where a system capable of supporting the proposed solution is absent. In the context of this research, it would be the Ethiopian child care government entities, most particularly the Ministry of Women and Children Affairs. It is important to note that while DHIS2 could be on the other side of this standardized information exchange, it does not have to be. There could be other similar systems more suited for this task either due to having more human capacity and resources or a closer connection with the respective government. We saw for instance a very promising system called the *Soweto Care System*, which according to a Board Member we interviewed was considered to be implemented by the Department of Social Development at some point in time. This could especially be the case in countries that are out of the reach of the HISP network and where DHIS2 has not yet been implemented in some shape or form.

The solution discussed is argued to complement SOS Children's Villages' information system by addressing the most prominent issue they have, which is managing the different streams of information flow; juggling between data management for organizational purposes, governmental reporting, and internal management of work-flow. Having DHIS2 instances that are interoperable with SOS Children's Villages' Program Database at the governmental level and a functionality for distributing data to the rightful recipients in the back-end of the Program Database would highly likely lessen the impact of this issue.

Furthermore, this solution is argued to be applicable beyond the national borders of Ethiopia and South Africa. The child care-related entities of other governments could opt-in on the child care information exchange standard and not only align their information needs with other countries, but also partake in the shaping of this standard. With such a standard in place, a widely used technology for data transfer (APIs), and attractors to align organizational and governmental entities, this strategy is very much applicable to and/or adoptable by other child care organizations

and government entities.

This research started by investigating the information system used by SOS Children's Villages, and the national child care ecosystems they partake in. The conclusion is a strategy that is argued to improve the general information flow on vulnerable children both on an organizational and the national level. The solution proposed is fundamentally constructed to not implicate the negative impacts from the various digital initiatives in the African health sector, and is therefore argued to be highly scalable and adoptable across organizations and national borders.

13.3   Limitations

The limitations of this research should also be noted. In Part III, I listed a wide array of constraining factors. The solution proposed addresses some of the more prominent of these, but cannot possibly address all. Most notably, constraining factors related to infrastructure - namely electricity and internet - will continue to hinder progress in digital data exchange, even with this solution in place. Fragmentation within the respective governments and miscommunication between them and NGOs exists for a variety of reasons, of which a lack of standardization and uniformity is only one.

The solution discussed in this thesis has not been piloted and tested adequately. The case for its effectiveness leans on a discussion with the main development team behind the Program Database and other people knowledgeable about digital information systems in both countries, as well as argumentation based on a qualitative data collection combined with existing literature and research. The solution includes the development and adoption of a child care exchange standard but does not propose a design for it. Examples of standards used in the health sector were highlighted as candidates to take inspiration from, although this should naturally be extensively researched in the future.

Lastly, several data elements, indicators, forms, and reports have been discussed, and the particular usage and distribution of them is the main point of the solution proposed. This thesis has not presented a holistic overview of data overlap, differences, and similarities. Such an overview needs to be provided for the solution proposed to be fully effective or even functional.

13.4 Future Work

The results of this thesis are intended to serve as indicators. Concepts, research, data, and argumentation are conjoined to form an initial blueprint meant to guide future work and implementation. No code was written and no solutions were tested. Testing and piloting based on this research is therefore the single most important pointer I can provide for future work by whomever it should concern.

For future implementation, an appropriate child care information exchange standard should either be created, adopted, or modified from another existing standard. Standardizing both disaggregated and aggregated data should be considered if there is a need for it. DHIS2 instances would have to be implemented as reporting tools and data warehouses at relevant government entities, and the possibility to interface with them through REST-based API calls would have to be developed in SOS Children's Villages' digital ecosystem.

For future research, it would be beneficial to examine the findings from this research in the contexts of other countries. Examining whether similar research has been done or similar projects have been initiated by other NGOs and collaborating governments could also provide additional context to this research. Other systems that could be up to the task should also be mapped out and considered.

Bibliography

Agency for Civil Society Organizations. *Agency for Civil Society Organizations - Home Page*. URL: http://www.chsa.gov.et/home.html (visited on 04/05/2020).

Arnesen, Mari and Adrian Haga (June 2020). *Information Flows in the Child Welfare Sector: Enabling and Constraining Factors Affecting Productiveness of Information Flows Within the SOS Children's Villages' Ecosystem in Ethiopia and South Africa*.

Baskaya, Mert et al. (Aug. 2019). "Health4Afrika - Implementing HL7 FHIR Based Interoperability". In: *Studies in health technology and informatics* 264, pp. 20–24. DOI: 10.3233/SHTI190175.

Biernacki, Patrick and Dan Waldorf (Nov. 1981). "Snowball Sampling: Problems and Techniques of Chain Referral Sampling". In: *Sociological Methods &amp Research* 10. DOI: 10.1177/004912418101000205.

Bowen, Glenn (Aug. 2009). "Document Analysis as a Qualitative Research Method". In: *Qualitative Research Journal* 9, pp. 27–40. DOI: 10.3316/QRJ0902027.

Braa, J. et al. (2007). "Developing Health Information Systems in Developing Countries: The Flexible Standards Strategy". In: *MIS Quarterly*, pp. 381 –402. DOI: doi:10.2307/25148796.

Braa, Jørn and Sundeep Sahay (Jan. 2012). *Integrated Health Information Architecture: Power to the Users*. ISBN: 978-93-81320-06-8.

– (Apr. 2017). "The DHIS2 Open Source Software Platform: Evolution Over Time and Space". In: ISBN: 9780262338127.

Braa, Jørn et al. (Nov. 2010). "Comprehensive Yet Scalable Health Information Systems for Low Resource Settings: A Collaborative Effort in Sierra Leone". In: *AMIA ... Annual Symposium proceedings / AMIA Symposium. AMIA Symposium* 2010, pp. 372–6.

Braun, Virginia and Victoria Clarke (2006). "Using thematic analysis in psychology". In: *Qualitative Research in Psychology* 3.2, pp. 77–101.

Central Intelligence Agency. *The World Factbook by the Central Intelligence Agency*. URL: https://www.cia.gov/library/publications/the-world-factbook/geos/et.html (visited on 01/27/2020).

– *The World Factbook by the Central Intelligence Agency*. URL: https://www.cia.gov/library/publications/the-world-factbook/geos/sf.html (visited on 01/27/2020).

Central Statistical Agency of Ethiopia. *City Population - Ethiopia*. URL: http://www.citypopulation.de/Ethiopia.html (visited on 06/04/2020).

Creswell, John (Jan. 2013). "Qualitative Inquiry & Research Design: Choosing Among Five Approaches". In: *SAGE Publications* 11.

Crichton, Ryan et al. (Jan. 2013). "An Architecture and Reference Implementation of an Open Health Information Mediator: Enabling Interoperability in the Rwandan Health Information Exchange". In: pp. 87–104. DOI: 10.1007/978-3-642-39088-3_6.

Dehnavieh, Reza et al. (June 2018). "The District Health Information System (DHIS2): A literature review and meta-synthesis of its strengths and operational challenges

based on the experiences of 11 countries". In: *Health Information Management Journal* 48, p. 183335831877771. DOI: 10.1177/1833358318777713.

Department of Health. *Department of Health, South Africa - Vision and Mission*. URL: http://www.health.gov.za/index.php/shortcodes/vision-mission (visited on 04/12/2020).

Department of Social Development. *Department of Social Development, South Africa - About Us*. URL: http://www.dsd.gov.za/index.php/about (visited on 04/14/2020).

Eoyang, Glenda (Jan. 1996). "Complex? Yes! Adaptive? Well, maybe...." In: *Interactions* 3, pp. 31–37. DOI: 10.1145/223500.223509.

Farmer, Paul et al. (Sept. 2013). *Reimagining Global Health: An Introduction*, pp. 74–110. ISBN: 0520271998.

Fielding, R. et al. (1999). *RFC2616: Hypertext Transfer Protocol – HTTP/1.1*. USA.

Fielding, Roy T. and Richard N. Taylor (2000). "Principled Design of the Modern Web Architecture". In: *Proceedings of the 22nd International Conference on Software Engineering*. ICSE '00. Limerick, Ireland: Association for Computing Machinery, 407–416. ISBN: 1581132069. DOI: 10.1145/337180.337228. URL: https://doi.org/10.1145/337180.337228.

Heiler, Sandra (June 1995). "Semantic Interoperability". In: *ACM Comput. Surv.* 27.2, 271–273. ISSN: 0360-0300. DOI: 10.1145/210376.210392. URL: https://doi.org/10.1145/210376.210392.

Heywood, A. and J. Rohde (Jan. 2001). *Using information for action. A manual for health workers at facility level*.

HISP/DHIS2 Community. *DHIS2 About*. URL: https://www.dhis2.org/about (visited on 01/26/2020).

– *DHIS2 Developer Manual - Chapter 1: Introduction*. URL: https://docs.dhis2.org/2.22/en/developer/html/ch01.html#d5e33 (visited on 06/04/2020).

– *DHIS2 FHIR Adapter*. URL: https://github.com/dhis2/dhis2-fhir-adapter (visited on 05/08/2020).

– *DHIS2 FHIR Adapter API Guide for Administration and Mapping*. URL: https://github.com/dhis2/dhis2-fhir-adapter/wiki/DHIS2-FHIR-Adapter-API-Guide-for-Administration-and-Mapping-(1.0) (visited on 05/08/2020).

– *DHIS2 In Action*. URL: https://www.dhis2.org/inaction (visited on 02/03/2020).

– *DHIS2 User Manual - Chapter 22: Configure metadata*. URL: https://docs.dhis2.org/master/en/user/html/maintenance_app.html# (visited on 04/23/2020).

– *DHIS2 User Manual - Chapter 6: Using the Data Entry app*. URL: https://docs.dhis2.org/master/en/user/html/data_entry_app.html# (visited on 04/23/2020).

Information Network Security Agency. *INSA Ethiopia - Vision and Mission*. URL: https://www.insa.gov.et/web/en/vision-and-mission (visited on 06/12/2020).

Information Systems Group. *University of Oslo website - Information Systems Group at the Department of Informatics*. URL: https://www.mn.uio.no/ifi/english/research/groups/is/#:~:text=The\%20Information\%20Systems\%20research\%20group,South\%20Africa\%20in\%20the\%201990s. (visited on 06/09/2020).

Kaplan, Jeff et al. (Feb. 2005). *Roadmap for Open ICT Ecosystems*.

Kariuki, James et al. (Sept. 2016). "Automating indicator data reporting from health facility EMR to a national aggregate data system in Kenya: An Interoperability field-test using OpenMRS and DHIS2". In: *Online Journal of Public Health Informatics* 8. DOI: 10.5210/ojphi.v8i2.6722.

Kihuba, Elesban et al. (July 2014). "Assessing the ability of health information systems in hospitals to support evidence-informed decisions in Kenya". In: *Global health action* 7, p. 24859. DOI: 10.3402/gha.v7.24859.

Kotzé, Paula et al. (July 2013). "A Review of Interoperability Standards in E-health and Imperatives for their Adoption in Africa". In: *South African Historical Journal* 50. DOI: 10.18489/sacj.v50i1.176.

Manoj, Subodha et al. (June 2013). "Implementation of District Health Information Software 2 (DHIS2) in Sri Lanka". In: *Sri Lanka Journal of Bio-Medical Informatics* Vol 3, pp. 109–114. DOI: 10.4038/sljbmi.v3i4.5431.

Ministry of Health. *Ministry of Health, Ethiopia - Mission, Vision & Objectives*. URL: http://www.moh.gov.et/ejcc/en/node/16 (visited on 04/08/2020).

Ministry of Women and Children Affairs. *About the Ministry of Women and Children Affairs*. URL: http://www.mowca.gov.et/about-the-ministry (visited on 04/04/2020).

Nowell, Lorelli S. et al. (2017). "Thematic Analysis: Striving to Meet the Trustworthiness Criteria". In: *International Journal of Qualitative Methods* 16.1. DOI: 10.1177/1609406917733847.

PricewaterhouseCoopers. *PWC Transportation Logistics - South Africa*. URL: https://www.pwc.com/gx/en/transportation-logistics/publications/africa-infrastructure-investment/assets/south-africa.pdf (visited on 01/29/2020).

Retief, Hanlie. *'Eskom is captured': Jan Oberholzer on wet coal, sabotage and stage 6 desperation*. URL: https://city-press.news24.com/News/eskom-is-captured-jan-oberholzer-on-wet-coal-sabotage-and-stage-6-desperation-20191216 (visited on 06/04/2020).

Sahay, Sundeep and Geoff Walsham (Mar. 2010). "Scaling of health information systems in India: Challenges and approaches". In: *Information Technology for Development* 12, pp. 185 –200. DOI: 10.1002/itdj.20041.

SOS Children's Villages. *CARE FOR CHILDREN IS CARE FOR DEVELOPMENT - How SOS Children's Villages supports the Sustainable Development Goals*. URL: https://www.sos-childrensvillages.org/getmedia/8f005d23-426d-4c35-9401-339d6fd2b7ba/sdgs-FINAL-WEB.pdf (visited on 06/09/2020).

– *NO CHILD SHOULD GROW UP ALONE - SOS Children's Villages Strategy 2030*. URL: https://www.sos-childrensvillages.org/getmedia/a396383a-c537-4a59-a0cc-b73151e4775f/SOS-Children-s-Villages-2030Strategy.pdf (visited on 06/09/2020).

– *SOS Children's Villages - Where We Help*. URL: https://www.sos-childrensvillages.org/where-we-help (visited on 06/02/2020).

– *SOS Children's Villages - Where We Help: Africa*. URL: https://www.sos-childrensvillages.org/where-we-help/africa (visited on 06/02/2020).

– *SOS Children's Villages Home Page - Where We Help/South Africa*. URL: https://www.sos-childrensvillages.org/where-we-help/africa/south-africa (visited on 01/29/2020).

Sæbø, Johan et al. (Jan. 2011). "Comparing strategies to integrate health information systems following a data warehouse approach in four countries". In: *Information Technology for Development* 17. DOI: 10.1080/02681102.2010.511702.

The World Bank Group. *Ethiopia - Total population, by The World Bank*. URL: https://data.worldbank.org/indicator/SP.POP.TOTL?end=2018&locations=ET&start=1982 (visited on 01/27/2020).

Titlestad, Ola, Knut Staring, and Jørn Braa (Jan. 2009). "Distributed development to enable user participation: Multilevel design in the HISP network". In: *Scandinavian Journal of Information Systems* 21, pp. 27–50.

Tiwana, Amrit (2013). *Platform Ecosystems: Aligning Architecture, Governance, and Strategy*. 1st. San Francisco, CA, USA: Morgan Kaufmann Publishers Inc. Chap. 5. ISBN: 0124080669.

Wilson, Virginia (Mar. 2014). "Research Methods: Triangulation". In: *Evidence Based Library and Information Practice* 9, pp. 74–75. DOI: 10.18438/B8WW3X.

Yin, R.K. (2003). *CASE STUDY RESEARCH: Design and Methods*. 3rd ed. Vol. 5. SAGE Publications.

– (2011). *Qualitative Research from Start to Finish*. 1st ed. Guilford Publications. ISBN: 978-1-60623-987-0.

Appendices

Appendix A

Core Assessment Form - Alternative Care

CORE ASSESSMENT
CHILD/YOUNG PERSON IN SOS ALTERNATIVE CARE

Date of core assessment (dd/mm/yyyy)
_____/_____/_____

HEALTH

Difficulty seeing, even if wearing glasses *(3 years and older)*

1. No, no difficulty	O
2. Yes, some difficulty	O
3. Yes, a lot of difficulty	O
4. Cannot do it at all	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Difficulty hearing, even if using a hearing aid *(3 years and older)*

1. No, no difficulty	O
2. Yes, some difficulty	O
3. Yes, a lot of difficulty	O
4. Cannot do it at all	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Difficulty walking or climbing steps *(3 years and older)*

1. No, no difficulty	O
2. Yes, some difficulty	O
3. Yes, a lot of difficulty	O
4. Cannot do it at all	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Difficulty remembering or concentrating *(5 years and older)*

1. No, no difficulty	O
2. Yes, some difficulty	O
3. Yes, a lot of difficulty	O
4. Cannot do it at all	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Difficulty (with self-care such as) washing all over or dressing *(5 years and older)*

1. No, no difficulty	O
2. Yes, some difficulty	O
3. Yes, a lot of difficulty	O
4. Cannot do it at all	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Difficulty communicating (for example understanding or being understood by others) *(5 years and older)*

1. No, no difficulty	O
2. Yes, some difficulty	O
3. Yes, a lot of difficulty	O
4. Cannot do it at all	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Disability certification (must be recognized by official authority)

No	O
Yes	O
No information/not evaluated	O

Health insurance

Yes	O
No	O
No information/not evaluated	O

Immunisation received as per national standards

Yes	O
No	O
No information/not evaluated	O

Only applicable if child/young person is in youth care and at least 18 years old

Food security - quantity

1. High food security	O
2. Marginal food security	O
3. Low food security	O
4. Very low food security	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Only applicable if child/young person is in youth care and at least 18 years old

Food consumption - quality

1. High food security	O
2. Marginal food security	O
3. Low food security	O
4. Very low food security	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Height in cm *(only in LAAM region)*

Weight in kg *(only in LAAM region)*

BMI *(automatically calculated in PDB2) (only in LAAM region)*

Nutritional status *(0-17 years)*

Obese	O
Overweight	O
Average	O
Malnourished	O
Severely malnourished	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Physical Health

1. Good physical health	O
2. Minor chronic illness/health issues	O
3. Fairly serious or stable chronic illness	O
4. Severe or life threatening illness	O
No information/not evaluated	O

Mental health difficulties (Multiple choice)

Emotional difficulties	O
Conduct difficulties	O
Social interaction difficulties	O
Peer difficulties	O
Attachment difficulties	O
Psychosomatic difficulties	O
No difficulties	O
Not evaluated/no information	O

Receives appropriate support for health issues

Yes	O
No	O
Not required	O
No information/not evaluated	O

Only applicable if young person is in Youth Care and at least 18 years old

Access to adequate health services

Yes	O
No	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Skip if child/young person has access to adequate health services

Main reason why there is no access to adequate health services

Discrimination	O
Being unaware of available service(s)/sources	O
Service is unclean/unsafe	O
Service is physically unaccessible (e.g. too far away)	O
Service is unaffordable	O
Service is insufficient/unreliable	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Date of last medical check-up (dd/mm/yyyy)

The data fields above might not cover all strengths and needs regarding health. Please use the comments to cover more details, which can help with the development planning (e.g. details on growth, development as well as physical and mental wellbeing; details on any health issues or illness of child/young person/caregiver; validity period of disability certificate; appropriate advice and information on issues that have an impact on health, including sex education; healthy lifestyle, physical activity level etc.).

Comments on health

_____

_____

_____

SOCIAL AND EMOTIONAL WELLBEING

Happiness

1. High life satisfaction	O
2. Medium life satisfaction	O
3. Low life satisfaction	O
4. No life satisfaction	O
No information/not evaluated	O

Social behaviour *(5 years and older)*

1. Interacts with peers and participates in activities	O
2. Minor problems in interacting with others	O
3. Very little or no interaction with others	O
4. Harmful behaviour towards others	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Misuse of alcohol

No	O
Yes	O
No information/not evaluated	O

Misuse of medicine/other substances or use of illegal drugs

No	O
Yes	O
No information/not evaluated	O

Self-esteem *(5 years and older)*

1. High self-esteem	O
2. Medium self-esteem	O
3. Low self-esteem	O
4. Very low self-esteem	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

The data fields above might not cover all strengths and needs regarding wellbeing. Please use the comments to cover more details, which can help with the development planning (e.g. emotional and social development, emotional stability, characteristics of temperament, behavioural development, psychological difficulties; traumas, adaptation to change, response to stress, degree of appropriate self-control, behaviour with peers, identity, perceptions of self etc.).

Comments on well-being

_____

_____

_____

EDUCATION AND SKILLS

Literate (able to read and write) *(8 years and older)*

Yes	O
No	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Educational status *(5 years and older)*

Enrolled	O
Not enrolled (minimum compulsory schooling not yet completed)	O
Completed (at least compulsory schooling)	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Enrolled in early childhood education *(0 - 6 years)*

Yes	O
No	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Only applicable if child/young person is enrolled

Current educational enrollment

Primary	O
Secondary	O
Post-secondary (non-tertiary)/short cycle tertiary	O
Bachelor or equivalent	O
Master or equivalent	O
Doctoral or equivalent	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Special educational needs

No	O
Yes	O
No information/not evaluated	O

Only applicable if child/young person is enrolled

Attending special needs school

Yes	O
No	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Only applicable if child/young person is enrolled

Attends SOS school

Yes	O
No	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Only applicable if child/young person does not attend SOS school. Link SOS school, if applicable

Name of school/educational programme

Only applicable if child/young person is enrolled

Educational grade/year (locally defined)

Not applicable (automatically populated in PDB2 if data field is skipped)

Only applicable if child/young person is enrolled

Educational enrollment according to age

Yes	O
No	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Only applicable if child/young person is enrolled

Educational attendance

1. Attending regularly	O
2. Attending most of the time	O
3. Attending rarely	O
4. Not attending, but should be	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Only applicable if child/young person is enrolled

Educational performance

1. Above average performance	O
2. Average performance	O
3. Below average performance	O
4. Poor performance	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Skip if child/young person is enrolled

Main reason why child/young person is not enrolled in school

Child/young person is sick or special needs are not adequately addressed	O
Child/young person is not willing to go to school	O
Child/young person is excluded by school	O
Child/young person failed school	O
School does not have space	O
No school available	O
Lack of transportation	O
Discrimination	O
Other reason for not enrolled	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Only applicable if child/young person is not enrolled

Date of drop-out from compulsary education (if dropped out)

Highest level of formal education completed *(9 years and older)*

No formal education completed	O
Primary	O
Secondary	O
Post-secondary (non-tertiary)/short cycle tertiary	O
Bachelor or equivalent	O
Master or equivalent	O
Doctoral or equivalent	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Professional/vocational training *(14 years and older)*

Enrolled	O
Not enrolled	O
Completed	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Digital and ICT skills *(10 years and older)*

1. Advanced	O
2. Intermediate	O
3. Basic	O
4. No skills	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Household skills (multiple choice) (14 years and older)

Able to clean household and do basic maintenance	☐
Able to do laundry	☐
Able to prepare food for her or himself and/or child(ren)	☐
Knows where and what to shop to cover basic needs	☐
None of the above applies	☐

Financial skills (multiple choice) (14 years and older)

Saves money for the future	☐
Saves resources where possible	☐
Spends money responsible (not overspending)	☐
None of the above applies	☐

Life skills (multiple choice) (14 years and older)

Has cognitive skills (problem solving, decision making, critical and creative thinking)	☐
Has interpersonal skills (empathy, effective communication, interpersonal relationship)	☐
Has personal skills (coping with stress and emotion)	☐
None of the above applies	☐

Employability / self-employment or employment skills *(15 years and older)*

1. High	O
2. Medium	O
3. Low	O
4. Very low	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

The data fields above might not cover all strengths and needs regarding education and skills. Please use the comments to cover more details, which can help with the development planning (e.g. progress and achievement in learning, school progress, available opportunities, extracurricular classes, interests, training and professional career activities; support with disruption to education; details on speech, language and communication; details on self-care skills, practical skills, talents etc.).

Comments on education and skills

_____

_____

_____

LIVELIHOOD

Self-employment or employment status *(15 years and older)*

Self-employed or employed	O
Not self-employed or employed	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Only applicable if young person is not self-employed or employed
Main reason why not being self-employed or employed *(15 years and older)*

Taking care for children/family members	O
Sufficient (family) income	O
Enrolled in school	O
Does not feel like working/not motivated	O
Not yet in working age	O
Discrimination	O
No suitable jobs available	O
Lack of skills for available jobs	O
Being sick or special needs are not adequately addressed	O
Other reason	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Only applicable if young person is not self-employed or employed

Seeking employment *(15 years and older)*

Yes	O
No	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Only applicable if young person/caregiver is not self-employed or employed and not seeking employment

Main reason for not being self-employed or employed *(15 years and older)*

Taking care for children/family members	O
Sufficient (family) income	O
Enrolled in school	O
Does not feel like working/not motivated	O
Not yet in working age	O
Discrimination	O
No suitable jobs available in acceptable distance	O
Lack of skills for available jobs	O
Being sick or special needs are not adequately addressed	O
Other reason	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Only applicable if young person is self-employed or employed

Sector of main work

Private sector	O
Public sector (incl. military service)	O
NGO/INGO/NPO	O
Informal sector (grey economy)	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Only applicable if young person is self-employed or employed

Type of main work

Employed full-time	O
Employed part-time	O
Self-employed	O
Internship (part-time or full-time)	O
Temporary jobs	O
No information/ not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Only applicable if young person is self-employed or employed

Current employment is related to education and/or career training

Yes	O
No	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Only applicable if young person is not self-employed or employed

Most recent day of self-employment / employment

Income is sufficient to meet basic needs *(15 years and above)*

Yes	O
No	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Income is stable (15 years and above)

Yes	O
No	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Sources of income *(multiple choice)*

Income from self-employment or employment	☐
Savings of the family	☐
Pension	☐
Scholarships	☐
Social grant/public allowance	☐
Loans or donations from extended family/social support networks	☐
Production of goods for own consumption/trade	☐
SOS support	☐
Other	☐
None of the above applies	☐

Child/young person has inheritance

Yes	O
No	O
No information/not evaluated	O

Only applicable if child/young person has inheritance
Assets child/young person has inherited

_____

Only applicable if child/young person has inheritance
Custodian of the inheritance

Child/young person	O
Father's family	O
Mother's family	O
SOS	O
Other	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

The data fields above might not cover all strengths and needs regarding livelihood. Please use the comments to cover more details, which can help with the development planning (e.g. details on employment, opportunities for career progression, job security, access to resources, expenses etc.).

Comments on livelihood

_____

_____

_____

PDB2 ID: _____

Only applicable if young person is in Youth Care and at least 18 years old

ACCOMMODATION

Access to adequate sanitation

Yes	O
No	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Skip if young person has access to adequate sanitation
Main reason why there is no access to adequate sanitation

Discrimination	O
Being unaware of available service(s)/sources	O
Service is unclean/unsafe	O
Service is physically unaccessible (e.g. too far away)	O
Service is unaffordable	O
Service is insufficient/unreliable	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Access to water (safe, accessible, affordable, sufficient)

Yes	O
No	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Skip if young person has access to water
Main reason why there is no acccess to water

Discrimination	O
Being unaware of available service(s)/sources	O
Service is unclean/unsafe	O
Service is physically unaccessible (e.g. too far away)	O
Service is unaffordable	O
Service is insufficient/unreliable	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Access to adequate energy services (electricity, clean cooking facilities)

Yes	O
No	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Skip if young person has access to adequate energy services
Main reason why there is no access to adequate energy services

Discrimination	O
Being unaware of available service(s)/sources	O
Service is unclean/unsafe	O
Service is physically unaccessible (e.g. too far away)	O
Service is unaffordable	O
Service is insufficient/unreliable	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Living conditions

1. Adequate, as per local standards	O
2. Fairly adequate, as per local standards	O
3. Below local standards, but does not affect well-being	O
4. Below local standards & affects well-being	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Stability of accommodation

1. Stable, no risk of loss	O
2. Stable, but some risk of loss	O
3. Unstable with high risk of loss	O
4. Homeless or residing in a temporary shelter	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

The data fields above might not cover all strengths and needs regarding accommodation. Please use the comments to cover more details, which can help with the development planning (e.g. details about essential services: type of sanitation, water sources etc.; housing aspects: tenure, sleeping arrangements, hygiene, safety, personal security, personal space etc.).

Comments on accommodation

_____

_____

_____

PROTECTION AND SOCIAL INCLUSION

Affected by discrimination

1. No discrimination	O
2. Some discrimination, but does not compromising well-being	O
3. Discrimination that compromises well-being	O
4. Discrimination putting life at risk	O
No information/not evaluated	O

Skip if child/young person is not affected by discrimination

Main reason for discrimination

Religion	O
Ethnicity or national origin	O
Gender or sexual orientation	O
Child/young person was 'born out of wedlock'	O
Relationship status of caregiver or young person (divorced, unmarried, remarried, or has a new partner)	O
Physical appearance	O
Social class (incl. poverty)	O
Living in alternative care	O
Disability (includes special needs)	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Knows the role of the local child safeguarding team *(5 years and older)*

Yes	O
No	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Child protection training received *(5 years and older)*

Yes	O
No	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Committed offences or in conflict with law *(5 years and older)*

No	O
Yes	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Legal identity document available

Yes	O
Partly, some missing	O
No	O
No information/not evaluated	O

Refugee or internally displaced family/person

Yes	O
No	O
No information/not evaluated	O

Regular participation in SOS activities *(multiple choice)*

Cultural activities (e.g. music/arts/theather)	☐
Educational activities (e.g. book club)	☐
Physical activities/sport	☐
Rights advocacy and promotion activities/forums/campaigns	☐
Youth clubs and networks	☐
No participation	☐
Other activities	☐

Regular participation in community activities *(multiple choice)*

Cultural activities (e.g. music/arts/theather)	☐
Educational activities (e.g. book club)	☐
Physical activities/sport	☐
Rights advocacy and promotion activities/forums/campaigns	☐
Youth clubs and networks	☐
No participation	☐
Other activities	☐

The data fields above might not cover all strengths and needs regarding protection and social inclusion. Please use the comments to cover more details, which can help with the development planning (e.g. available/missing documents, legal issues, relationships with extended family and with the wider community, details on heritage, culture, religion etc.).

Comments on protection and social inclusion

_____

_____

Disclaimer abuse: Should you learn about any incident of abuse affecting children and young people in care of or supported by SOS Children's Villages, inform the child safeguarding team within the respective programme immediately. If any of the members of the child safeguarding team is not available, inform the national child safeguarding focal person.

CARE

Level of participation in decisions affecting own life (e.g. development planning)

1. Shared/own decision-making	O
2. Consulted about decisions	O
3. Informed about decisions	O
4. No participation in decisions	O
No information/not evaluated	O

Only applicable if young person has own child(ren)
Presence of caregiver

1. Is always with and/or aware of whereabouts of children/young person(s)	O
2. Is mostly with and/or aware of whereabouts of children/young person(s)	O
3. Is sometimes with and/or aware of whereabouts of children/young person(s)	O
4. Is rarely with and/or aware of whereabouts of children/young person(s)	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Only applicable if young person has own child(ren)
Parental skills *(multiple choice)*

Uses positive discipline	☐
Gives conscious affection	☐
Able to manage conflicts with child	☐
Ensures home safety	☐
Ensures adequate hygiene	☐
Provides appropriate clothing for child/young person	☐
Promotes healthy lifestyle	☐
Provides stimulating and nurturing home environment	☐
Promotes autonomy and independence	☐
None of the above applies	☐

Social support networks *(5 years and older)*

1. Strong positive relationships	O
2. Some positive relationships	O
3. Unstable and unhealthy relationships	O
4. No relationships	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

The data fields above might not cover all strengths and needs regarding **care**. Please use the comments to cover more details, which can help with the development planning (caregiving behaviour especially during early childhood development, details on parental skills, parental support in learning and education, relationship with caregiver(s) and attachment style, child/young person's autonomy and role in the family, family dynamic, relationship between caregivers and each sibling/differences in parental care etc.).

Comments on care

FAMILY OF ORIGIN

Siblings living within SOS if any (add PDB ID of siblings living with SOS)

Name of family of origin if known

Siblings (below 18 years) living outside SOS

No	O
Yes	O
No information/not evaluated	O

Frequency of contact with family of origin

Regularly	O
Rarely	O
Never (knows family of origin)	O
Never (doesn't know family of origin)	O
Never (not allowed by court decision)	O
No family of origin	O
No information/not evaluated	O

Skip if child/young person has no contact to family of origin

Relationship with the family of origin

1. Positive relationship	O
2. Mostly positive relationship	O
3. Difficult relationship	O
4. Very difficult/harmful relationship	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Skip if child/young person has no contact to family of origin

Child/young person (sometimes) stays with the family of origin

Yes	O
No	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Skip if child/young person has no contact to family of origin

Child/young person has a good chance to

Reintegrate with his/her family of origin	O
Relink with his/her family of origin	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Skip if child/young person has no contact to family of origin

Process started to reintegrate with family of origin

Yes	O
No	O

Not applicable (automatically populated in PDB2 if data field is skipped)

The data fields above might not cover all strengths and needs regarding the family of origin. Please use the comments to cover more details, which can help with the development planning (e.g. contacts with biological families, frequency and conditions; child's satisfaction with the contacts, feelings about his birth parents and siblings, caregiver's attitudes toward biological parents and their views on the impact of the contacts with birth family on the child development; etc.).

Comments on family of origin

SUMMARY

Summary (e.g. strengths and needs)

Change of care setting planned

Yes	O
No	O

Planned type of care setting

Different type of SOS alternative care	O
Reunification with family of origin	O
Independent living	O
Other alternative care	O

Planned year of transfer/exit (yyyy)

Appendix B

Core Assessment Form - Family Strengthening

CORE ASSESSMENT
OF FAMILY MEMBERS IN FS PROGRAMME

SOS CHILDREN'S VILLAGES

Date of core assessment (dd/mm/yyyy)

_____/_____/_____

HEALTH

Difficulty seeing, even if wearing glasses *(3 years and older)*

	C1	C2	C3	C4	PC	SC
1. No, no difficulty	O	O	O	O	O	O
2. Yes, some difficulty	O	O	O	O	O	O
3. Yes, a lot of difficulty	O	O	O	O	O	O
4. Cannot do it at all	O	O	O	O	O	O
No information/not evaluated	O	O	O	O	O	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Difficulty hearing, even if using a hearing aid *(3 years and older)*

	C1	C2	C3	C4	PC	SC
1. No, no difficulty	O	O	O	O	O	O
2. Yes, some difficulty	O	O	O	O	O	O
3. Yes, a lot of difficulty	O	O	O	O	O	O
4. Cannot do it at all	O	O	O	O	O	O
No information/not evaluated	O	O	O	O	O	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Difficulty walking or climbing steps *(3 years and older)*

	C1	C2	C3	C4	PC	SC
1. No, no difficulty	O	O	O	O	O	O
2. Yes, some difficulty	O	O	O	O	O	O
3. Yes, a lot of difficulty	O	O	O	O	O	O
4. Cannot do it at all	O	O	O	O	O	O
No information/not evaluated	O	O	O	O	O	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Difficulty remembering or concentrating *(5 years and older)*

	C1	C2	C3	C4	PC	SC
1. No, no difficulty	O	O	O	O	O	O
2. Yes, some difficulty	O	O	O	O	O	O
3. Yes, a lot of difficulty	O	O	O	O	O	O
4. Cannot do it at all	O	O	O	O	O	O
No information/not evaluated	O	O	O	O	O	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Difficulty (with self-care such as) washing all over or dressing *(5 years and older)*

	C1	C2	C3	C4	PC	SC
1. No, no difficulty	O	O	O	O	O	O
2. Yes, some difficulty	O	O	O	O	O	O
3. Yes, a lot of difficulty	O	O	O	O	O	O
4. Cannot do it at all	O	O	O	O	O	O
No information/not evaluated	O	O	O	O	O	O

Not applicable (automatically populated in PDB2 if data field is skipped)

(5 years and older)

	C1	C2	C3	C4	PC	SC
1. No, no difficulty	O	O	O	O	O	O
2. Yes, some difficulty	O	O	O	O	O	O
3. Yes, a lot of difficulty	O	O	O	O	O	O
4. Cannot do it at all	O	O	O	O	O	O
No information/not evaluated	O	O	O	O	O	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Disability status (must be recognized by official authority)

	C1	C2	C3	C4	PC	SC
No	O	O	O	O	O	O

	C1	C2	C3	C4	PC	SC
Yes	O	O	O	O	O	O
No information/not evaluated	O	O	O	O	O	O

Health insurance

	C1	C2	C3	C4	PC	SC
Yes	O	O	O	O	O	O
No	O	O	O	O	O	O
No information/not evaluated	O	O	O	O	O	O

Immunisation received as per national standards

	C1	C2	C3	C4
Yes	O	O	O	O
No	O	O	O	O
Not applicable	O	O	O	O
No information/not evaluated	O	O	O	O

Food security - quantity

	C1	C2	C3	C4	PC	SC
1. Has always access to sufficient food (no hunger)	O	O	O	O	O	O
2. Has most of the times access to sufficient food (light hunger)	O	O	O	O	O	O
3. Has sometimes access to sufficient food (moderate hunger)	O	O	O	O	O	O
4. Has rarely access to sufficient food (severe hunger)	O	O	O	O	O	O
No information/not evaluated	O	O	O	O	O	O

Food consumption - quality

	C1	C2	C3	C4	PC	SC
1. Eats always nutritious food	O	O	O	O	O	O
2. Eats most of the times nutritious food	O	O	O	O	O	O
3. Eats sometimes nutritious food	O	O	O	O	O	O
4. Eats rarely nutritious food	O	O	O	O	O	O
No information/not evaluated	O	O	O	O	O	O

Nutritional status *(0-17 years)*

	C1	C2	C3	C4
Obese	O	O	O	O
Overweight	O	O	O	O
Average	O	O	O	O
Malnourished	O	O	O	O
Severely malnourished	O	O	O	O
No information/not evaluated	O	O	O	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Physical health

	C1	C2	C3	C4	PC	SC
1. Good physical health	O	O	O	O	O	O
2. Minor chronic illness/health issues	O	O	O	O	O	O
3. Fairly serious or stable chronic illness	O	O	O	O	O	O
4. Severe or life threatening illness	O	O	O	O	O	O
No information/not evaluated	O	O	O	O	O	O

Receives appropriate support for health issues (difficulty/disability and/or illness)

	C1	C2	C3	C4	PC	SC
Yes	O	O	O	O	O	O
No	O	O	O	O	O	O
Not required	O	O	O	O	O	O
No information/not evaluated	O	O	O	O	O	O

Access to adequate health services

	Family
Yes	O
No	O
No information/not evaluated	O

Skip if family has access to adequate health services

Main reason why there is no access to adequate health services

	Family
Discrimination	O

Being unaware of available service(s)/sources	O
Service is unclean/unsafe	O
Service is physically unaccessible (e.g. too far away)	O
Service is unaffordable	O
Service is insufficient/unreliable	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Comments on health

_____
_____
_____
_____
_____
_____
_____

WELLBEING

Social behaviour *(5 years and older)*	C1	C2	C3	C4
1. Interacts with peers and participates in activities	O	O	O	O
2. Minor problems in interacting with others	O	O	O	O
3. Very little or no interaction with others	O	O	O	O
4. Harmful behaviour towards others	O	O	O	O
No information/not evaluated	O	O	O	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Misuse of alcohol	C1	C2	C3	C4	PC	SC
No	O	O	O	O	O	O
Yes	O	O	O	O	O	O
No information/not evaluated	O	O	O	O	O	O

Misuse of medicine/other substances or use of illegal drugs	C1	C2	C3	C4	PC	SC
No	O	O	O	O	O	O
Yes	O	O	O	O	O	O
No information/not evaluated	O	O	O	O	O	O

Self-esteem *(5 years and older)*	C1	C2	C3	C4	PC	SC
1. High self-esteem	O	O	O	O	O	O
2. Medium self-esteem	O	O	O	O	O	O
3. Low self-esteem	O	O	O	O	O	O
4. Very low self-esteem	O	O	O	O	O	O
No information/not evaluated	O	O	O	O	O	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Comments on well-being

_____
_____
_____
_____
_____
_____
_____

EDUCATION AND SKILLS

Literate (able to read and write) *(8 years and older)*	C1	C2	C3	C4	PC	SC
Yes	O	O	O	O	O	O
No	O	O	O	O	O	O
No information/not evaluated	O	O	O	O	O	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Educational status *(5 years and older)*	C1	C2	C3	C4	PC	SC
Enrolled	O	O	O	O	O	O
Not enrolled (minimum compulsory schooling not yet completed)	O	O	O	O	O	O
Completed (at least minimum compulsory schooling)	O	O	O	O	O	O
No information/not applicable	O	O	O	O	O	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Enrolled in early childhood education *(0 - 6 years)*	C1	C2	C3	C4
Yes	O	O	O	O
No	O	O	O	O
No information/not evaluated	O	O	O	O

Only applicable if child/young person/caregiver is enrolled

Current educational enrollment	C1	C2	C3	C4	PC	SC
Primary	O	O	O	O	O	O
Secondary	O	O	O	O	O	O
Post-secondary (non-tertiary)/short cycle tertiary	O	O	O	O	O	O
Bachelor or equivalent	O	O	O	O	O	O
Master or equivalent	O	O	O	O	O	O
Doctoral or equivalent	O	O	O	O	O	O
No information/not evaluated	O	O	O	O	O	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Special educational needs	C1	C2	C3	C4
No	O	O	O	O
Yes	O	O	O	O
No information/not evaluated	O	O	O	O

Only applicable if child/young person is enrolled

Child/young person attending specialized educational facility	C1	C2	C3	C4
Yes	O	O	O	O
No	O	O	O	O
No information/not evaluated	O	O	O	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Only applicable if child/young person is enrolled

Educational grade/year (locally defined) C1

Educational grade/year (locally defined) C2

Educational grade/year (locally defined) C3

Educational grade/year (locally defined) C4

Only applicable if child/young person is enrolled

Educational enrollment according to age	C1	C2	C3	C4
Yes	O	O	O	O
No	O	O	O	O
No information/not evaluated	O	O	O	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Only applicable if child/young person is enrolled

Educational attendance	C1	C2	C3	C4
1. Attending regularly	O	O	O	O
2. Attending most of the time	O	O	O	O
3. Attending rarely	O	O	O	O
4. Not attending, but should be	O	O	O	O
No information/not evaluated	O	O	O	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Only applicable if child/young person is enrolled

Educational performance	C1	C2	C3	C4
1. Above average performance	O	O	O	O
2. Average performance	O	O	O	O
3. Below average performance	O	O	O	O
4. Poor performance	O	O	O	O
No information/not evaluated	O	O	O	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Skip if child/young person is enrolled

Main reason why child/young person is not enrolled in school	C1	C2	C3	C4
Caregiver does not send child/young person to school	O	O	O	O
Child/young person is sick or special needs are not adequately addressed	O	O	O	O
Child/young person is working (incl. helping family)	O	O	O	O
Child/young person is not willing to go to school	O	O	O	O
Child/young person is excluded by school	O	O	O	O
Family cannot afford school fees	O	O	O	O
School does not have space	O	O	O	O
No school available	O	O	O	O
Lack of transportation	O	O	O	O
Other reason for not enrolled	O	O	O	O
No information/not evaluated	O	O	O	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Date of drop-out from compulsary education (if dropped out) C1 ____/____/_____ (dd/mm/yyyy
Date of drop-out from compulsary education (if dropped out) C2 ____/____/_____ (dd/mm/yyyy
Date of drop-out from compulsary education (if dropped out) C3 ____/____/_____ (dd/mm/yyyy)
Date of drop-out from compulsary education (if dropped out) C4 ____/____/_____ (dd/mm/yyyy)

Highest level of formal education completed *(9 years and older)*	C1	C2	C3	C4	PC	SC
No formal education completed	O	O	O	O	O	O
Primary	O	O	O	O	O	O
Secondary	O	O	O	O	O	O
Post-secondary (non-tertiary)/short cycle tertiary	O	O	O	O	O	O
Bachelor or equivalent	O	O	O	O	O	O
Master or equivalent	O	O	O	O	O	O
Doctoral or equivalent	O	O	O	O	O	O
No information/not evaluated	O	O	O	O	O	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Professional/vocational training *(14 years and older)*	C1	C2	C3	C4	PC	SC
Enrolled	O	O	O	O	O	O
Not enrolled	O	O	O	O	O	O
Completed	O	O	O	O	O	O
No information/not evaluated	O	O	O	O	O	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Only applicable if child/young person is enrolled

Attends SOS school	C1	C2	C3	C4
Yes	O	O	O	O
No	O	O	O	O
No information/not evaluated	O	O	O	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Only applicable if child/young person is enrolled. Link SOS school, if applicable

Name of school/educational programme C1
Name of school/educational programme C2

Name of school/educational programme C3

Name of school/educational programme C4

Digital and ICT Skills *(10 years and older)*

	C1	C2	C3	C4	PC	SC
1. Advanced	O	O	O	O	O	O
2. Intermediate	O	O	O	O	O	O
3. Basic	O	O	O	O	O	O
4. No skills	O	O	O	O	O	O
No information/not evaluated	O	O	O	O	O	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Household skills *(multiple choice) (14 years and older)*

	C1	C2	C3	C4	PC	SC
Able to clean household	☐	☐	☐	☐	☐	☐
Able to do laundry	☐	☐	☐	☐	☐	☐
Able to prepare food for her or himself and/or child(ren)	☐	☐	☐	☐	☐	☐
Knows where and what to shop to cover basic needs	☐	☐	☐	☐	☐	☐
No information/not evaluated	☐	☐	☐	☐	☐	☐

Not applicable (automatically populated in PDB2 if data field is skipped)

Financial skills *(multiple choice) (14 years and older)*

	C1	C2	C3	C4	PC	SC
Saves money for the future	☐	☐	☐	☐	☐	☐
Saves resources where possible	☐	☐	☐	☐	☐	☐
Spends money responsible (not overspending)	☐	☐	☐	☐	☐	☐
No information/not evaluated	☐	☐	☐	☐	☐	☐

Not applicable (automatically populated in PDB2 if data field is skipped)

Life skills *(multiple choice) (14 years and older)*

	C1	C2	C3	C4	PC	SC
Has cognitive skills (problem solving, decision making, critical and creative thinking)	☐	☐	☐	☐	☐	☐
Has interpersonal skills (empathy, effective communication, interpersonal relationship)	☐	☐	☐	☐	☐	☐
Has personal skills (coping with stress and emotion)	☐	☐	☐	☐	☐	☐
No information/not evaluated	☐	☐	☐	☐	☐	☐

Not applicable (automatically populated in PDB2 if data field is skipped)

Employability skills/ability to generate income *(15 years and older)*

	C1	C2	C3	C4	PC	SC
1. High	O	O	O	O	O	O
2. Medium	O	O	O	O	O	O
3. Low	O	O	O	O	O	O
4. Very low	O	O	O	O	O	O
No information/not evaluated	O	O	O	O	O	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Comments on education and skills

_____
_____
_____
_____
_____
_____
_____

LIVELIHOOD

(Self-)employment status *(15 years and older)*

	C1	C2	C3	C4	PC	SC
(Self-)employed	O	O	O	O	O	O
Not (self-)employed	O	O	O	O	O	O
No information/not evaluated	O	O	O	O	O	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Only applicable if young person/caregiver is not (self-)employed

Seeking employment *(15 years and older)*

	C1	C2	C3	C4	PC	SC
Yes	O	O	O	O	O	O
No	O	O	O	O	O	O
No information/not evaluated	O	O	O	O	O	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Only applicable if young person/caregiver is not (self-)employed

Sector of main work

	C1	C2	C3	C4	PC	SC
Private sector	O	O	O	O	O	O
Public sector (incl. military service)	O	O	O	O	O	O
NGO/INGO/NPO	O	O	O	O	O	O
Informal sector (grey economy)	O	O	O	O	O	O
No information/not evaluated	O	O	O	O	O	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Only applicable if young person/caregiver is not (self-)employed

Type of main work

	C1	C2	C3	C4	PC	SC
Employed full-time	O	O	O	O	O	O
Entrepreneur/self-employed	O	O	O	O	O	O
Employed part-time	O	O	O	O	O	O
Internship/apprenticeship	O	O	O	O	O	O
Other	O	O	O	O	O	O
No information/not evaluated	O	O	O	O	O	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Only applicable if young person/caregiver is not (self-)employed

Current employment is related to education and/or career training

	C1	C2	C3	C4	PC	SC
Yes	O	O	O	O	O	O
No	O	O	O	O	O	O
No information/not evaluated	O	O	O	O	O	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Only applicable if young person/caregiver is not (self-)employed

Most recent day of (self-)employment C1 ____/_____/_____ (dd/mm/yyyy)
Most recent day of (self-)employment C2 ____/_____/_____ (dd/mm/yyyy)
Most recent day of (self-)employment C3 ____/_____/_____ (dd/mm/yyyy)
Most recent day of (self-)employment C4 ____/_____/_____ (dd/mm/yyyy)
Most recent day of (self-)employment PC ____/_____/_____ (dd/mm/yyyy)
Most recent day of (self-)employment SC ____/_____/_____ (dd/mm/yyyy)

Household income is sufficient to meet basic needs

	Family
Yes	O
No	O
No information/not evaluated	O

Household income is stable

	Family
Yes	O
No	O
No information/not evaluated	O

Sources of income *(multiple choice)*

	Family
Income from (self-)employment	☐
Savings of the family	☐
Pension	☐
Scholarships	☐
Social grant/public allowance	☐
Loans or donations from extended family/social support networks	☐
Production of goods for own consumption/trade	☐

Other	☐
No information/not evaluated	☐

Comments on livelihood

_____
_____
_____
_____
_____
_____
_____

ACCOMMODATION

Access to adequate sanitation	**Family**
Yes	O
No	O
No information/not evaluated	O

Skip if family has access to adequate sanitation

Main reason why there is no access to adequate sanitation	**Family**
Discrimination	O
Being unaware of available service(s)/sources	O
Service is unclean/unsafe	O
Service is physically unaccessible (e.g. too far away)	O
Service is unaffordable	O
Service is insufficient/unreliable	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Access to water (safe, accessible, affordable, sufficient)	**Family**
Yes	O
No	O
No information/not evaluated	O

Skip if family has access to water

Main reason why there is no acccess to water	**Family**
Discrimination	O
Being unaware of available service(s)/sources	O
Service is unclean/unsafe	O
Service is physically unaccessible (e.g. too far away)	O
Service is unaffordable	O
Service is insufficient/unreliable	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Access to electricity whenever needed	**Family**
Yes	O
No	O
No information/not evaluated	O

Skip if family has access to electricity

Main reason why there is no access to electricity whenever needed	**Family**
Discrimination	O
Being unaware of available service(s)/sources	O
Service is unclean/unsafe	O
Service is physically unaccessible (e.g. too far away)	O
Service is unaffordable	O
Service is insufficient/unreliable	O

No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Living conditions	**Family**
1. Acceptable, as per local standards	O
2. Fairly acceptable, as per local standards	O
3. Below local standards, but does not affect well-being	O
4. Below local standards & affects well-being	O
No information/not evaluated	O

Stability of accommodation	**Family**
1. Stable, no risk of loss	O
2. Stable, but some risk of loss	O
3. Unstable with high risk of loss	O
4. Homeless or residing in a temporary shelter	O
No information/not evaluated	O

Comments on accommodation

_____
_____
_____
_____
_____
_____
_____

PROTECTION AND SOCIAL INCLUSION

Affected by discrimination	C1	C2	C3	C4	PC	SC
1. No discrimination	O	O	O	O	O	O
2. Some discrimination, but does not compromising well-being	O	O	O	O	O	O
3. Discrimination that compromises well-being	O	O	O	O	O	O
4. Discrimination putting life at risk	O	O	O	O	O	O
No information/not evaluated	O	O	O	O	O	O

Skip if child/young person/caregiver is not affected by discrimination

Main reason for discrimination	C1	C2	C3	C4	PC	SC
Religion	O	O	O	O	O	O
Ethnicity or national origin	O	O	O	O	O	O
Gender or sexual orientation	O	O	O	O	O	O
Child/young person was 'born out of wedlock'	O	O	O	O	O	O
Relationship status of caregiver or young person (divorced, unmarried, remarried, or has a new partner	O	O	O	O	O	O
Physical appearance	O	O	O	O	O	O
Social class (incl. poverty)	O	O	O	O	O	O
Living in alternative care	O	O	O	O	O	O
Disability (includes special needs)	O	O	O	O	O	O
No information/not evaluated	O	O	O	O	O	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Child labour *(0-17 years)*	C1	C2	C3	C4
No	O	O	O	O
Yes	O	O	O	O
No information/not evaluated	O	O	O	O

Committed offences or in conflict with law *(5 years and older)*	C1	C2	C3	C4	PC	SC
No	O	O	O	O	O	O
Yes	O	O	O	O	O	O
No information/not evaluated	O	O	O	O	O	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Legal identity document available

	C1	C2	C3	C4	PC	SC
Yes	O	O	O	O	O	O
No	O	O	O	O	O	O
No information/not evaluated	O	O	O	O	O	O

Domestic violence within the family (incl. against children)

	Family
No	O
Yes	O
No information/not evaluated	O

Refugee or internally displaced family/person

	Family
Yes, the entire family	O
Yes, some family members	O
No	O
No information/not evaluated	O

Social support networks *(5 years and older)*

	C1	C2	C3	C4	PC	SC
1. Strong positive relationships	O	O	O	O	O	O
2. Some positive relationships	O	O	O	O	O	O
3. Unstable and unhealthy relationships	O	O	O	O	O	O
4. No relationships	O	O	O	O	O	O
No information/not evaluated	O	O	O	O	O	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Comments on protection and social inclusion

_____
_____
_____
_____
_____
_____

Disclaimer abuse: Should you learn about any incident of abuse affecting children and young people in care of or supported by

CARE

Presence of caregiver

	Family
1. Is always with and/or aware of whereabouts of children/young person(s)	O
2. Is mostly with and/or aware of whereabouts of children/young person(s)	O
3. Is sometimes with and/or aware of whereabouts of children/young person(s)	O
4. Is rarely with and/or aware of whereabouts of children/young person(s)	O
No information/not evaluated	O

Only applicable if there is a secondary caregiver

Nature of relationship between caregivers

	Family
1. Positive relationship	O
2. Mostly positive relationship	O
3. Difficult relationship	O
4. Very difficult/harmful relationship	O
No information/not evaluated	O

Not applicable (automatically populated in PDB2 if data field is skipped)

Parental skills *(multiple choice)*

	PC	SC
Uses positive discipline	☐	☐
Gives conscious affection	☐	☐
Able to manage conflicts with child	☐	☐
Ensures home safety	☐	☐
Ensures adequate hygiene	☐	☐

Provides appropriate clothing for child/young person	☐	☐
Promotes healthy lifestyle	☐	☐
Provides stimulating and nurturing home environment	☐	☐
Promotes autonomy and independence	☐	☐
No information/not evaluated	☐	☐

Level of participation in decisions affecting own life	**C1**	**C2**	**C3**	**C4**
1. Shared decision-making	O	O	O	O
2. Consulted about decisions	O	O	O	O
3. Informed about decisions	O	O	O	O
4. No participation in decisions	O	O	O	O
No information/not evaluated	O	O	O	O

Distribution of tasks and responsibilities in the household (according to age)	**C1**	**C2**	**C3**	**C4**
1. Always fair and equal	O	O	O	O
2. Mostly fair and equal	O	O	O	O
3. Rarely fair and equal	O	O	O	O
4. Never fair and equal	O	O	O	O
No information/not evaluated	O	O	O	O

Family is preparing for re-integration of a child/young person from alternative care	**Family**
Yes	O
No	O
No information/not evaluated	O

Comments on care

_____
_____
_____
_____
_____
_____

SUMMARY

Summary (e.g. strengths and needs)

_____
_____
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_____
_____

How adequate is the current care situation?	**Family**
1. Consistent quality care	O
2. Consistent quality care, but more suitable quality care setting available	O
3. Some shortfalls in consistency and quality of care/increasing risk of separation	O
4. Serious or frequent shortfalls in consistency and quality of care/high risk of separation	O
5. No care is provided	O

Should the family (still) participate in the programme?	**Family**
Yes	O

No	O
No, but on waiting list	O
No, refer to other organisation	O

Appendix C

Participation Letter

Are you interested in taking part in the research project

"DHIS2 as a candidate for improving the Information System within SOS Children's Villages"?

This is an inquiry about participation in a research project where the main purpose is to *ascertain whether an integration between SOS Children's Villages' information system and the open-source health platform DHIS2 could improve the quality of SOS Children's Villages' collection/aggregation/processing and sharing of data on children in their care*. In this letter we will give you information about the purpose of the project and what your participation will involve.

Purpose of the project
The project is a master thesis which will serve as a part of a research initiative between SOS Children's Villages Norway and the Department of Informatics at the University of Oslo.

The purpose of the project is to ascertain whether the *District Health Information Software* (DHIS2) could provide increased flexibility, functionality, and visibility to SOS Children's Villages' systems and ways of collecting, aggregating, processing, and sharing of data on children in alternative care.

District Health Information Software 2 (DHIS2) is an open source, web-based health management information system (HMIS) platform. It is the world's largest HMIS platform in use by 67 low and middle-income countries. It is currently being utilized on a national scale in South Africa and piloted in Ethiopia.

The study will take place in selected Children's Villages in Ethiopia and South Africa.

Who is responsible for the research project?
- The Information Systems research group at the Department of Informatics, University of Oslo
- SOS Children's Villages Norway

Why are you being asked to participate?
You have been selected because your position includes certain tasks related to data collection, aggregation, processing, and sharing within SOS Children's Villages. The number of people asked to take part in this research is uncertain as of now.

What does participation involve for you?
- If you chose to take part in the project, this will involve being interviewed (individually or as a group). The topics of the interview will mostly be related to your position and daily tasks at SOS Children's Villages, the Information System (including the Core Assessment and Family Strengthening forms, and the Program Database). The interview will be performed with sound recording with your consent. It will also be recorded on paper.
- It might also include observation of you performing certain tasks related to your position. An example of this would be me observing you fill in data forms or creating graphs from the collected data, of any of those are applicable to your position, and making notes of that.

Participation is voluntary
Participation in the project is voluntary. If you choose to participate, you can withdraw your consent at

any time without giving a reason. All information about you will then be made anonymous. There will be no negative consequences for you if you chose not to participate or later decide to withdraw. It is important to note that this is strictly for research purposes and is in no way meant to cause any professional trouble for you or impact your relationship with your superiors or the organization as a whole in any way.

Your personal privacy – how we will store and use your personal data
We will only use your personal data for the purpose(s) specified in this information letter. We will process your personal data confidentially and in accordance with data protection legislation (the General Data Protection Regulation and Personal Data Act).

- Access to personal data will only be accessible to myself and, if needed, my supervisor.
- The list of names and contact details will be stored separately from the rest of the collected data. All data will be stored locally by myself and will as such only be accessible to myself, my supervisor, and my project partners from the University of Oslo.
- Personal data is mostly of no importance in this project. Position, experience, education and other forms of training will be documented and specified in my thesis. Names and other personal data apart from those mentioned will not.
- Participants will not be recognizable from the contents of this thesis alone.

What will happen to your personal data at the end of the research project?
The project is scheduled to end *May 1st, 2020.* After the project is concluded, the raw data will only be accessible to myself. The master thesis and its contents will be available for students and staff members at the University of Oslo, as well as our partner institutes in South Africa, Ethiopia, and SOS Children's Villages.

Your rights
So long as you can be identified in the collected data, you have the right to:
- access the personal data that is being processed about you
- request that your personal data is deleted
- request that incorrect personal data about you is corrected/rectified
- receive a copy of your personal data (data portability), and
- send a complaint to the Data Protection Officer or The Norwegian Data Protection Authority regarding the processing of your personal data

What gives us the right to process your personal data?
We will process your personal data based on your consent.

Based on an agreement with the Information Systems research group at the Department of Informatics, University of Oslo, NSD – The Norwegian Centre for Research Data AS has assessed that the processing of personal data in this project is in accordance with data protection legislation.

Where can I find out more?
If you have questions about the project, or want to exercise your rights, contact:
- Kim Sverre Hilton, MSc student at the Department of Informatics.
  - Phone:
  - Email: kimsh@ifi.uio.no
- Professor Jens Johan Kaasbøll, Supervisor at the Department of Informatics.
  - Phone:
  - Email: jensj@ifi.uio.no

- NSD – The Norwegian Centre for Research Data AS
  - Phone: (+47) 55582117
  - Email: personverntjenester@nsd.no

Yours sincerely,

Project Leader   Student (if applicable)
(Researcher/supervisor)

Consent form

Consent can be given in writing (including electronically) or orally. NB! You must be able to document/demonstrate that you have given information and gained consent from project participants i.e. from the people whose personal data you will be processing (data subjects). As a rule, we recommend written information and written consent.

- *For written consent on paper you can use this template*
- *For written consent which is collected electronically, you must chose a procedure that will allow you to demonstrate that you have gained explicit consent (read more on our website)*
- *If the context dictates that you should give oral information and gain oral consent (e.g. for research in oral cultures or with people who are illiterate) we recommend that you make a sound recording of the information and consent.*

If a parent/guardian will give consent on behalf of their child or someone without the capacity to consent, you must adjust this information accordingly. Remember that the name of the participant must be included.

Adjust the checkboxes in accordance with participation in your project. It is possible to use bullet points instead of checkboxes. However, if you intend to process special categories of personal data (sensitive personal data) and/or one of the last four points in the list below is applicable to your project, we recommend that you use checkboxes. This because of the requirement of explicit consent.

I have received and understood information about the project *[insert project title]* and have been given the opportunity to ask questions. I give consent:

- ☐ to participate in *(insert method, e.g. an interview)*
- ☐ to participate in *(insert other methods, e.g. an online survey) – if applicable*
- ☐ *for my/my child's teacher to give information about me/my child to this project (include the type of information)– if applicable*
- ☐ *for my personal data to be processed outside the EU – if applicable*
- ☐ *for information about me/myself to be published in a way that I can be recognised (describe in more detail)– if applicable*
- ☐ *for my personal data to be stored after the end of the project for (insert purpose of storage e.g. follow-up studies) – if applicable*

I give consent for my personal data to be processed until the end date of the project, approx. *[insert date]*

(Signed by participant, date)

Appendix D

Selection of Interview Guides

Interview Guide - Department of Social Development South Africa

About

- Deputy Director

Goals

- Find out about the DSD organizational structure
- Find out about the status of handling of information on vulnerable children from DSD perspective
- Find out what systems DSD use - digital or paper based
- Find out the information flow
    - how is information exchanged between DSD and SOS or other NGOs
    - in what format
    - digital or analog
    - what forms?
    - Find out DSD connections to SOS CV - regional and national
- Find out about DSD social workers
- Find out about challenges DSD faces in collecting, using and sharing information
- Find out about DSD relations to other governmental actors - who are they communicating with regarding information on vulnerable children

Overall goals

Govermental side of things:
1. Figuring out what DSD uses and have used of information systems
2. How these systems worked
3. Interoperability with other systems
4. Challenges
5. Potentials
6. Road ahead of digitization
7. If other departments using the same
8. Reports/Data sets important to collect by the government
9. What this data is uses for
10. Information flows from lower levels to government - and where does it end up?
11. How does the government experience cooperation with lower levels?

Introduction

Talk about us, what we want to do, and that **we focus on data sets, systems and information flows regarding vulnerable children**. Also clarify if he knows about SOS CV and their relations to DSD.

We want to get the DSD point of view since we have only been talking to NGOs so far. It is important to get information from both sides to know the holistic situation on information on vulnerable children. We would love to get informed on what works, and what does not, regarding systems used, integration and standardization, information flow and communication and data sets. What could be improved and what works well?

About the interviewe
- Role
- Responsibilities
- Regional or national DSD?
- Relations to CBIMS

General about DSD
- How is the DSD organisation structured?
  - What governmental "levels" and functions?
  - Different sub-departments internally in DSD?

General status on handling of information on vulnerable children
- What would you describe the status of handling information on vulnerable children like?
  - What information is collected from the child care organizations?
    - How is it done?
  - Is enough information collected?
  - Is too much information collected?
  - What is the information used for?
    - Is the information utilized sufficiently?
- Does any information travel or otherwise get reported to the ministry of health?
  - (relevant because of child health data and the use of the software DHIS2 in that sector)
- Does any information travel to other governmental departments or upwards in the system?
- National Plan of Action for Children in South Africa 2018-2022?

Relationship with SOS CV and other NGOs
- how would you describe DSDs relationship with SOS CV?
  (or other NGOs if SOS not applicable)

Systems
- What systems are the DSD currently using to handle information on vulnerable children?
  - Analog

- ○ Digital
- ○ Difference between your department and at other departments?
- ○ Are these working well?
- ○ For clarification: When SOS CV (NGO) sends information to DSD social workers - where does it end up (what system, where)?
  - ■ What is the system named?
  - ■ What is the information used for?
  - ■ is the information sent further to other actors?
- ○ Planning on digitizing or using other systems in the future?
- ○ Is there a need or incentive to improve the systems? Please elaborate.
- We learned about a software called CBIMS from another interview subject
  - ○ Could you elaborate this?
  - ○ What is the status of CBIMS now, and will it be utilized further in the future?
    - ■ If not, other systems taking over?
    - ■ maybe you could share a screenshot or something similar of the CBIMS so we could get a clue of what it looks like?
- Could you mention any similar systems like CBIMS (and those mentioned) that you know is being used?

Integration with other systems
- IF digital system: Is DSD's system interoperable or integrated with any other systems?
  - ○ Within the government
  - ○ With third-party systems
- If yes, please elaborate on:
  - ○ *Why* there was a need for interoperability/intergration
  - ○ *How* these systems are integrated
- If not, please elaborate on:
  - ○ Is there a need for integration, and if so, why, and with who/what systems?

Information flow
- How does information on children in care programs end up at the DSD - what are the steps from lower levels to your?

Forms
- What forms are being issued by DSD to SOS CV
  (or other NGOs if not knowing about SOS)
  - ○ (After he has answered): We have noted that monthly report and quarterly report is to be sent to social workers by SOS CV (or NGOs), is this the case?
    - ■ Could you elaborate on this?
- Could we get a soft copy of these (without data values)?
- What forms are DSD using to report to other actors, if they are?
- Could we get soft copies of these as well?
- In addition to forms, do you have any indicators sheets you could share with us, in relation to what you capture in the systems and use in the forms you issue?

- ○ This is very relevant to see if what you gather matches what other actors gather, looking at consistency

Social workers
- Social/Case workers connected to children in vulnerable situations - are they placed at regional or national level?
- What are their responsibilities?
  - ○ Legally
  - ○ In terms of gathering information
  - ○ In terms of reporting
- How do you find the communication and collaboration between social workers and NPOs to be?
- To your knowledge, how long does a social worker stay with the DSD?

Challenges
- What are the main challenges faced by DSD in terms of handling information on children in alternative care?
- How do you think information flow on vulnerable children could improve in the future?
  - ○ What must be done?

Actors related to DSD
- Who manages DSD?
- Does DSD get any requirements from other actors in terms of what to collect or share of information on children?
- Does DSD give any requirements to other actors in terms of reporting to DSD?
- We have heard there is a collaboration between USAID and DSD - do you want to briefly explain this collaboration?

Clarifications
When children are being placed in care at NGOs, there should be an initial assessment of the child. Is this the responsibility of DSD or the NGO?
(SOS CV talked about a panel assessing the child for placement)

When we were collecting data in Ethiopia, they had a governmental actor called Civil Society Organization that helped NGOs with their project plans, followed them up and gave them fundings. Do you have any similar governmental organization in SA?

Other things you would like to mention or ask?

HISP interview guide

General
- Disclaimers
- What do you do for a living?

DHIS2

- Can you tell us how DHIS2 is implemented in South Africa (department, ministires, NGOs?)
- What is your opinion on the usage of DHIS2 here?
- Is the government autonomous in their usage of DHIS2
- Do you know is DHIS2 is used to handle data on children to any extent in SA?
  - Tracker for personal data?
- Tell us about how data could be *exported* from DHIS2
- Tell us about how data could be *imported* from DHIS2
- Is interoperability between DHIS and other systems easy to accomplish?
  - Is it integrated with a system now?
- DHIS2 server distribution - how many and where?
  - Do you maintain servers the government uses for DHIS2?

As a member of the South African HISP group, can you tell us about your workings relationship with the government:
- In regards to health information
- In regards to DHIS2

The Department of Social Development is the government organ responsible for all matters related to children in SA. We've learned that there at least has been an initiative for them to digitalize their systems to something akin to DHIS2.
- Do you know anything about this?
- Do you know about any initiatives to integrate whatever information systems the different government entities has?
- Do you know any systems or platforms in SA that is similar to DHIS2

SOS Children's Villages

My theses is specifically to assert whether DHIS2 could be a viable candidate for intergration to or substitution of SOS Children's Villages' IS.
NOTE TO SELF: Explain the SOS information flow. Important to note that SOS collects personal data on the lower levels, and aggregates them to the higher levels.

Some of the issues raised by SOS NO include lack of flexibility. Data is collected by paper forms, the content of which is static and pre-defined by the main office in Austria.

- With DHIS2 being fully flexible, that might be a point where it could be of benefit. What are your thoughts on this?

Data presentation also seems to be an issue. It has been pointed out to us that SOS' tools for data presentation (graphs, tables, etc) are somewhat lacking.
- How do you view the quality of data presentation tools in DHIS2?
- Do you have any examples of those tools helping decision makers to make more informed decisions compared to their previous information input?

We're in the process of finding out the extend to which data is exchanged between SOS and the ethiopian government.
- If SOS were to integrate with DHIS2: in terms of DHIS2 structure, how would you for instance see data exchange between SOS and the government being done? (SOS as a sub-group to gov.?)
- Do you know if there has been a case where an organization and a nation both implementing DHIS2 and using it to exhange or share information?

Interview Guide

Village level - Mera Officer - SOS

19.11.2019

Interview

About the Mera officer

- What are your work-related responsibilities?
    - Analysis?
    - Sending reports upwards?
    - Data quality checks?
    - Sending feedback?
- Could you explain to us your regular daily work?

PDB/PDB2 and reports

- What does the reports in PDB/PDB2 look like?
    - How are the reports analysed?
        - Exported to excel or other means?
        - How do you create graphs?
- Is the data delivered to you entirely paper-based, or digital?
- How are the reports aggregated and sent to higher levels?
    - Send to national office only or other sources reports are given to?
    - How do you aggregate data?
    - How do you send the reports
        - Available through PDB or exported and sent by other means?
    - How are the reports presented - export to excel or other means?
- The forms are static, the content of which are defined by the SOS headquarters in Austria. Do you feel that the forms are lacking in any way?
    - Anything that could be added to suit your context?
    - Anything that is not relevant for your context?
- Who configures the setup of PDB?
- What do you think are the positive sides of PDB?
    - Negative sides?
- What do you think are the positive sides of PDB2?
    - Negative sides?
- Does the PDB2 bring a <u>positive</u> impact to your tasks (compared to PDB1)?
    - Why/why not?
- Does the PDB2 bring a <u>negative</u> impact to your tasks (compared to PDB1)?
    - Why/why not?

- Do you think there are functionality not in PDB or PDB2 that would be beneficial to you?

Information exchange

- Do you share data with other actors?
  - Government
  - NGOs
  - Other
- What kind of data?

SOS CV <Village>

- Get a clear overview of the services/programs for SOS CV <Village>! These could be different from others, as well as having different naming conventions.
  - What goes under AC?
  - What goes under FS?

Challenges

- What challenges do you face in relation to your work?
  - Connectivity issues?
    - How much downtime (in percentages) would you say the network has?
  - Capacity?

Observation

- Can we look at the reports and aggregated reports from the PDB menu?
- The Compass feature - can we look at it?
  - Do you use it?
- Could we have a look at the functionality in PDB and PDB2 that you usually use and how you use it?

Data use observation

- Could you show us a comparison over time? Showing the development over time?
- Could you show us a comparison between two family strengthening programmes?
- Could you show us some way you could use the data in the PDB for decision making or creating charts for decision making?
- Can you show us how you create your reports?
- Can you show us how you edit data in the PDB?
- Are you the only one in the village tasked with reporting?

- Who in the village (and SOS in general) can see/edit data in the PDB?
- … Other roles related to the PDB we have not talked to that have other responsibilities than yourself?

Interview Guide - Program Director, Programme level SOS CV

Let's start with SOS' relationship with the government:
- What parts of the government do you report to?
- What do you report and how often do you report it?
  - PDB data
  - Operational data
  - Other
- Do you see any challenges with the status quo of government data exchange?
- Do the government require anything from you?
- Do you think it would be beneficial to further integrate your information system with the government's?

- Can you explain in as much detail as possible how these different stages of data treatment and utilization are being executed here in this village:
  - Data collection
  - Data processing
  - Data presentation
  - Action/Use
- Is the use of CAs mainly paper-based or is it digital in any way?
- The CA/FS are static forms, the content of which are defined by the SOS headquarters in Austria. Do you feel that the forms are lacking in any way?
  - Anything that could be added to suit your context?
    - Why?
  - Anything that is not relevant for your context?
- What changes would like to see to data exchange between you (village or SOS as an org.) and the government or other actors similar to yourselves?
  - Why?

- What vulnerable children are your target group in SOS <Village>?

- Who from the governmental actors do you report to?
  - Other departments?

- What kind of relationship would you say you have with the <Country> government in regards to cooperation and sharing data on children?
  - Do you think there are challenges in regards to the government knowing the well-being of all children in <Country>?
    - Chances that vulnerable children might not get help? Why?
    - What is being done to further the reach and visibility of such children?

- You also report to National Office SOS? Anyone else within SOS?
  - What reports goes to National Office?

- What reports do you report for your own use and never share with anyone?
    - Do you think it would be beneficial to share this info with others?

- What other actors do you report to?
    - Sponsors?
        - Who?
    - Directly or through national office or something?

- Challenges
    - What do you think are the positive sides to sharing information on children in your programs?
    - Could there be any negative sides of sharing info on children in your programs?
    - What challenges are you currently facing in regards to getting information on vulnerable children in <Country>?
    - What challenges are you currently facing in regards to sharing information on the children in your programs with others?

- Do you use other systems than PDB in this village for reporting on the children or other related activities?

REQUEST:
- Could we get a copy of all the forms you use for reporting to these sources?
- Do you have an organization chart / a diagram over your organization that we could get?

Interview Guide - SOS National Office

28.11.2019

Interview questions

OVERVIEW
- What are the roles found on the national level of SOS regarding gathering, processing, analysing, sharing and using information on children in your programs?
- We see the SOS levels as such:
    - National
    - Province
    - Region
    - Ward
    - Community
        - What levels are using the PDB? Only national and wards (the program locations), or more?
- Opinions on cooperation w/ government?
    - What challenges are there?
    - What can be improved?

FORMS
- Forms you send to villages that you require to be sent to you?
    - What forms
    - How is it sent
    - What is the data used for
    - What data, forms, etc. do YOU require that villages give you?

PDB
- What data do you require that villages put into the PDB?
    - I.e. follow-up, core assessment?
        - (seems like only enrollment and exit from village level is registered in PDB sometimes?)
- What requirements to you get from the international office on what to put into the PDB, if any?
- The contents of the PDB is static. Is there any PDB data you would add or remove?
- What are your opinions on the quality/variety of reporting tools of the PDB?

REPORTING
- What governmental departments are you reporting to?
    - Reporting how?
    - What forms, can we see?
- Do you see a need for system integration between you and the government?

SYSTEMS

- Lucy
    - Integrated with PDB?
    - Can we have a look at Lucy?
- Navision
- Takes on PDB2?
    - Do you think it improves work tasks and will be suited for social workers?
- PDB
- Other systems used in national office for gathering, processing, analysing, sharing information on children?

REQUESTS
- Organization chart?
- All forms you send to lower levels?
- All forms you send to other actors, i.e. that you report on yourself

NGO Interview Guide South Africa

26.11.19

Interview questions

In general - children in SA
- How would you describe the child care system in South Africa?
  - Challenges?
- How does the state track the children of this country's well-being?
  - Challenges?
  - Differences in rural and urban areas?
- What do you think would make it easier for the government to track the well-being of children in this country?
- What challenges in regards to child care do you face in Johannesburg?
- What challenges do you in <NGO> face in general?

In general - <NGO>
- How does the organizational chart look, what are the roles in the facilities?
- Do you recieve resources from the state for the work you do?
- Could you elaborate on how you coordinate work together with social workers and department of social services?
  - What are their role in terms of what <NGO> does?
- After children have been placed in permanent families, who tracks their well-being further?

Digital systems
- What systems are used internally?
  - What do you use them for?
- Are your systems linked with any external systems?
- Are your systems capable of importing data?
- Are your systems capable of exporting data?
- What challenges, if any, do you face with your current digital systems?
  - Are you addressing them? How?
- Do you see any positive sides with linking your system with those of other similar NGOs and the government?
- Do you see any cons to linking your system with those of other similar NGOs and the government?

Infrastructure/Data
- If any, what is reported to the government?
- Reporting to other stakeholders, like donors, NGOs, other departments in the government?
- Is the government providing physical visits?

- What data is being gathered on the children?
  - For internal use
    - What is the data used for internally?
  - For external use
    - What is the data used for externally?
- How is the reporting done?
  - Forms - from who
    - Soft copy/hard copy
  - Who is responsible?

Needs

1. Do you think there is a need for tracking children's well-being through data collection and dissemination?
   1. What could be the negative sides to this?
   2. What could be the positive sides to this?

Requests

- If you are collecting data and reporting through forms
  - could we get soft copies of these?
- If systems
  - some documentation or more information available online?

Interview guide - Ethiopian government

Get information on
- *is this the regional level or national level?*
- *role?*

About the ministry
- What is your responsibility?
- How do you track the well-being of the children in your target group?
- What makes tracking well-being of children difficult in <Country>?
- What are the current challenges in <Country> in regards to vulnerable children?
- What do you think could help you get a broader view of the well-being of children in <Country>?
- How broadly are you represented in <Country>?
  - How big is the reach?
  - What are you doing to expand your representation and reach?
- What other authorities do you cooperate with?
- How do you handle vulnerable children in <Country's> rural and urban population?

Challenges
- What challenges do you face in terms of information on vulnerable children?
  - Infrastructure?
  - Capacity?
  - Resources?
  - Monitoring systems?

Collaboration with SOS CV
- What relationship do you have with SOS CV?
  - What collaborations?
- What levels of SOS are you getting reports from?
- What reports do you require to get from SOS CV?
  - Why? *For what use?*
  - How often?
- What are SOS CV reports used for?
- How could the cooperation with SOS CV be improved?
  - Do you think that a tighter integration of your systems would be beneficial or not?
    - why?

Collaboration with other actors
- We know there is a agency that NGOs have to give plans to and report to
  - What do they gather of information that you don't?
  - Do you share information between you / collaborate?
- Do you require reporting from other NGOs like SOS?

Systems used

- What systems do you use for handling information on children?
  - What are the processes around gathering information and putting it into this system?
  - Is the system integrated with other actors systems in terms of reporting from lower levels?
  - Is data from other actors fed into your system?
    - Can you give an example of a report you receive from (for example, SOS) and how it ends up in your systems?

Interview Guide

Social Worker Village Level

19.11.2019

SOS
- What does a normal day for you look like?
- What forms are you responsible for filling out?
  - How do you fill out?
- Do you face any challenges when gathering information and reporting?
  - Are the forms sufficient for your needs?
    - Is there data you would like to add to forms that is not put in the forms?
    - Is there data you would like to remove that is not suiting your context?
- Do you use the information collected in the forms yourself?
  - For what purposes?
  - Do you wish there were more information that you did have access to?
- Could you show us the forms you use?
- Could we get a copy of a form you have reported on (removing child ID)?

Data
- Who receives your collected data?
  - Do you know what happens with the data collected?
  - Do you know why you have to collect it?
  - Do you receive feedback?
- Who decides what data to be collected?
- Are there situations where you are unable to collect data?
  - Situations where you are unable to report the data collected?
    - How do you report on the data?
      - Giving reports to PDB clerk via email/paper-based?
      - Always the same way of reporting?
- How often is the data collected?
- How often is the data collected reported?
- Why do you think it's important to collect data about children in alternative care?
- Do you think there are any challenges relating to sharing information on the children with others?
- Do you experience issues with transportation?

Resources
- Are you using any digital devices for work you do?
  - if yes;
    - What kind?
    - For what purpose?
  - Is it making the work easier, or does it complicated?
    - Why?
    - How you you describe your digital literacy?
- Do you experience any general issues?
  - What and why?

Final remarks
Do you have any questions for us?
Is there anything you would like to add?

Interview Guide

SOS CV International

25.11.2019

Clarifications

We are working on two master theses as you might know. The background for this initiative is that SOS CV Norway approached us and expressed a need for governments to have a better overview over the situation of the children in their care. For this, one could need a system that is integrated with other systems from lower levels, and create practices where lower levels report beneficial data to these higher governmental levels. So one data pool of information on children from different sources is what is the long-term goal here. This is just a preliminary phase of mapping out how things are done right now, looking at gaps and opportunities, and in addition, for Kim's thesis; seeing how DHIS2 could fit into all of this.

Adrian and Mari are not really specifically looking at DHIS2, we are looking at what actors shares what data with who, or what data should be shared between who, and how this might be done. We are looking for gaps in terms of parallel reporting systems and silo systems and other challenges, but also opportunities for more consistent and coordinated information flow between actors that have relevant data on children's wellbeing.

Kim is looking at how DHIS2 could fit into the ecosystem of SOS; either in terms of integration with PDB and DHIS2 as a governmental system, or DHIS2 as a replacement of PDB - but the latter, we believe is not very likely and we think PDB seems to be a good system for its context. Either way, it could be interesting to see if DHIS2 could be used as a system for such contexts like PDB is used, and not only for health information. So right now we are interested in both, but integrations seems more realistic and beneficial for now.

We are not interested in health information any more than we are in other information, DHIS2 is used for health information primarily, but is flexible and configured from scratch, meaning that data elements could be of all sorts. DHIS2 has been used i.e. for data on Education and such in other countries as well.

From this meeting I think the technical sides to PDB will be most beneficial to talk about, and also we would like to know more about the International level in terms of receiving data from lower levels and using this data, and other non-SOS actors that are somehow connected to this international level in terms of reporting requirements, sharing of information and so forth.

Information flow, reports and actors

- What organizations are SOS CV International collaborating with?
- What kind of collaboration would you describe that you have with governments in the nations providing SOS programs?
  - What differences in context do you recognize?
- What levels do you get reports from?
  - Regional office?
- What reports do you require lower levels to report on?
  - What levels reports directly to you and what kind of reports?
- How do you get the reports?
  - Through PDB or sent by mail?
- What do you use the information from the reports for?
- How would you describe the information culture in regards to sharing of information within SOS CV globally?
  - Challenges?
    - In relation to sharing the information with governments?
  - Recognized opportunities?

PDB/PDB2

We know that the SOS IS consists of different "subsystems". We've learned that some of them are connected and exchange information, for instance PDB and Lucy.

- Technically speaking, how are these subsystems connected and how is information being exchanged between them?
  - And what systems (all)
- Are there other ways to *import data to the PDB* (File formats, APIs), that are suitable for systems or services outside of the SOS IS?
- Are there other ways to *export data from the PDB* (File formats, APIs), that are suitable for systems or services outside of the SOS IS?
- What challenges are you facing with the current PDB?
- Are these challenges being addressed with PDB2?
  - Are these challenges being addressed with the current PDB?
- Can you explain how PD2 will differ from the current PDB in terms of
  - Technical features
  - Policy changes
- We heard that there might be developed functionality for prohibiting data quality issues (like rules for negative numbers etc.) in PDB2 - is this the case?
  - Yes, we developed logical checks that are either used to validation rules in the user interface or in data quality monitoring. Let's discuss in the call,

what exactly you are interested in. But I can already provide you examples:

We heard there is an app (or some sort of mobile functionality) being developed for data collection for the PDB.

- Technically speaking, how is data being exchanged between the PDB and the mobile app?
- Does/will it have offline capabilites?
    - If so, how does it work
- What is the status of the development of the app?
    - Is the app supposed to be used internationally or by specific nations and/or villages?
    - When do you plan on deploying/launching it?

DHIS2 and the potential benefits from an integration with the SOS IS (Kim Hilton Specific)

As you may now, DHIS is a health management information platform with development backing from UiO. It is a general platform with the possibility of developing applications and configuring it pretty much however you want to. It's the world's largest HMIS platform, and is being used by 67 countries (mostly in Africa and Asia).
It serves as an example in our theses, so we're trying to assess whether it would be a help to SOS. This assessment will be built on initial mapping of the SOS IS and the IS of the respective nations we'll be visiting. It's a work in progress, but as of now we've identified the following areas for DHIS2 to potentially support or improve through an integration with SOS IS:

1. **Flexibility**. Data elements could be added or removed. If a village or nation has a problem that they would like to be covered in the PDB, but isn't, they could add that. This would at the very least be usefull locally. There is an issue on how this would work when transcending levels, i.e. if the national layer were to have different data elements than a particular local one.
2. **Integration with national HMIS**. DHIS2 is currently used as a national HMIS2 in South Africa and Ethiopia (although the Ethiopian implementation isn't quite as mature as the South African). An integration between SOS IS and DHIS2 could as such serve as a link between SOS and state databases/HMIS.
3. **Data presentation tools**. DHIS2 has a wide range of data presentation tools. From what we've learned (correct us if we're wrong), the current tools for presenting data from the PDB are somewhat limited.

4. **Offline capabilities**. DHIS2-applications are often designed with offline capabilites. This is suitable for health workers, possibly also in SOS, who works in the field and collects data where network connectivity is sparse or non-existing.

… what are your thoughts on this?

Requests

- Are you able to send us some screenshots from the PDB and PDB2 from international level? - We would like to see what the interface looks like from the highest level
  - *What differences are there at the higher level PDB view compared to other views?*
  - *How many "levels" of views are there in PDB?*
- Could you email us system documentation on PDB and PDB2 (and other systems used, i.e. Lucy and Navision)?
- Could you email us system documentation on the mobile data collection app?
- Information on "the stack" - what languages and technologies used to develop PDB and PDB2?
- If there is difference on the interface/system used for collecting data offline from tablets and phones, it would be great if you could provide us with some documentation/screenshots from this as well.