

UiO : **Department of Informatics**
University of Oslo

Data use challenges and the potential of live data visualization tools

A case study of health data-use workshops in Zambia

Master's Thesis

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November, 2017



Data use challenges and the potential of live data visualization tools

“...data needs not only to be reviewed, it needs to be contextualized, synthesized, and it need to be prioritized.” – Zambia partner representative; on improving data use in Zambia.

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Title

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Abstract

Zambia's Health Management Information System (HMIS) is currently undergoing a strengthening process. One aim of the strengthening process is to improve data use. Data in Zambia's HMIS receives limited usage for data-informed decision making. Earlier studies have identified some challenges to data use such as poor data quality, data availability etc. This thesis is an exploratory interpretive study on Zambia's data-use workshops and how they contribute to data use in Zambia public health domain. It looked to identify how and for what purposes data is used, what are the key challenges to data use, and the prospects of introducing live data visualization tools to strengthen data-use workshops and data use. The study has involved users from all levels of Zambia's HMIS in order to identify common thoughts and ideas on live data visualization tools; and data use at large. It mainly involved attending a data-use workshop, conducting interviews along with document analysis.

The study identifies key challenges to data use as financial constraints, infrastructure constraints, poor data quality, limited data availability and accountability and lack of key data competencies by personnel. The implementation of live data visualizations tools, for the strengthening of DIMs and data use, was likely to impact both positively. However, while the study's findings suggest that live data tools could potentially improve data use through improving data access, data availability and data quality, such measures would also be challenged by general financial and infrastructural constraints. In addition, I develop a model for the potential introduction of live data visualization tools. The model identifies reciprocal and determinant relationship between the challenges and the live data visualization tools.

Acknowledgement

All this work wouldn't be possible on my own. I would therefore like to acknowledge the efforts of several people. First, I would like to thank my supervisor Terje Aksel Sanner for his guidance, support and light moments throughout the journey of writing this thesis. I would like to thank the Akros team and Zambian team; for making my stay as comfortable as possible. Scott Russpatrick for informative talks, help and review, Natasha Mwelwa for being my 'PA' during my visits, Albert for making sure I got the right materials for my research, Tabonga for her assistance, and Tabo for helping me settle in well during my visits to Lusaka.

I would like to thank my 'study buddy' and friend Anastasia Parramore for the good times, thoughts on various topics and the chit-chat. They were always interesting. Martine Wanjiku for helping me spellcheck, tremendous love and support. Lastly, I would like to thank my family for believing me, supporting me, and letting me make my own decisions; including studying abroad.

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Abbreviations

7NDP	Seventh National Development Plan
AFD	African Development Index
CC	Community Champion
CHA	Community Health Assistant
CHAZ	Churches Health Associations of Zambia
CHW	Community Health Worker
CLTS	Community-led Total Sanitation
CP	Cooperating Partner
DC	District Commissioner
DDH	District Director of Health
EHT	Environmental Health Technician
DHIO	District Health Information Officer
DHIS2	District Health Information System 2
DHMT	District Health Management Team
DHO	District Health Office
DIM	District Integrated Meeting
HIS	Health Information System
HISP	Health Information Systems Program
HMIS	Health Management Information Systems
IS	Information Systems
J2ME	Java 2 Platform, Micro Edition
MOH	Ministry of Health
NGO	Non-Governmental Organization
NHSP	National Health Sector Strategic Plan
PHO	Provincial Health Office
PHC	Primary Health Care
PMO	Provincial Medical Office
PRISMA	Preferred Reporting Items for Systematic reviews and Meta-Analyses
RMNCH&N	Reproductive, Maternal, Newborn and Child Health and Nutrition
UiO	University of Oslo
UNFPA	United Nations Population Fund

UNICEF	United Nations Children's Fund
WASH	Water, Sanitation and Hygiene
WHO	World Health Organization

1 INTRODUCTION

This thesis is a study about data use, its challenges and the potential of utilizing live data visualization tools in Zambia's public health domain. It primarily involves attending a data-use workshop and conducting interviews. The study identifies key challenges to data use as financial constraints, infrastructure constraints, poor data quality, limited data availability and accountability and lack of key data competencies by personnel. The implementation of live data visualizations tools, for the strengthening of District Integrated Meetings (DIM) and data use, was likely to impact both positively i.e strengthen and improve them than the current situation. However, while the study findings suggest that live data tools could potentially improve data use through improving data access, availability and quality, such measures would also be challenged by general financial and infrastructural constraints.

In addition, I develop a model for the synthesis of the potential introduction of live data visualization tools (see chapter, 6.2.7, page 79). The model identifies the relationship between the challenges identified and the live visualization tools and uses this to group them. Two groups of challenge are identified;

Reciprocal challenges - affect and are affected by the various challenges identified. These include poor data quality, lack of key data competencies by staff, limited data availability, access and accountability, poor partner coordination and lack of standardization or standardized processes/procedure.

Determinant challenges - limit the introduction of live data tools. These are infrastructural and financial constraints.

This chapter includes a statement of the general problem. The research context and the motivations – describing the purpose and the significance of the study - are to be discussed next, followed by the study's assumptions and research questions. Lastly, an overview of this thesis structure will be outlined.

1.1 Problem statement

Health management information systems (HMIS) are used to generate data health status, and health service provision data - of a population. The intention being; use of this data for planning and decision-making at every level of the systems - with emphasis on the level

where they are produced. The health information system is greatly inclined towards quantitative data. For example, mortality of a population overtime, description of health status among others (AbouZahr and Boerma, 2005).

“The HMIS in Zambia is essentially being used more or less as a vacuum cleaner; get data out of the facility but very little is actually able to go back down.” – partner representative

In practice, HMIS is not being adequately utilized at community, facility, or district level (Wickremasinghe et al., 2016) The situation is similar in the Zambian context. There might be a number of reasons for this. One is the absence of standardized process for their use (Harrison and Nutley, 2010; Qazi and Ali, 2011). Secondly, data may be incomplete or, not available or of a poor quality. (Braa et al., 2012; Nutley, 2012). Thirdly, data is used for different purposes such as task force surveillance rather than for decision-making (Feldman and March, 1981). (Wickremasinghe et al., 2016) states this (third reason) when he considers information use in an organization, although (ibid.) argues that this may apply to the field of health administration.

“People for the most part, they don’t use data to make decisions; they use data to validate decisions they’ve already made.” - partner representative on Zambia’s data use

In health systems, managerial or administrative decisions are not always based on the data (Walshe and Rundall, 2001; Pappaioanou et al., 2003). In Zambia, the case is no different. There is limited use of data in decision making; in addition to having challenges that are affecting and limiting data use. The aim of this is to identify how data is being used, identify key challenges affecting data use, and the prospects of introducing live visualization data tools to strengthen data use and data reviews. This thesis is therefore an exploratory interpretive study on district level data use and decision-making in Zambia.

1.2 Research context

This thesis is written with the Information System (IS) group at University of Oslo (UiO) in partnership with Akros-Zambia. IS-group is part of HISP-UiO who are the main developers of District Health Information System 2 (DHIS2) platform. DHIS2 is widely used in HMIS and currently implemented in over 40 countries (see chapter 3.3.2) (DHIS2, 2017c). Akros is a partner of UiO and uses DHIS2 in various areas such as sanitation, malaria etc. (Akros Inc., 2017c). Akros-Zambia is also a partner of MOH Zambia. My study and access to the field

was through these collaborations. The empirical study was done in Zambia, Lusaka province – Lusaka and Rufunsa districts – in February 2017. It involved people from MOH, partners of MOH, district, and facility level health workers.

1.3 Motivation

I will present my personal motivation for carrying out this research. I will also present the practical and knowledge motivation behind the study. Lastly, I state my assumptions of the study.

1.3.1 Personal motivation

Browsing through the available master projects on the university's website, I had two clear things in mind; I wanted to do a master project that would fully utilize my skills while gaining new ones, and at the same time make an impact in the world. I saw projects in Zambia dealing with improving and strengthening DHIS2 and HIS. I was interested in these projects because they fitted with what I wanted and could offer. Working with DHIS2 in a developing country was a big opportunity that I couldn't let pass. Being able to work and improve Zambia's DHIS2 instance, would give me the chance to make the impact I had pictured. I had little prior knowledge of DHIS2 and therefore saw this as an opportunity to learn and be conversant with the software hence gaining new skills. After a short talk with my (now) supervisor, we were able to settle on a specific project. A project that we both thought I would leverage; give and get the best out of.

1.3.2 Practical motivation

A lot of studies have shown that improving data use improves and strengthens HIS e.g (Braa et al., 2012). In a bid to strengthen its HMIS, Zambia embarked on strengthening its data use, HMIS and health service delivery in general. With this came the push to strengthen their data review meetings, referred to as District Integrated Meeting (DIM). One way to strengthen this was by switching from offline data visualization tools to live/online visualization tools. The shift from offline to live presentations and analysis would entail an adjustment to the routine of the DIMs to fully utilize these capabilities. Microsoft excel and PowerPoint were being utilized for data presentation, discussion and analysis.

Having briefly worked with the development of the Reproductive, Maternal, Newborn and Child Health and Nutrition (RMNCH&N) Scorecard (see page 27), it was therefore, deemed, necessary to attend a DIM (to get a feel of what it entails – identify the good and bad practices) before any adjustments to its routine would be made. Getting the real picture of the current situation was key, instead of assumptions-based changes. The focus areas settled on were district data use and its challenges, and the introduction of live data visualization tools at the DIMs.

1.3.3 Knowledge motivation

A lot has been written about improving data quality and the health systems data collection, for instance (Abajebel et al., 2011; Chitama et al., 2011; Braa et al., 2012). On the contrary, little has been written about how data is being used. The situation is similar when it comes to the utilization of live data visualization tools in data use and decision-making processes. (Braa et al., 2012) writes about Zanzibar and how use of DHIS2 positively impacted data use workshops.

In contrast, there is little literature about challenges facing such live data visualization tools, and how to strengthen data reviews/ data use workshops beyond infrastructure and financial constraints. My knowledge motivation hence stems from shedding more light on the influence, challenges and impact such visualization tools have on data use and data review meetings.

1.3.4 Assumptions

My assumption going into the study was that attending one DIM would give a general overview of what goes on in (all) DIMs. It was my assumption that practices of the DIMs were more similar than different. My assumption was however, challenged. During the study, I found that DIMs varied from province to province. This implies that practices varied. Some practices may have been close, while others may have differed with a huge margin. Some practices were common across the DIMs, according to the empirical data.

1.4 Research Questions

The study looks at district level data use, its challenges, as well as utilization of live data visualization tools in DIMs. It was therefore necessary to gain a deep insight of these DIMs;

the processes of data use, decision-making and the challenges. The research is thus guided by these principles. It looks at how data is being used, the challenges affecting data use, and the utilization of live data visualization tools.

The research questions are therefore;

- 1) *How is data being used (how and for what purposes), and what are the key obstacles to data use?*
- 2) *What are the prospects of using live data visualization tools to strengthen DIMs and data use?*

1.5 Thesis structure

Chapter 2 presents the adopted framework used as the lens on the empirical data, related literature on data use in and HMIS context, district level decision-making and the use of scorecards as a visual tool. I discuss the key implications from this related literature and highlight a few gaps that exist.

Chapter 3 describes the context and background of the study. I describe the relevant context of the country (Zambia) and district where the research was done. In particular I elaborate on Zambia's current health system, HMIS strengthening efforts, and data collection routines. I also explain the role of the Health Information Systems Program (HISP), and the District Health Information System 2 (DHIS2) in the Zambian HMIS context. Finally, I present some of MOH Zambia Cooperating Partners (CPs) as they play a central role in supporting and funding HMIS data use initiatives in Zambia.

Chapter 4 describes my methodology. The research approach, the research methods, data collection methods and data sources are presented and discussed. Data analysis, study limitation along with ethical considerations are addressed here.

Chapter 5 presents my empirical findings. Findings presented are on data use, capacity of personnel, infrastructure, data quality, Quality Improvement (QI), partner involvement, and funding.

In Chapter 6 I discuss further the empirical findings by applying the analytical framework. I present the results from the study and highlight the relationship between the two research questions.

Chapter 7 concludes and gives a summary of the thesis as well as suggesting areas for further research.

2 LITERATURE REVIEW

This chapter has two sections: the first section, presents related literature on data use-workshops in low-resource settings, visualization tools such as scorecards and finally a summary. The second section present the adopted framework as well as literature on challenges to data use in low-resource setting. Finally, a comparison of the adopted framework and the challenges are made in the form of a table.

2.1 Data use in Low-resource context: data-use workshops and data visualization tools.

The following section looks at related literature on data reviews and data use. It presents data on data use workshops/peer reviews, their relationship to data use, and scorecards. It also presents the impact they have on data use and decision-making. A summary concludes the section.

2.1.1 Data use workshops and Peer reviews

The notion of peer based review has a multiple definitions and functions, and is applied in diverse fields and studies (Grol, 1994). Peer based review (considered same as data-use workshop in this thesis) is seen as an evaluation by peers collaborating in a practice, intended to achieve continuous improvement Various peer review models have been used for improving clinical performance, and internal quality of care (ibid.). There is little information about data use workshops routine itself along with its goals and purposes. Countries such as Zambia, Malawi and Tanzania have data use workshops. In these cases, they're intended to be conducted quarterly with involvement of stakeholders from all levels (facility, national and partner).

A study done by (Braa et al., 2012) on improving data quality and data use through data-use workshops found out that data-use workshops with participation of data users themselves can improve HIS, as well as enhancing staff capacity for presentation, information use, and analysis for decision-making. Although not much is mentioned about the data-use workshops routine itself, in the study data was presented online using DHIS2 and its analytical tools such as pivot tables and graphs. Standardized analysis templates based on MDG and local strategies were also used. Improvements were then noted in some of the areas such as;

Data quality; use of data quality checks, as well as heated discussion on data quality issues in the workshops, contributed to improved data quality.

Data analysis and interpretation; in the beginning, presentation focused on raw data, but as competency in HMIS tasks (data analysis tools, targets and indicators) increased, self-assessment was strengthened. Emphasis on targets and indicators helped increase their use at local levels.

Integration; several databases were integrated and this allowed members to better understand the roles played by the various actors. This resulted in improved practical collaboration.

Problem-solving; through increased appreciation for improved data quality and more competency in performing HMIS tasks, District Health Management Teams (DHMT) were able to solve daily data management issues.

Presentation and practical computer skills; by use of DHIS for analysis, presentation and dissemination, the workshop participants improved their computer skills along with knowledge of basic software and computer hardware e.g backup. Presentation skills of the DHMT were initially weak but later on developed enough for them to run the workshop without outside facilitators. They were used to drawing graphs and using PowerPoint but standardized templates for presentations were developed.

“The workshops directly contributed to improvements in data coverage, data set quality and rationalization, and local use of target indicators.” (ibid.). The research thus proved their hypothesis - that more use of data leads to improved data quality, which leads to substantial information use innovations in. Eventually, the culture of non-use and poor quality of data was broken.

(Moyo et al., 2014) investigated the potential of peer based review strategy to improve data quality and data use in Malawi. *“Peer based reviews can contribute to strengthening HIS in developing countries through promoting learning networks, data quality checks, data use, and enhancing collaboration among managers.”* (ibid.). (ibid.) did a case study based on implementation of quarterly zonal-reviews aimed at strengthening HIS. The peer based reviews provided an opportunity for skills development of health workers, establishment of learning networks to improve coordination and collaboration among stakeholders and improved data quality and promotion of its use in decision making processes. (ibid.) states

that peer review has the potential to break the vicious circle of poor data quality and limited data use.

“The key to the effort is people, not technology, and that success lies in sharpening their skills, motivating them and enabling them to work effectively.” (Srinivasan, 1989) A study on how Primary Health Care (PHC) performance data use in monthly peer review improved the health workers’ motivation, skills and professionalism in Maharashtra, India (ibid.) It also found that restricting collection, analysis and decision-making programs to top management make them have limited use. Extending processes to include peers and lowest level workers increases their (processes) benefits.

2.1.2 Scorecard

Scorecard has emerged as a tool that allows various users to rapidly understand the meaning of the information and successfully use them in decision-making, planning, and strategic prioritization; particularly in resources-constrained settings (Garrib et al., 2008). A scorecard is defined as a *“visual display used in a strategically oriented performance measurement system that shows progress towards achieving strategic goals and objectives by comparing performance against targets and thresholds”* (Kaplan and Norton, 1996). It uses the traffic lights codes to express the organization performance and its link to its targets. It can be used to measure organization performance, improve transparency in decision-making processes, and to create a culture of responsibility at all levels within an organization (SENYONI and Jorn, 2017). Figure 1; Scorecard example (DHIS2, 2017a) shows an example of scorecard made in DHIS2.

ANC 1 Coverage		ANC 2 Coverage		ANC 3 Coverage		ANC => 4 Coverage		ANC IPT 1
Oct to Dec 2016 #	Jul to Sep 2016 #	Oct to Dec 2016 #	Jul to Sep 2016 #	Oct to Dec 2016 #	Jul to Sep 2016 #	Oct to Dec 2016 #	Jul to Sep 2016 #	Oct to Dec 2016 #
136.6	165.2	119.1	155	120.3	94.8	63.2	51.9	127.1
54.5	88.8	51.3	75.2	36.3	59	17.6	30.2	98.7
35.8	118	35.4	117.6	30.1	84.3	22.1	55.4	125.5
77.4	84.7	83.3	84.1	72.2	71.7	45.8	49.1	130.1
109.4	97.7	95.3	94.8	65.6	65.8	33.9	29.1	120.7
93.5	90	117	106.3	86.7	87.7	57.5	56	94.3
37.7	84.4	28.9	70	20.5	51.7	16.1	38.4	112.5
26.6	57.4	25.2	55.3	15.9	43.9	5.8	29.1	85
108	123.1	97.9	111.6	83.9	96.1	76.7	82	104.4
64.2	112.1	57.7	95.5	36.6	57.1	20.3	31.6	168.3
0.71	113.1	1.1	106.6	0.74	82	0.13	48.3	223.8
139.6	135	114.4	104.2	67.6	60.4	28.2	25	127.8
122.2	123.7	111.8	112.9	72.3	83.8	66.2	63.3	119.6

Figure 1; Scorecard example (DHIS2, 2017a)

(ibid.) studies the design and implementation of a Maternal and Child Health scorecard for the EAC. It enabled participating members to use the scorecard as a common tool for discussion and communication. It created a shared understanding and hence aligning s at the regional level. According to (ibid.), it has a mediator's capacity to support collaboration, communication and sharing of knowledge among the participating members.

Afghanistan introduced a balance scorecard (BSC) performance system in 2004 (Edward et al., 2011). It was used to manage the delivery of PHC services. A study by (ibid.) on the trends of the BSC found that it was successfully utilized. It was used to evaluate and improve health service capacity and service delivery by use of performance indicators. However, to ensure its continued relevance, effectiveness and efficiency measures, it needed to be reconfigured to accommodate changes in health systems' policy (ibid.).

A study by (Rosinski et al., 2013) on efforts to control diarrhea finds that (introducing) a new diarrhea control scorecard could help track progress, establish accountability and transparency, focus efforts towards the most effective interventions and bring out inadequacies in diarrhea control attempts to the attention of various stakeholders such as Ministries of Health and donors.

2.1.3 Summary

All in all, data-use workshops encourage self-assessment. They also present an opportunity to compare presentation and performances; pinpointing common problems relating to data quality and health services performance. Even further, they promote local involvement and improve data quality. In a technical sense, they provide feedback for HMIS development such as the revision of indicators, the design and development of new functionalities etc. They are therefore a very important tool as far as HMIS and data use is concerned.

There are various ways of creating a scorecard. They include; the Alma scorecard (ALMA, 2017), making it on excel such as the one seen in fFigure 1; Scorecard example

(DHIS2, 2017a)¹, use of pivot table on DHIS2 (DHIS2, 2017a) - just to mention a few. So far literature suggests that the utilization of a scorecard improves data use and health service delivery; although their sustainability has to be considered in their design. As mentioned above, it's an emerging tool. It thus needs more and further research is therefore

needed to identify its main impact and contribution to data use and decision-making, especially in low-resource settings.

2.2 Conceptual framework

This section presents the conceptual framework that is used for data analysis. Moreover, it presents data use and decision-making at the district level – low-resource settings. IT also presents challenges to data use. A summary then discusses the relationship between the conceptual framework interventions and challenges presented.

2.2.1 Data use and decision making

(Nutley, 2012, p.2) defines the “‘use’ of data as the analysis, synthesis, interpretation, and review of data for data-informed decision-making processes, regardless of the source of data.” It describes and defines interventions (within a framework) to improve the use of data in the decision-making process. Building on a framework by (Aqil et al., 2009) it provides a conceptual framework shown by Figure 2; The conceptual framework (Nutley, 2012). The framework identifies specific interventions that can improve the demand and use for data from health information data sources.

Since the identified framework and the logic model are broad and comprehensive, 6 out of 8 interventions, from the framework, were settled upon for this study. The choice was informed by empirical data collected, preliminary data analysis and early literature review. The interventions that were not selected are; “*Assess and improve data use context*” and “*identify information needs*”. The framework is an intervention framework but it’s used as an assessment framework of an exploratory study in this case. More on why this framework was adopted is presented in *chapter 4.4*.

Assess and improve data use context was not selected as it’s closely tied to the framework – which has been developed as an intervention framework; not a framework for an exploratory study. It’s also closely associated with the power to change the DIMs e.g. their routines. *Identify information needs* was not chosen because it’s very broad and falls out of the scope of this study. My assumption is it would require more research and ethnographic study. It requires going to the facilities and spending more time there to actually find out what information is needed. More research is needed in this area to uncover the information needs.

Last but not least, the two interventions don't directly point to a specific problem or challenge in this study.

Although *improve data quality* and *improve data availability* are separate in figure 2, they are initially discussed as one in the conceptual framework. However, for data analysis and discussions, they are slightly revised; split into 2(as in figure 2.) More on this revision and examples can be found in chapter 4.4.

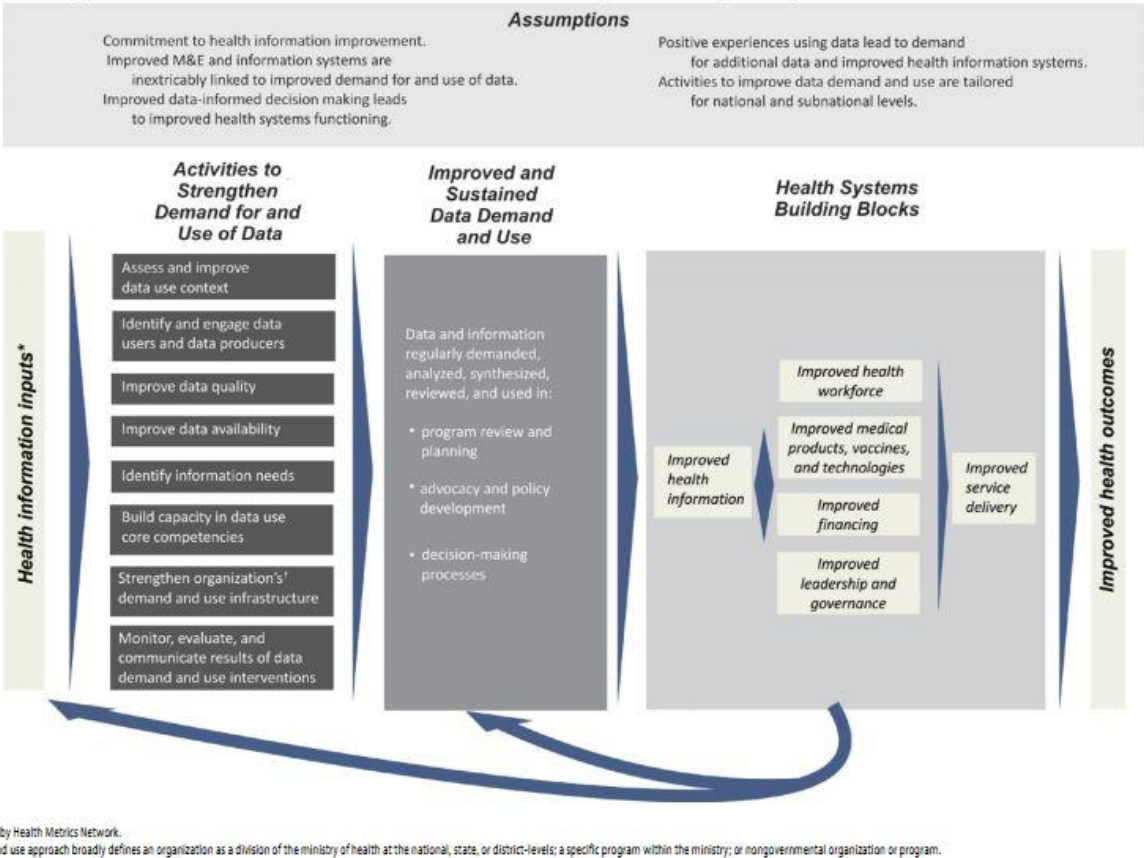


Figure 2; The conceptual framework (Nutley, 2012)

The 6 interventions are;

- **Engaging data users and data producers**

Data users – those who use data in program development and improvement, and data producers - those who design, implement, and manage information systems and research; lack of interaction between data producers and data users leads to breakdowns in the decision-making cycle (Lomas, 1997; 2007).

When data users and data producers collaborate, they become more aware of available data sources, data collection methods and processes, and the quality of their data. They have the chance to overcome barricades to data use, besides improving the sharing of data resources. By understanding who the data users and data producers are, then linking their work together; the Information cycle is strengthened. Moreover, the value of data with regards to program improvement becomes clear (Lomas, 1997; Berg, 2001; Lomas, 2007; Patton, 2008; Blanchard and Aral, 2010; Koon et al., 2012).

- **Improving data quality; improving data availability**

Poor data quality leads to drop in demand for data, hence crippling the cycle of data informed decision making (Foreit et al., 2006; Braa et al., 2012). There is therefore, need to develop, communicate and implement data quality procedures, in addition to training and re-training of health personnel on data quality techniques and procedures/measures. Consistent data use occurrence requires high quality data, in that the data users are assertive that the data they are using is accurate, timely and complete. Without quality data; informed decision making will not occur, and program efficiency and effectiveness will suffer (Mavimbe et al., 2005).

There is also the need to improve data availability in terms of synthesis, communication, and access. Data users have different roles, different information needs, different interest levels in the decision-making process (Davies et al., 2011). Well-designed information systems often comprise of information technology infrastructure, report templates and policies to support the communication of analyzed data through dissemination and feedback procedures. Data users' ability to access and share data easily is always under-developed in these systems. Data analysis, access and communication need to be ameliorated; to support use of the information in decision making (Aqil et al., 2009).

- **Building capacity in data use core competencies**

Competencies include skills in data analysis, presentation, interpretation, synthesis and the creation of data-informed programmatic recommendations. Data users often struggle with these competencies. They therefore need training on analysis, critical review and data interpretation hence understanding the data they possess, data they will need and when, so that they can demand it. Data producers often receive short term training (as part of M&E training) with limited follow up. Skills are therefore not totally developed. These newly

trained personnel are thus not well equipped to apply the new skills in their work setting (Clotteau et al., 2011).

- **Strengthening the organization's data demand and use infrastructure**

Colleagues, data users and data producers function in an organizational context (Aqil et al., 2009). The organization is administrated by rules, processes, values, and systems. These rules, processes, values, and systems have the capability of supporting or impeding an individual's capacity to use data in decision making (ibid.). An organization that provides clear guidelines for data quality processes, and define roles responsibilities and roles related to using data, will strengthen other interventions (in place) to improve data informed decisions making. Standard operating procedures and policies, that govern how work is accomplished, should distinctly state the role and value of data in an organizational setting.

- **Monitoring and evaluating, communicating data demand and use successes.**

Data users are more likely to use data if they highly value data informed decisions making. Stakeholders and decision makers will only use data for decision making if only they put value on data (Lavis et al., 2006). Training or positive messages about benefits of using data in decision making or positive experiences of data informed decisions making can be used to build this value. Frequent use of data for decision-making increases the data demand. (Foreit et al., 2006).

2.2.2 District level data use and decision-making

HMIS used in low-income setting countries collect a lot of data. As mentioned earlier, data use at district and community level is low. There are several reasons for this e.g poor data quality (Braa et al., 2012). Moreover, much as been written about data use and district decision making using data collected by HMIS. For example, (Wickremasinghe et al., 2016) did a systematic literature review, following PRISMA statement and guidelines (Moher et al., 2009), on district decision making for health in low-income settings (e.g Ethiopia, Nigeria, Zambia etc). It explores manners in which health managers, and district administrators use health data to make decisions. Additionally, it outlines the decision-making tools used, and pinpoint challenges faced when using these tools.

It found 12 examples of tools to assist decision making at the district level. At least all of them had two key stages: identification of priorities, and development of an action plan to address them. Those with more steps, four incorporated steps to review or monitor action plans settled upon (suggesting the use of HMIS data). Challenges to the decision-making processes identified, were categorized into 3 primary categories;

- **The availability and quality of health and health facility data**

Unreliable data, untimely data, difficulties accessing data and challenges agreeing on the minimum data set for inclusion in HMIS were some of the challenges encountered.

Examples include; (La Vincente et al., 2013) where lack of data and data accessibility difficulties were reported; the cases of (Maluka et al., 2010; Nnaji et al., 2010; Maluka et al., 2011) unreliable data and untimely data production couldn't contribute to decision-making process.

- **Human dynamics (Social and political dynamics in the decision-making process)**

Political conflicts would lead to decisions being made, but not based on data and thus some issues remained unsolved. Following of the national level goals, and priorities and ignoring local data was also noted. Training in addition to informal mentoring was needed - to develop administration, management and other skills related to planning.

Examples include: In Nigeria, (Nnaji et al., 2010) notes that neither the private sector representative nor the community were wholly involved in decision-making; (De Savigny, 2008) states that capacity strengthening (through training) was needed – besides emphasizing that tools are important but not sufficient; in (Murthy, 1998) local data was ignored for decision-making, instead national priorities were used.

- **Financial constraints.**

For instance, discontinued plans and expenditure due to lack of flexible funds; competitive and time-consuming process of securing funds; limited overall funding. It was easy to lose motivation over time.

Examples include: in (Maluka et al., 2011) delays in funds disbursement from the central government constrained the decision-making process. (ibid.) notes a disconnection of plans and expenditure due to the lack of flexible funds.

Review of the data revealed three recurring features: one, relevant and good quality data are essential. Two, a structured decision-making process needs to include activities/events that will aid building of consensus. Three, the community can have a well-defined role. *“Transparency and accountability are underlying factors for a standardized decision-making process.”* - (Wickremasinghe et al., 2016). It then recommends that the decision-making process is standardized to help replicability - which was not the case in any of the studies they reviewed.

“The use of a structured process can not only help decision makers make priority decisions, but can also increase the demand for, and the availability and quality of data.” (ibid.) To overcome the challenges to decisions-making they suggest that; health systems be decentralized for better autonomy to make and implement decisions (including financial autonomy); timely, accurate and relevant data for decentralized decisions making; equipping stakeholders with knowledge and skills to carry out their tasks, and use of structured process.

2.2.3 Summary

The challenges identified can be related to some of this study’s objective; research question 1. It was therefore necessary to do some analysis on the challenges identified by the (ibid.) and try fit them into the conceptual framework; during literature review. The 3 categories of challenges from (Wickremasinghe et al., 2016) are placed into the 6 interventions from the framework as shown in Table 1; Summary of framework. This was helpful in deciding the choice of the framework; as it was preliminary data analysis. In addition, it helped with structuring the empirical data later on during data analysis.

Category	Framework intervention
The availability and quality of health and health facility data	<ul style="list-style-type: none"> • Improving data quality; improving data availability
Human dynamics (Social and political dynamics in the decision-making process)	<ul style="list-style-type: none"> • Engaging data users and data producers • Building capacity in data use core competencies • Monitoring and evaluating, communicating data demand and use successes. • Strengthening the organization’s data demand and use infrastructure
Financial constraints.	Cross cuts along all the interventions

Table 1; Summary of framework

There is however, limited literature on the implementation of the (Nutley, 2012) framework. It’s therefore difficult to tell whether upon adoption and implementation the framework (as a whole) would be successful or unsuccessful. This can thus be seen as a limitation of the framework. By looking at (Wickremasinghe et al., 2016) which has extensive case studies, it’s quite clear that the findings, challenges and suggested interventions tend to align with the framework alluding to a trend (or some of such). I therefore, settled on the (Nutley, 2012) framework as my analytical lens of the data collected.

3 BACKGROUND

This chapter presents the context of this study in detail. The country Zambia, Lusaka province and Rufunsa district are presented. I also elaborate on Zambia’s current health system, HMIS strengthening efforts, data collection routines. I also explain the role of the Health Information Systems Program (HISP), and the District Health Information System 2(DHIS2) in the context of Zambia HMIS. Finally, I present some of CPs that play role in HMIS data use initiatives in Zambia.

3.1 Zambia overview

Zambia is a landlocked country located in the south central African region. It has a land area of 752.6 thousand square kilometers (Central Intelligence Agency, 2017) and a growing population of around 16 million (Central Statistical Office, 2017). It has a population growth rate of about 2.9% (ibid.). It’s bordered by DRC and Tanzania to the north; Malawi to the east; Botswana, Zimbabwe, and Namibia to the south; and Angola to the west. Figure 3 shows a map of Zambia and her neighboring countries. Zambia’s economy is driven by mining, agriculture, construction and transport. The country is divided into 10 provinces and has 103 districts. Life expectancy at birth is 52.5 year (ibid.).



Figure 3; Map of Zambia and her neighboring countries. (Google, 2017)

English is the language of communication and instruction in Zambia. However, there are also local languages such as Bemba, Lozi, Kuvale, Kaonde, Lunda, Nyanja and Tonga etc. Zambia is an urbanized country; with about 40% of the population living in urban areas (Central Statistical Office, 2017). Majority of Zambians continue to live in poverty. As of 2015 incidence of poverty is at 54.4% (ibid.). Even though the data shows there has been a decline in the poverty from the year 2004, poverty in rural areas is at 76.6% and 23.4% in urban areas

In matters infrastructure, Zambia suffers a lot of challenges in terms of electricity, roads and ICT. Rural areas are more affected than urban areas. Underdevelopment of rural areas is credited to having a highly-centralised system of development delivery among other factors. Zambia is largely dependent on solar and hydro energy. This has led to power shortages, especially during the dry season. Moreover, poor management of water resources contributed to the same which in turn affected industrial productivity (Central Intelligence Agency, 2017). Only 31% of households are connected to electricity by 2015 (found under living condition statistics) (Central Statistical Office, 2017).

Zambia has tarmacked roads connecting the major cities and international borders. It was ranked 22nd of 54 in the AFD Index for 2016 (Charles Lufumpa et al., 2016). It's estimated that about 77 out of 100 inhabitants use cellular mobile (Central Intelligence Agency, 2017). 22% of the population use the internet as of 2015 (ibid.).

The seventh National Development Plan (7NDP) was formulated to achieve the goals of vision 2030; create a resilient and diverse economy for sustained growth and socio-economic growth transformation (Ministry of National Development Planning, 2017). All sectors of the economy (agriculture, mining, fishing etc) thus use the 7ndp as guiding tool in their overall operations

In addition, Zambia has traditional leaders; the chiefs. In total, they're 288 chiefs (Ministry of Chiefs and Traditional Affairs, 2016). Chiefs are the head of chiefdoms. They are under the Ministry of Chiefs and Traditional affairs which acts as an advisory body to the government on traditional and customary issues. It may also advise on matter referred to them by the president. In the community, the chiefs command a lot of respect and are considered royalties. Chiefdoms are passed down through inheritance. It's a norm to give gifts such as maize, sugar, cooking oil to the chiefs when you go visit them. They reside in chief's palaces and welcome an audience from the government/NGO officials.

Community interventions may fail if the chief is not engaged. For example, Akros used the chiefs to help in the carrying out of the Community-led Total Sanitation (CLTS) project (DHIS2) - the projects It seeks to eliminate water and food contamination (improve sanitation). Figure 4 shows a chief with the tablet used to track the sanitation levels.



Figure 4; A Zambian Chief with a tablet used to track his chiefdom’s performance

Lusaka province is one of the 10 provinces of Zambia. It’s located in the south-central part of the country and hosts the country’s capital, Lusaka, also the capital of the province. Lusaka city acts as a hub for services, businesses and organizations (Ministry of National

Development Planning, 2017). It's bordered by Zimbabwe and the smallest in term of area. Figure 5 shows Lusaka province and some of its major towns. It has a population of about 2.7 million people as of 2015 and is the most populated province (Central Statistical Office, 2017). It had a population growth of 4% as of 2014. Lusaka province has 5 districts.

Rufunsa is one of the new districts in Zambia. It's located in Lusaka province and was carved out of Chongwe district. It's located in the north-east part of Lusaka province and is bordered by eastern province of Zambia and Mozambique to the east. Rufunsa is mainly a rural district with vast distances between facilities. It has 22 health facilities.



Figure 5; Lusaka province (adopted from (Unicef Zambia, 2015))

3.2 Health System in Zambia

“The MOH’s focus is the provision of a continuum of care with particular emphasis placed on strengthening health systems and services using the primary health care (PHC) approach.” (MOH Zambia, 2017)

Zambia’s health services are provided by four main players: the government, the mines, private providers (for-profit), and faith-based providers (not-for-profit) (ibid.). The public sector is the biggest provider of health services (ibid.). The 2017-2021 National Health Sector Strategic Plan (NHSP) provides guidance on all health interventions in the health sector. Zambian health sector has been implementing reforms in a bid to improve service delivery. Decentralization where health delivery was delegated to the district, has been at core of these reforms (ibid.).

As stated earlier, Zambia has 10 administrative provinces and 105 districts. Provincial health offices (PHOs) (10), DHOs (105), and statutory bodies provide health management in the country. Zambia therefore has (ibid.);

- 8 third-level hospitals – all owned by the government
- 34 second-level hospitals – 26 Government-owned, and 8 Churches Health Associations of Zambia (CHAZ) owned.
- 99 first-level hospitals,
- 1,839 health centers (see example in figure 6) and 953 health posts.



Figure 6; a rural health center in Zambia

The health service delivery system mirrors the political administrative structure. The national level is tasked with general coordination and management, resource mobilization, strategic planning and policy formulation. The PHOs are the links between the national and district levels. They are responsible for backstopping provincial and district health services. The Provincial Medical Office (PMO), DHIOs, third and second-level hospitals, central hospitals, and training schools receive funds directly from Ministry of Finance (MOF) (ibid.). Figure 7 shows a visualization of the health system.

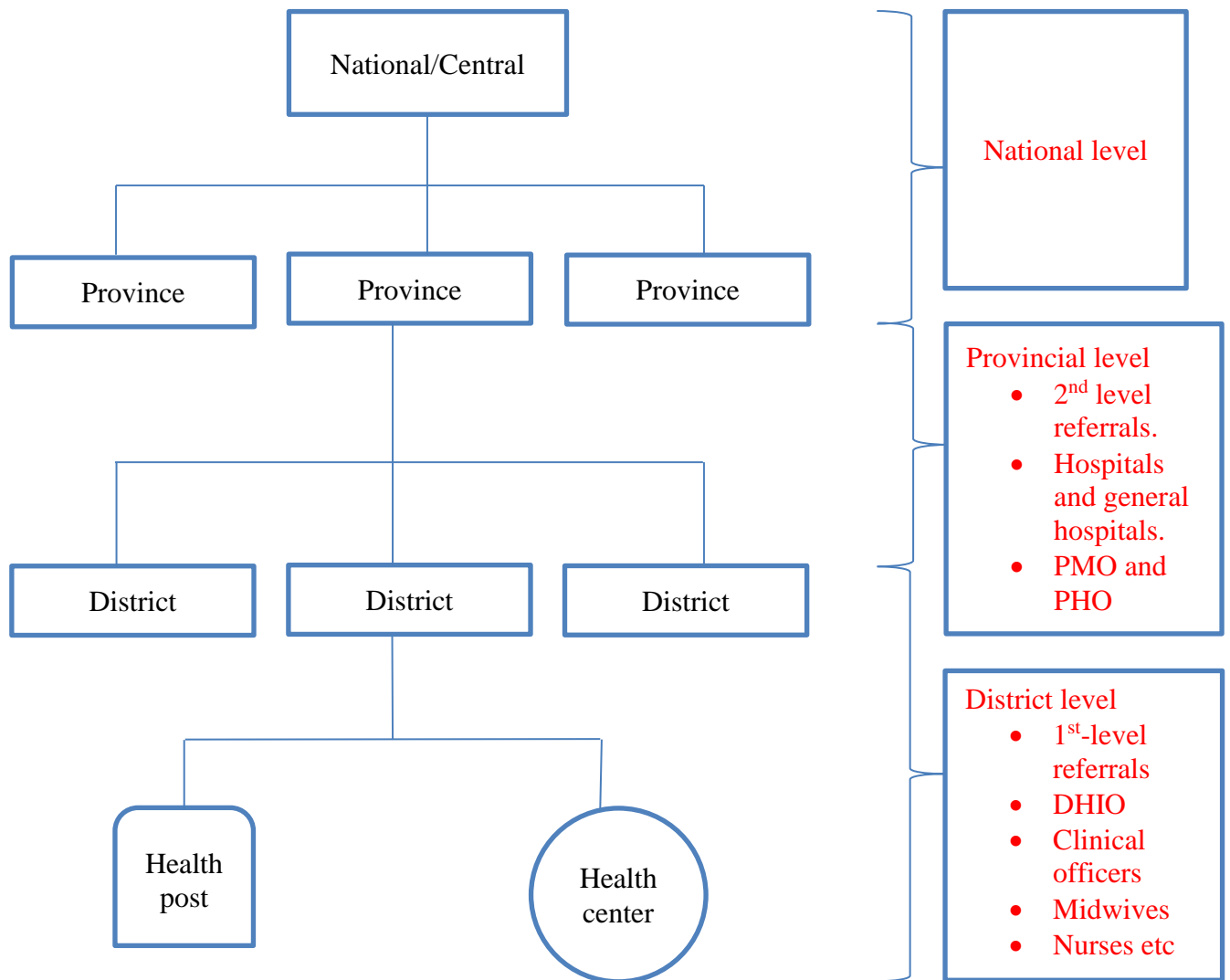


Figure 7; a visualization of Zambia's Health System

The health system in Zambia has been decentralized to district level. Nevertheless, the national level will provide standards in construction and renovation of health infrastructure, and in-service training of health workers (ibid.). MOH provides technical guidance on human resource, quality of care, rational of drug, health facility management and good governance at the district level. The districts are responsible for administrative supervision of health facilities and data compilation; which will be shared with the MOH (ibid.).

In addition to these official services, we have volunteer community health workers (CHWs) working in rural areas who provide basic health care services and have with them small stock of medicine and necessary equipment. For instance, they (CHW) have been used in malaria control program by Akros (Akros Inc., 2017d). Community Health Assistants (CHAs) are also a group of health workers who are being used currently. They receive training thought he government and afterwards are posted to the community. They help the health-post staff and the CHW with their work. Additionally, Zambia has volunteers that help in tracking,

collecting and reporting health data for various programs. They are often referred to as Community Champions (CCs) or champions (see figure 8).



Figure 8; CC at work

During my trip to Zambia, I noted that the introduction of CHAs improved the performance of some of the indicators. Furthermore, I noted very vast distances between health facilities (during my visit to Shibuyunji District). This meant that the residents had to travel long distances to access health services; in a way discouraging frequent utilization. On the contrary, CHWs and CHAs bring the service to the community hence more utilization.

3.3 Health Information Systems Program (HISP) and District Health Information System 2 (DHIS2)

3.3.1 Health Information Systems Program

HISP is a global network/movement to improve HIS in developing countries. It started in South Africa in the 1990's (HISP UiO, 2017a). They design, implement and sustain HIS following a participatory approach. They also support local management of health care delivery and information flows in regions, countries, provinces, districts and facilities. HISP at UiO is one of the leading organizations in this movement; they do implementation support,

capacity building, research (PhD and masters). There are several HISP groups around the world. Some of them are in Uganda, Vietnam, Bangladesh, Tanzania etc. (HISP UiO, 2017b).

3.3.2 District Health Information System 2

“DHIS 2 is the preferred health management information system in 30 countries and even more organizations across four continents.” – (DHIS2, 2017c).

The development of DHIS2 is at the core of the HISP movement. The core development team is hosted by HISP at UiO (HISP UiO, 2017a). DHIS2 is a tool (software) that allows data collection processing, analysis and visualization from several sources for different user groups. It’s a web-based software, in addition to being used on J2ME-applications and Android (DHIS2, 2017e). It’s an open source software distributed under the BSD license meaning it’s free to install, use, modify and distribute (DHIS2, 2017d). DHIS2 is presently implemented at different levels in 47 countries. Figure 9 illustrates where DHIS2 is being implemented.

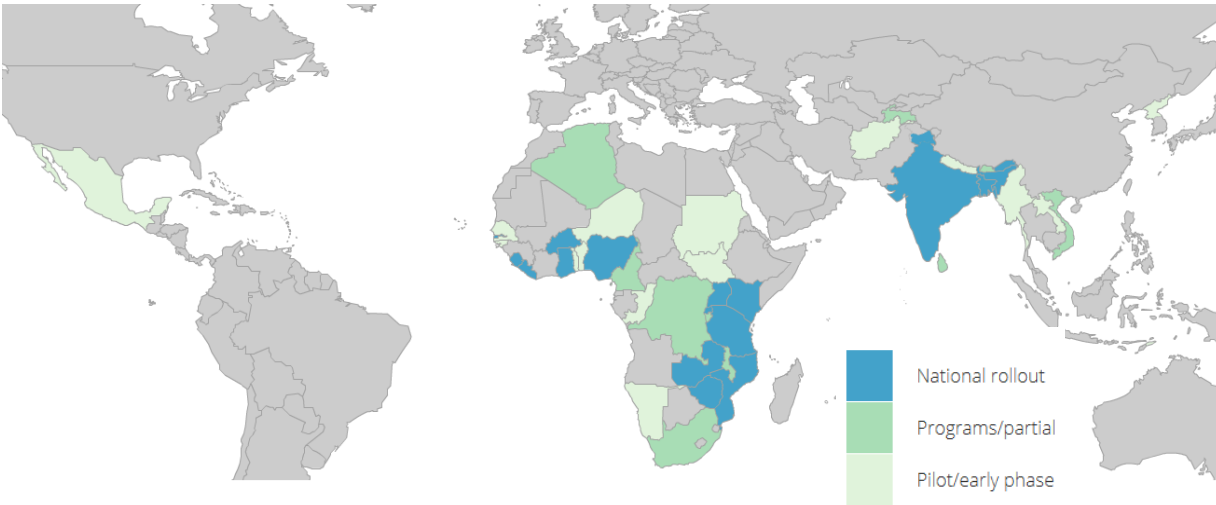


Figure 9; DHIS2 role out (DHIS2, 2017c)

DHIS2 is as a data warehouse and can be integrated with other software to achieve this (Braa and Sahay, 2012). Figure 10 shows integration of DHIS with other technologies. As listed by (Heywood and Rohde, 2002) states that DHIS has a number of principles; it supports the district level PHC approach, encourages decentralized information use by health workers, collects essential data, includes all the service providers, supports and is integrated with other IS.

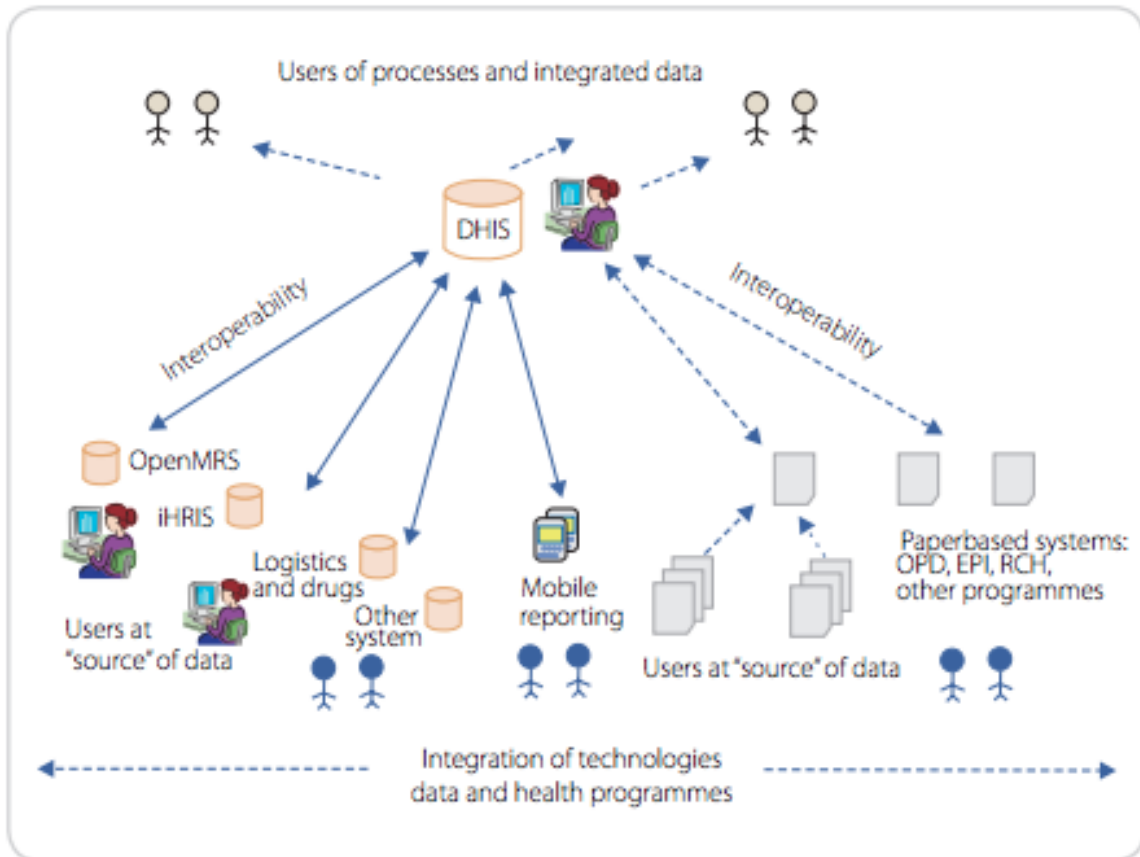


Figure 10; DHIS as a data warehouse (Braa and Sahay, 2012)

3.3.3 Visualization tools

DHIS2 allows users to aggregate and manage routine data. You can configure and set-up various aspects, such as data entry forms, indicators and reports, for a comprehensive data management. In addition, DHIS2 has several features for data visualization which help you bring meaning to your data. They include; charts, dashboards, pivot tables etc (DHIS2, 2017b).

Dashboard and Scorecard

Dashboards are a data visualization feature in DHIS2 that allows you to place your favorite reports, charts and maps for ease/swift access. It has an integrated message functionality that lets you communicate with other users directly (ibid.). You can also access the data interpretation feed; comment and start discussions and thus have a better understanding of your data (ibid.). Figure 11 shows an example of a dashboard from a demo version of DHIS2.



Figure 11; dashboard example (DHIS2, 2017b)

As discussed in *chapter 2.1.2*, scorecards have emerged in the HMIS context as a popular data visualization tool and the use of dashboards is promoted by various health programs. There are a number of ways to create scorecards in dhis2. One is using the scorecard app. I could not find literature and sources on its development and implementation. According to one informant, plans are underway to integrate it with the main DHIS2, and roll it out to the general public. The second way is by use of pivot tables (DHIS2, 2017a). Pivot tables allow you to analyze data along all data dimensions. Elements are placed in columns and rows. Figure 1 (see page 9) shows an example of a scorecard made using pivot tables.

Reproductive, Maternal, Newborn and Child Health and Nutrition Scorecard

This scorecard was developed for/under the MDGi project (see chapter 3.4.1). It is developed in DHIS2 and is meant to track the performance of various indicators under RMNCH&N program. Figure 12 shows a RMNCH&N sample scorecard.



Figure 12; RMNCH&N sample scorecard

3.3.4 DHIS2 in Zambia

Zambia has recently migrated to DHIS2 for its national system and thus supporting collection of data from all facilities in the country. DHIS2 utilization also spans across to various facility data collection programs and projects by CHW (DHIS2, 2017c). Some of the MOH partners also have access to the national level instance of DHIS2. Zambia is currently running on DHIS2 version 2.27 (MoH, 2017). DHIS2 is being implemented at all districts in Zambia. It's implemented at the district level, and at some hospitals. There is no direct entry of data into DHIS2 from the facility level (Akros Inc., 2016).

3.4 MOH Cooperating Partners

Zambia has a number of development partners in different various sectors of the economy. Cooperating Partners (CP) as they are called in (7NDP). In this section, I look at some of the partners that work with MOH. I specifically look at the CPs that are somehow involved in this study.

3.4.1 UNICEF and Millennium Development Goals initiative (MDGi)

The Millennium Development Goal Initiative's (MDGi) is a programme that seeks to improve the quality and availability reproductive, maternal, newborn and child health and nutrition (RMNCH&N) services in Zambia. It's present in 11 districts of Lusaka and Copperbelt Provinces (Unicef Zambia, 2017). See figure 13 for a map representation of MDGi Presence. MDGi is implemented under the leadership of MOH, and the Ministry of Community

Development, Mother and Child Health along with close collaboration with UNICEF, WHO and UNFPA (Unicef Zambia, 2015).

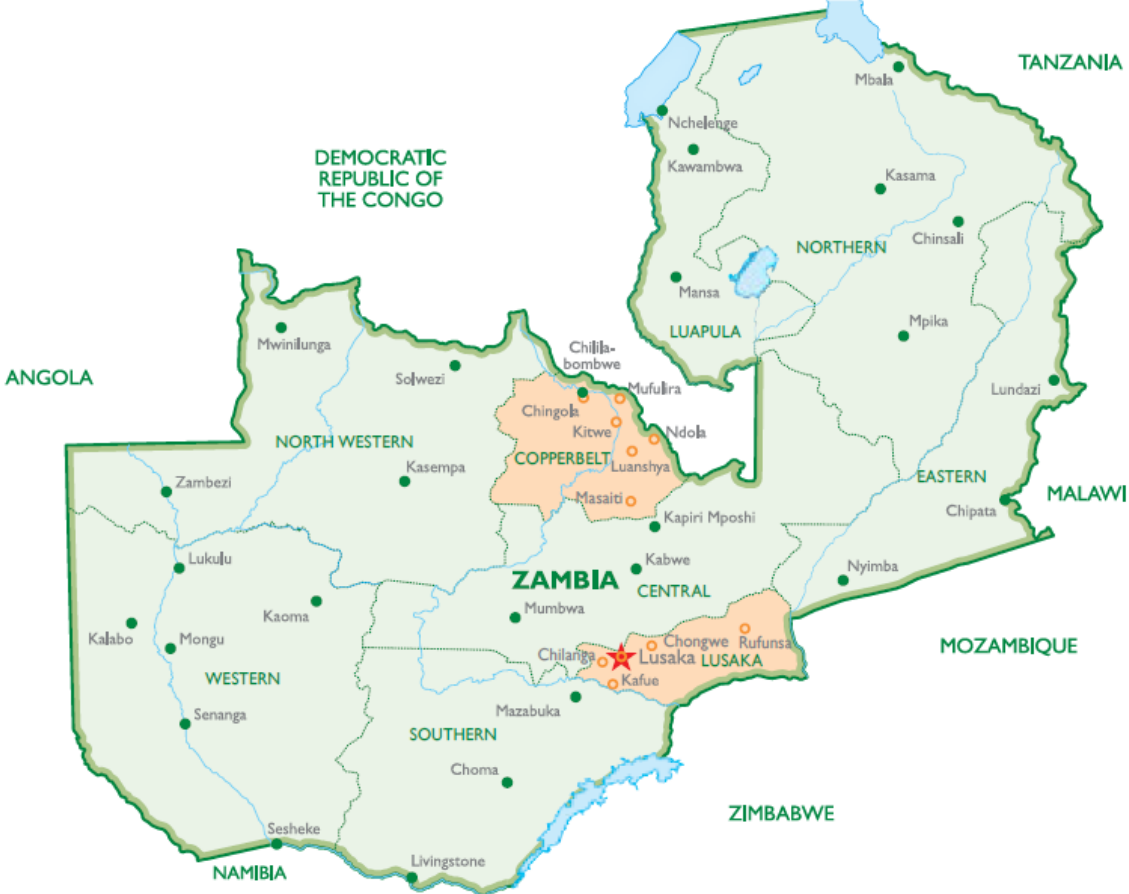


Figure 13; MDGi presence (Unicef Zambia, 2015)

MDGi is funded by the European Union. UNICEF manages the overall support of UN support to the programme, besides providing technical support for key aspects of maternal, newborn and child health, nutrition, adolescent health, and health system strengthening. UNFPA offers technical support in adolescent health area. WHO delivers technical assistance in the adaptation of national guidelines in newborn and child health, as well as with “training of trainers” (ibid.).

MDGi’s core activities are (ibid.);

- Cross cutting activities – activities such as health workers training, updating health standards and practices,
- Nutrition activities – improving nutrition outcomes

- Adolescent and youth friendly services activities
- Maternal, newborn and child health
- Communication for development activities
- Health systems strengthening activities – activities such as support of HMIS, capacity building

3.4.2 Akros

“Akros establishes data-driven systems that improve the health and well-being of disadvantaged communities” – (Akros Inc., 2017b)

Akros is a small for-profit organization which works with various donors, such as UNICEF, USAID, and government ministries to achieve its mission. It has a presence across the southern Africa region although most of its staff members are located in Lusaka, Zambia. It creates data-driven systems to improve the health, and welfare of disadvantaged communities. Akros’ projects have enabled it to develop working relationships at central levels in Angola, Botswana, Malawi, Mozambique, Namibia, South Africa, Swaziland and Zimbabwe (Akros Inc., 2017a).

Akros focus areas are (Akros Inc., 2017c);

- Malaria prevention - Akros uses a number of tools to combat malaria: Entomological surveillance, genotyping, indoor residual spraying tools and community surveillance.
- Water & Sanitation - Akros along with UNICEF Zambia and Ministry of Local Government and Housing (Zambia), to develop a monthly mobile surveillance system that shows precisely which villages do not have adequate latrines. An example is CLTS under the water and sanitation programme (WASH) project (DHIS2).
- Health Data Systems - Akros is involved with various activities: Helps MOH with data collection, transmission and analysis, teach partners on how to use HMIS, and assist in program management.

3.5 HMIS strengthening project

(Aqil et al., 2009, p.226) refers to HMIS “*any data collection conducted regularly with an interval of less than 1 year in health facilities and their extension in the community.*”

Strengthening HMIS is one of the core functions of the MDGi project. Akros was thus contracted by MOH to carry out an assessment (Akros Inc., 2016) of the 11 MDGi districts. The assessment was done partially with MOH, for MOH.

The assessment found challenges in term of decision-making, data quality, HMIS among other areas. There is thus, a comprehensive strategy to tackle the three objectives of the HMIS strengthening. These objectives are;

- Strengthening human resource (HR) capacity – to support the consistent, timely flow of quality data, and feedback through the health system hierarchy.
- Broad DHIS2 support - from hardware support to software configuration and HR capacity, in order to support and improve programmatic decision making.
- HMIS system-wide support - to increase demand and use of quality data, planning and intervention management; throughout the health system hierarchy.

The assessment was used to guide the implementation of the project; decisions were made based on the current state facts found at facility, provincial and national levels.

3.5.1 Quality Improvement

QI is the process of engaging appropriate methodologies and quality management tools to close the gap between current and expected levels of performance(USAID Systems for Better Health, July 2016). In the health sector, the reach and scope of QI is translated to measurable improvements in health care services and the health status of targeted patient/client groups. The World Health Organization (WHO) considers QI a permanent and on-going obligation and a priority for health service development.

Figure 14 shows the structure of QI committees for the various MOH levels. MOH has institutionalized the QI system through the following initiatives (just to mention a few) (USAID Systems for Better Health, July 2016);

- Facilitating implementation of QI projects to address gaps in health service delivery
- Strengthening and expanding clinical mentorship
- Establishment of QI coordination mechanisms with defined roles at all levels

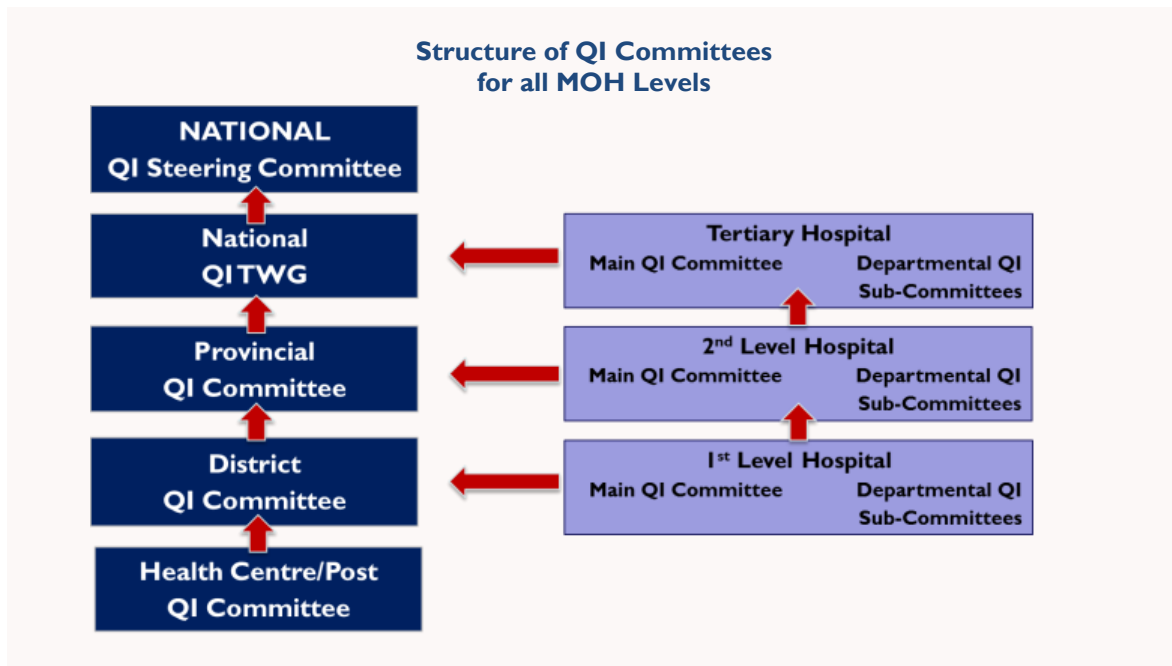


Figure 14; QI committees structure (USAID Systems for Better Health, July 2016)

3.5.2 District Integrated Meeting

DIMs are data review/ data-use workshops in Zambia. They are intended to be quarterly although this varies due to various reasons such as financial constraints. They are attended by facility staff, district staff, national level representatives and partner representatives. They normally occur over a two-day period. Different partners, and different district have different ways on carrying out these DIMs. DIMs are discussed in detail in *chapter 5* as part of my observations in the field. My attempts to get access to MOH documents on DIMs such as their history, their objectives etc were unsuccessful. According to informants, such documents don't exist; if they do, they did not have access to them.

3.6 Summary

This chapter presented a broad overview of this study's empirical setting. It highlighted important characteristics with the country, the province and district, its HMIS structure and health system. It also highlighted the HMIS strengthening efforts which is a practical

motivation for this research. In addition, it mentioned some of the visualization tools especially those available through DHIS2. Some of the partners' efforts and involvement with work that affects this study are also mentioned. The next chapter (methods) describes the various methods employed to conduct the research

4 METHODS

In this chapter, I present how the study was carried out. I begin with the research design, where I discuss the approach and the choice of this approach. The role of the research and reflexivity is also discussed under this section. Research methods are next to be presented – case study and its choice. Thereafter will follow a section on data collection method and procedures; including sources of data. How data was analyzed and structured is then presented. Ethical considerations are final to be discussed, before a summary concludes the chapter.

A quick reminder of the objectives of this research - this study is an *exploratory* study on data use, district decision-making and live visualization tools impact on data use. It therefore, asks the two questions:

RQ1: How is data being used, and what are the key obstacles to data use?

RQ2: What are the prospects of using live data visualization tools to strengthen DIMs and data use?

4.1 Research Strategy

4.1.1 Research approach

When doing research, you can choose between quantitative or qualitative approaches. Data that can be expressed in entities or pure numbers i.e more/less, few/many etc is held as quantitative data, while data that cannot be expressed in this manner is held as qualitative data (Grønmo, 1996). A qualitative study design facilitates the understanding of why people act the way they do. Simultaneously, it derives a deeper insight into how they experience and interpret the world they live in. Qualitative studies therefore, allow the participants to respond to questions of an explorative nature; such as how and what (Malterud, 2003).

I have chosen to use a qualitative research approach as the basic method. Drawing on informants' thoughts, feelings, perceptions and experiences (with respects to cultural, social and economic conditions) offer a more holistic understanding of the phenomenon (data use and decision making) hence, a qualitative research design was considered to be most appropriate for this study. Observations, in-depth interviews and document analysis were

done to contextualize the findings, and contribute to the mastery of the phenomenon under study from various angles.

Qualitative studies can be divided into 3 different approaches; positivistic, interpretative or critical approach (Klein and Myers, 1999). Positivistic which is focused on measureable effects, critical which is focused on social critique and bringing restrictive conditions of the status quo to light, or interpretive which *“assumes that our knowledge of reality is gained only through social constructions such a language, consciousness, shared meanings, documents, tools, and other artifacts”* (ibid.). Moreover, interpretive research does not pre-state variables, instead it centres/concentrate on the convolution of human sense-making as the state comes out (Kaplan and Maxwell, 1994).

In an IS settings, interpretive methods are *“aimed at producing an understanding of the context of the information system, and the process whereby the information system influences and is influenced by the context”*(Walsham, 1993, p.4). (Klein and Myers, 1999) states that conducting interpretive research, in an IS setting, helps the researchers understand human thought and action in organizational and social and environments. It has the capability to produce deep insights into IS phenomena; such information management and IS development.

The philosophical foundation of this thesis is thus interpretive, as I attribute that knowledge is accessible through social constructs like language, consciousness and shared meanings. The descriptions provided in this thesis are the result of formal interviews and observations, which, again, is based on the subject’s own interpretation of a situation hence interpretive in nature. A qualitative interpretive study was considered the best in this case taking into consideration objectives of the study. In addition, as earlier stated in this section (along with the objectives of the study), explaining a situation goes hand in hand with changing it; to change a situation you must first understand it. In this case, it’s through a proper research.

4.1.2 Reflexivity

Through reflexivity, a qualitative researcher is supposed to observe and document their own roles in the research process (Malterud, 2001; Patton, 2002; Kaplan and Maxwell, 2005). These include assumptions, biases or reaction that might impact data collection and interpretation (Tolley et al., 2016). Qualitative researchers should make their role as a researcher an explicit part of data collection, analysis, and reporting (Kaplan and Maxwell,

2005). Their interests, biases, perceptions, knowledge, observations all play a role in the study (ibid.). This is because knowledge is created in social, cultural and relational contexts. An interview itself is considered as one of the context of interactive knowledge creation. My preconceptions, my position and who I am would influence knowledge creation.

Results are one way of analyzing the materials gathered. However, there is no guarantee this “truth” will fully arise from views of the participants themselves (Patton, 2002; Malterud, 2003). There is thus a chance that observations and interpretations of situation may not match the participant’s understanding of the same issues. In this study, I came from a slightly different background which may have created a little distance in the interviews. However, having an African background may have had positive impact in data collection. This may have made it easier to have informal talks with the informants and mingle in informal settings.

I had prior experience on DHIS2 which helped in understanding some of phenomena observed in the DIM. However, not having a background in the health sector/environment may have affected the observation process negatively. I sometimes did not understand the proceeding and discussions of the DIM. I had to ask for clarification from the person seated next to me or later during the breaks. However, I did have some prior knowledge on the health issue such as the indicators (from DHIS2 training and the indicators workshop) and this may have had a positive impact on my ability to interpret people’s comments and responses during the DIMs.

Role of the researcher

The degree of involvement is a vital decision to make when conducting research. This is because it can affect the relationship with participants, bias the data collected, and how it’s interpreted. Walsham positions researcher involvement into two categories; neutral, though not unbiased, observer and a full action researcher (Walsham, 1995; 2006). In the context of this research, an observer researcher was considered the best; with regards to the research objectives. However, it’s been important to highlight my role as an independent researcher, and confidentiality; to get honest feedback, and a realistic, comprehensive overview.

4.2 Research methods

4.2.1 Case study

When first choosing the research methodology to be used for this study, a few methods were interesting and thus need a careful evaluation. Action research was considered and is one of the widely-used methodology in the IS-group within the University of Oslo (Baskerville, 1999; Braa et al., 2004). However, doing a full-scale AR project did not seem feasible due to the relatively short time frame of the research. Dealing with the partners and stakeholders in Zambia could have led to delays, could affect the timeline of a study. An example is the case of a fellow master student (Parramore, 2017) where facility trainings (methods chapter) were delayed for a couple of months hence affecting the data collection timeline.

A case study methodology was settled upon as it was the most appropriate given the exploratory objectives of the study. A case study is defined, by (Benbasat et al., 1987) as one which studies a phenomenon in its natural setting and uses multiple data collection methods to collect information from one or more entities. Case study research is the most frequently used qualitative method in IS (Orlikowski and Baroudi, 1991; Alavi and Carlson, 1992). According to (Yin, 2009, p.4) case studies allow researchers to keep the holistic and meaningful features of real-life events; for example, managerial and organizational processes. He goes on further to state that they are appropriate for answering the “what” and “how” questions. Although (Yin, 2009, p.17) has primarily been engaged in positivist studies, he argues that the same characteristics apply to interpretivist studies.

A case study seeks to enlighten a decision(s); how they were implemented, and with what aftermaths(Schramm, 1971). It will deal with a number of decisions taken, describe the state in which they were taken, and the procedures involved in carrying them out. In addition, it will also describe a variety of situations and relationships (Schramm, 1971). (Yin, 1994, p. 10-11) explains “*ethnographies usually require long periods of time in the 'field' and emphasize detailed, observational.*” In contrast to ethnography, “*...case studies are a form of enquiry that does not depend solely on ethnographic or participant-observer data.*” (ibid.). A case study thus fitted well with the objectives of this study.

4.3 Data collection

This section will describe the data collection process and methods. As you will note various qualitative data collection methods have been used. Qualitative studies normally use several data collection methods to give a wider coverage range (Bonoma, 1985). Most of the data has been collected through interviews. The reason being they let researchers access participants' interpretations and to examine them at a later date (Walsham, 1995).

4.3.1 Access and study setting

Access to research site/field was through the IS-group at the UiO partnership with Akros. Akros is a member of the HISP-network. In total, I made 3 trips to Zambia each lasting 2 weeks. The first 2 trips in, June 2016 and October-November 2016, were preliminary visits. During the first trip, no research area and topic had been chosen. It was meant to be a preparation visit to see what projects and areas Akros works with, along with gaining knowledge on the context and the culture. I travelled to Shibuyunji district with Akros Surveillance officers involved with the CLTS project (DHIS2). The trip involved visiting villages to check on its sanitation state, configuring phones for the CCs and visiting the District Commissioner's (DC) office.

The second trip's objective was to decide on a research area and topic. I attended the indicators workshop in Kabwe. The workshop was meant to decide the different definitions and names of indicators to be include in DHIS2. It was used to decide the various data elements¹ for DHIS2. It's through this workshop that the MOH representatives in attendance, voiced and pushed for the use of live DHIS2. I also had a talk with the Akros team working on the RMNCH&N scorecard on their plans and thoughts on the impact of introducing the scorecard as well as live DHIS2. The trip was fruitful as the research area of data use and interactive DHIS2 was decided. I was also introduced to a DHIO whom I kept in contact with through emails. When a DIM date was set, I made my final trip in February 2017 to attend the DIM.

Before the final trip, some documents were shared through email so that I could be well prepared for the trip. Interview guides and questions were then developed. To understand the

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¹ Data elements are used to calculate various indicators in DHIS2. They contain actual reported health figures/data.

decisions making process entirely, participants need to represent the various levels involved in the process. At least one person from every level was interviewed. With the help of Akros team, I was able to identify informants and set up interviews.

My presence was announced and recognized by the facilitators of the DIM. As a master student from Norway, I attracted curiosity and interest. These circumstances may have made my informants more willing and interested in talking to me during or after the DIM. No kind of incentive was provided by me or demanded by the informants. However most of the health personnel attending the DIM receive allowances and per diems. I also attended the 2-day DIM (explained in *chapter 5*) and 3rd day QI session.

4.3.2 Data collection methods

Various qualitative data collection methods have been used. According to (Benbasat et al., 1987) multiple data collection methods are usually employed in case research. Table 2 in *chapter 4.3.3* (page 44) summarizes the sources of data and the data collection methods used. Evidence from two or more sources will always converge to support the research findings. (ibid.) identifies these sources of evidence that work well as;

- Documentation – written material ranging from newspapers clippings to formal reports
- Archival records – organization charts, finance or personnel records
- Interviews – may be open-ended or focused
- Direct observation – observing and noting down of events, actions of the field environment
- Physical artifacts – devices, tools, outputs.

The main data collection methods of the study have thus been interviews, observation and documentation.

4.3.2.1 Interviews

Interviews in qualitative interviews make efforts to understand the world from the perspective of those interviewed. In addition, they give details about the meaning behind their

experiences (Kvale and Brinkmann, 2009). Moreover, interviews are among the most common strategies for qualitative data collection (DiCicco-Bloom and Crabtree, 2006).

Interview participants

In this study, the health workers interviewed represent the district and facility levels of Rufunsa district. In addition, partners of MOH such UNICEF, Akros and SBH were also interviewed. Due to the limited time of the study, not so many informants were interviewed. These interviews were supplemented with having informal talks with the informants at the DIM's location, and Akros office.

The selection of the participants was centered on their ability to provide in-depth information about the topic under study; referred to as purposive sampling (Patton, 2002). This kind of sampling facilitates finding of participants that will reflect on the topic. The data will thus inform the objectives of the study; by consisting of adequate and appropriate information. The interview participants at the DIM were selected in consultation with the DHIO and an Akros project manager.

Interview guides

As mentioned earlier, interview guides were developed before the February trip to Zambia. An interview guide is a list of the questions or themes that will be studied during an interview study (ibid.). Two different interview guides were used in this study: one for the facility staff and one for health workers for the other levels (similar with facility staff guide but with extra questions). The interview guides were developed in consultation with my supervisor. The guides made sure to avoid leading questions as this would be asking what we `want to hear/know`. (McCracken, 1988) appries against asking leading questions because you risk losing rapport or have the informants go along with your definition. For example, questions avoided taking side on whether it preferred offline or live data visualization tools utilization. Instead, questions asked on general perceptions on these themes.

One form of qualitative interview styles is semi-structured interview. They are usually organized with a set of questions at hand, while new questions arise from the conversation between the interviewer and interviewee (DiCicco-Bloom and Crabtree, 2006). In this study, interviews were conducted in a semi-structured manner. Through this way, as the researcher gained more understanding of the research case more questions were added, and some irrelevant questions from the guide skipped. New themes that were not originally thought of

during the planning of the study arose, and having a semi-structured allowed for the researcher to address these themes.

Interviews were conducted in English as it is the official language of Zambia. Moreover, all the participants were well conversant with the language. At the beginning of the interviews, participants were informed about the study, what questions and the average duration of the interview. These are in line with (Rowley, 2012) for conducting research interviews. (ibid.) points that the researcher should make sure the interviewee does not feel embarrassed, inconvenienced, or expected to disclose something confidential. These would involve;

- Indicating who the researcher was and why they were conducting the study.
- Brief explanation of the research.
- Giving an estimate of the interview duration
- Assuring the interviewees of the confidentiality of the interviews

Interview guides

Facility and district level staff interviews were done during the 3 days of the DIM and QI meeting. They were conducted during breaks and after the DIM, so as not interfere the participants' contribution in the data review process. They were done in a quiet room near the location of the DIM.

The other interviews were done at Akros offices. A few challenges were faced while conducting these interviews. One was finding a vacant and quiet room to conduct the interview. The meeting room was sometimes booked and hence couldn't be used at will. The solution was to find another room or wait till the meeting room was available for use. Second challenge, was the busy schedule of the informants from MOH and partner level. They always had meetings. Planned interviews had to be postpone to another day on a few occasions.

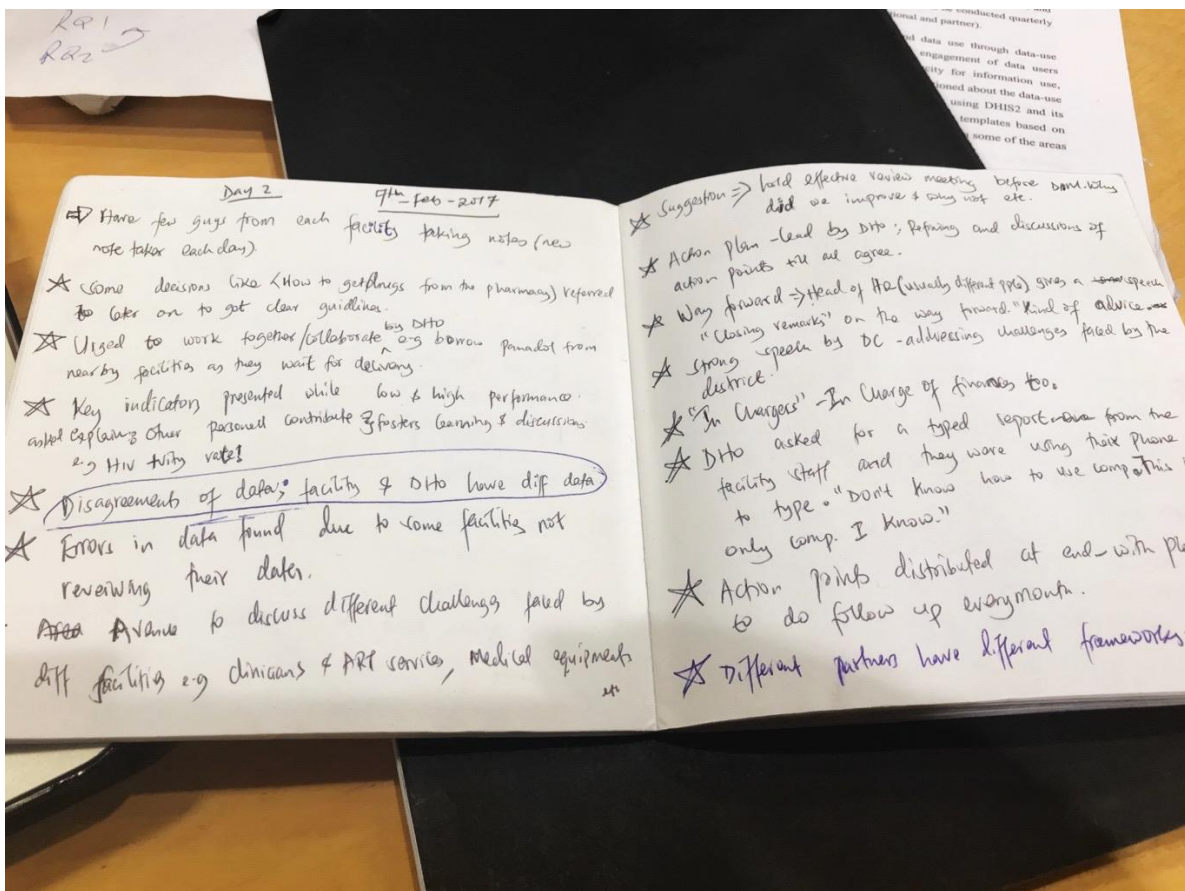
Interview recording and transcription

A tape recorder is used in this kind of studies to document, and thereafter analyze the interviews (Kvale and Brinkmann, 2009). In this study, one tape recorder (phone voice recorder) was used to record all the interviews. Afterwards all the interviews were transcribed word for word by the researcher.

4.3.2.2 Observation

Observation is a complementary method to get more precise information on behavior because it gives first-hand association with the social world under study (Patton, 2002). When research is conducted through in-depth interviews, the information acquired will depend heavily on informants willing to share; contrary to observation. There is generally a disparity between what people say they do, and what they actually do (Malterud, 2003). Moreover, it is probable that one can misconstrue or miss information that is crucial to the research (Patton, 2002). Being part of a study environment can influence it to some degree; just by being present.

Observation was done throughout the fieldwork. During the DIM, I took the role of a passive observer. Observations were noted down mostly in an unstructured manner with use of bullet points to separate the observations. Follow up questions were also noted down in the same manner. Notes were taken down especially during the DIM, QI session and indicators' workshop. Figure 15 shows my observation notes from the DIM. The date and purpose of the event were noted down; for easier analysis and interpretation.



4.3.2.3 Document analysis

Documents were shared by Akros before the final trip to Zambia. They included published and unpublished works, and reports. They gave me an insight on the goal and reasons for the HMIS strengthening carried out by Akros, as well as reports on the country's current state of data use and DIMs. Other documents on Zambia DHIS2 were shared upon arrival. They gave an insight on some of the errors in Zambia's HMIS. Most of the documents reviewed were shared through email and the cloud.

4.3.2.4 Pictures

Pictures were taken throughout the study. The main purposes being to document the context, as well as acting as reference later on; during analysis and interpretation. Peoples' privacy was taken into consideration when doing this. Therefore, it was important to ask for consent before sharing and publishing them. Pictures were taken mainly at the DIM with the emphasis being to show the setting rather than the people involved in them.

4.3.2.5 Online calls and Email

Online calls such as Skype and Google hangout were conducted with Akros employees, my supervisor, and other master students working on similar projects. They were used to update each other on the progress and current situation of the projects. Email was a good way of asking follow-up questions to some of the informants such as progress being made in terms of DHIS and how analyzed data is disseminated. Moreover, it was used to request and receive more documents on the research case such as data quality reports and Agenda for DIM.

I did, at some point, have a problem getting responses from some of the informants. One of the main informants stopped responding to my emails for a few months; even after sending several follow up emails on the initial email. This delayed and affected the data collection and analysis process. I had to make personal phone calls to the informants; in addition to having third party persons do a follow up for me. These methods were successful as the informants responded soon afterwards.

4.3.2.6 Conversations during breaks

There were several breaks at the DIM – lunch and tea breaks. I used this opportunity to socialize with the attendance. As I was already introduced to the attendees, getting to have

informal talks wasn't so hard. I could easily have conversation with the attendees. During these talks, I would ask follow-up questions noted during the DIM, or ask for clarification as to the what and how regarding to a specific area. Through this, I was able to find out some personal opinions on some matters regarding DIM and data use; that would not necessarily have been expressed in the DIM itself. I also got more information and understood certain phenomena in the research case.

The informal talks would also include other general topics and areas such as Norway, studying in Norway, and my background. Whether the informants were biased because of my background is hard to say. Most the time I took a neutral side, and avoided making it look like I preferred one options to the other. For example, with the case of offline to online DHIS2 utilization. All in all, the informal talks were helpful as they helped me gain a deeper insight of the research case.

4.3.3 Sources for data collection

Source of data collection	Method	Frequency
Akros employees	Interview	3 employees
	Informal talk	5 employees
UNICEF	Interview	1 employee
	Informal talk	1 employee
Facility level staff	Meeting observation	Over 15 staff
	Informal talk	Around 10 staff
District level staff	Meeting observation	Over 5 staff
	Informal talks	Around 5 staff
National and provincial level staff	Interview	2 employees
SBH	Interview	1 employee
DHIS and HMIS	Documents	Several

Table 2; list of data sources

4.4 Data analysis

Interpretive case studies rely on 'thick' descriptions from the field to understand what is happening in the field of study (Walsham, 1995). The purpose of data analysis is to develop interpretation or an understating that primarily answers the question of what's going on (in a context); states (Kaplan and Maxwell, 2005). Data analysis illustrates the manner in which the findings have been revealed throughout the research process. As mentioned above, I used multiple methods to collect data. This was done to reduce the likelihood of misinterpreting the data. Even further, notes were continuously written during the research trips to give an insight into the main areas of interest, impressions and act as a source of information at a later point.

(DiCicco-Bloom and Crabtree, 2006) states that qualitative data analysis ideally occurs simultaneously with data collection. This gives the researcher an opportunity to generate emerging understanding about research questions. This then informs the sampling and the questions asked. This iterative process of data collection and data analysis, ultimately leads to a point in the data collection where no new themes or categories arise (ibid.). During my research, I carried out daily data analysis and interpretation of the interview. This helped me identify new themes and areas that could do ask questions on this helped me identify new themes and areas that I could derive questions from. After a few iterations, no new themes arose or could be identified. (ibid.) refers to this as saturation, and signals the completion of data collection. Continuous note taking and review thus aided this iterative process.

The prime part of the data consists of interviews which as earlier mentioned were transcribed in full, along with field observations. Transcripts were coded using the Atlas.ti software. This was preferred over paper-based manual analysis because the software makes it easier to revise coding and categorization based on the emergent interpretation of the data i.e it made it easier to track the quotes related to various codes and themes such as data presentation, staff skills, thoughts on visualization tools etc. Furthermore, it has functionality such as network and smart codes which facilitate easier categorization and mapping; of codes, groups and categories.

When looking for a framework to use as a lens for data, a few frameworks were found and considered. One is the information cycle (a framework that has been previously used in the study of obstacles to HMIS decision-making). (Heywood and Rohde, 2002) defines the information cycle as a schematic way of looking at information. It allows one to see the links

between the different phases data goes through. These phases include; collecting, processing, analyzing, presenting, interpreting and using information. An example of the information cycle use, is the case of (Garrib et al., 2008) where it was used to evaluate the implementation of the DHIS in 10 primary health care clinics in South Africa.

However, I found this framework to be too broad and not specific about the different types of challenges associated with HMIS data use and decision making. Hence, it would be difficult to draw on the information cycle to structure empirical data and identify specific challenges and potential remedies to those challenges. Besides, live visualization data tools, which is an important theme in the study, it didn't clearly transcend the information cycle framework hence would be a challenge to develop a model for the live data tools introduction.

“This paper also focuses specifically on those interventions that most directly affect the demand for and use of data.” (Nutley, 2012, p.3)

In search of a more specific framework, the (Nutley, 2012) conceptual framework was identified. It was adopted because of;

- It's a specific elaboration of the PRISM assessment tools – which has been widely used to assess and improve HMISs. An example is the Zambia HMIS assessment (Akros Inc., 2016). It has interventions that I could use to identify specific challenges, and eventually develop a model for the synthesis of potential use of live data visualization tools.
- It fits with this research's practical motivation; which is improving data use leads to improved HMIS and health service delivery.
- The framework has backing from literature/findings, and data from other sources. Each framework intervention is clearly explained and then backed up by literature. I therefore, considered it a credible source/framework.

The field notes were reviewed and coded by themes that emerged through the review of the transcripts. Codes, themes and categories created were mainly informed by the framework and (Wickremasinghe et al., 2016) as discussed in *chapter 2.2* An example from the transcripts is *“We do not have many people who have the skill in terms of data analysis.”* This was coded as “staff skills”. It was grouped under the category *“personnel capacity and*

processes”, along with other groups that involved tasks, processes, skills, and capabilities of the staff; such as “*staffing*” and “*training*”. Staffing was involved with the number of staff, their roles and schedule while training was involved with the process of instilling competency to the staff.

Another example of how the observation notes were coded is “*Day 2: disagreement of data; facility and DHIO have different data.*” This was coded as “*data error*”. It was later grouped under the category data quality, as data error is concerned with data quality, along with other codes such as “*population data*” and “*data entry*”, which all contributed to the quality of the data.

As data availability was split from data quality, issues dealing with data demand, data access and data accountability were all grouped into the category “*data availability and accountability*”. An example, “... *if it means me having access to data, then I have to seek for a permission of the information officer...*” was coded as data access. It was later combined with the other codes dealing with availability and access, mentioned above, to form the final aforementioned category.

(Kaplan and Maxwell, 2005) states that coding categories may be informed by evaluation questions, theory or existing knowledge, but it can also be developed inductively during analysis by the evaluator. A few categories outside the framework emerged. Categories such “*financial constraints*”, “*data visualization tools*”, and “*infrastructure*”. Since I knew the contents of each category, it was possible to map out the categories, their dependencies and relationship. Figure 16 shows a picture of my data analysis notes (using different colors of post-it notes) when mapping, identifying and visualizing these relationship and dependencies. Table 3 shows the final data analysis categories, their framework intervention relation and key findings.

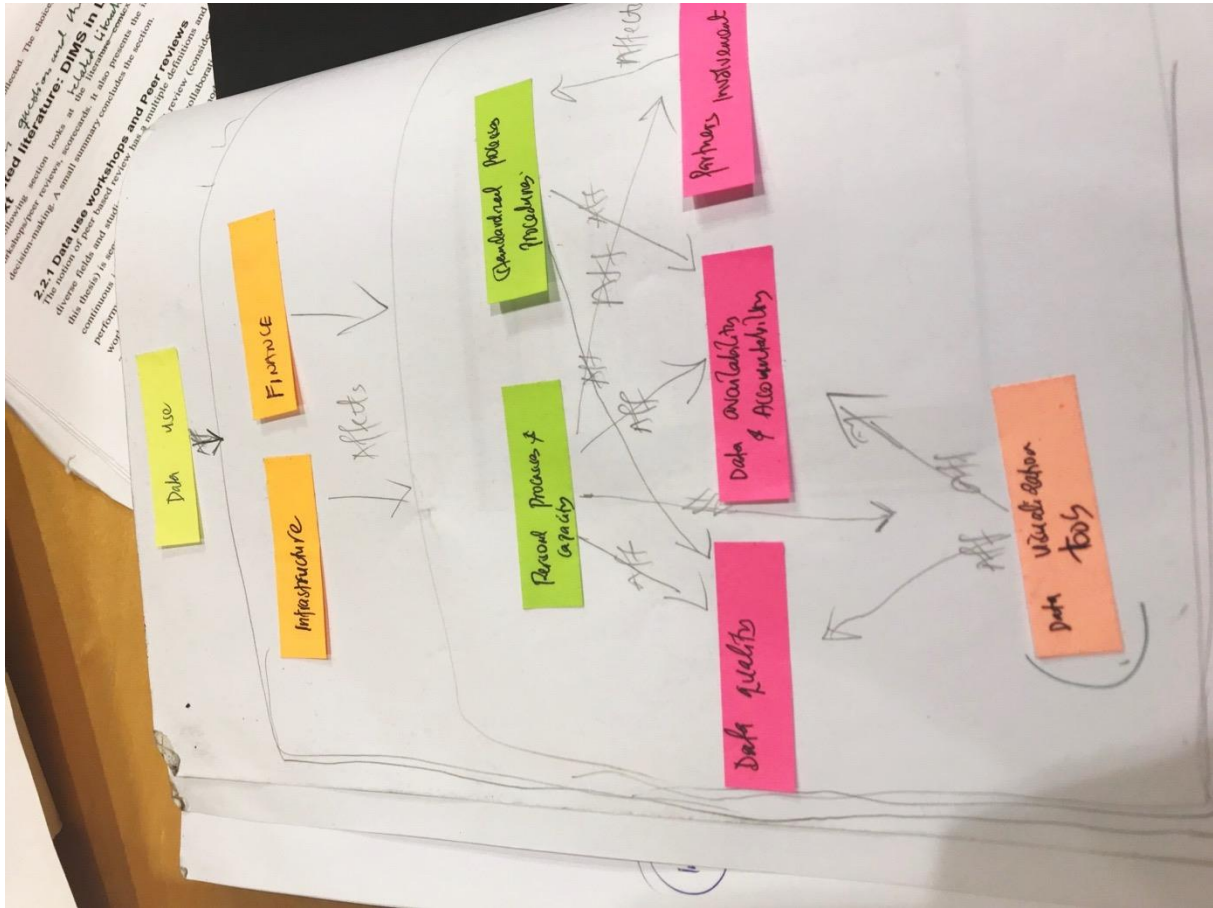


Figure 16; data analysis notes and category mapping and relationships

Category	Framework intervention	Key finding
Data quality	<ul style="list-style-type: none"> Improving data quality; improving data availability 	Poor data quality.
Data availability and accountability	<ul style="list-style-type: none"> Improving data quality; improving data availability 	<p>Limited access to data – especially to the facility levels.</p> <p>Low data accountability</p>
Standard processes and procedures	<ul style="list-style-type: none"> Strengthening the organization’s data demand and use infrastructure. 	Lack of national standards and guidelines for DIMs and data use.

Partners involvement	<ul style="list-style-type: none"> • Engaging data users and data producers. • Strengthening the organization’s data demand and use infrastructure. 	Poor partner coordination; fragmented HMIS.
Personnel processes and capacity	<ul style="list-style-type: none"> • Engaging data users and data producers. • Building capacity in data use core competencies. • Monitoring and evaluating, communicating data demand and use successes. 	Lack of data analysis skills by staff; especially the facility level. Staffing challenges.
Live visualization tools	<ul style="list-style-type: none"> • Strengthening the organization’s data demand and use infrastructure. 	Current limited use of Visualization tools. Impact positively on data use
Infrastructure	<ul style="list-style-type: none"> • All interventions 	Various infrastructural constraints.
Finance	<ul style="list-style-type: none"> • All intervention 	Financial constraints for DIMs and health programs.

Table 3: Data analysis categories, key findings and framework intervention relation

A model for synthesizing the potential of live data visualization data tools was also developed. It’s shown by figure 23 and discussed further in chapter 6.2.7 (see page 79). With the help of the conceptual framework, the identified challenges (from data analysis) are mapped out in terms of their relationship to the live data visualization tools. Two groups of relationships emerged. I named them with respect to their already identified relationship. The two groups of challenges are “*determinant challenges*” - which limit the use of data

visualization tools; and “reciprocal challenges” - which affect and are potentially affected by the use of live data tools. Figure 17 shows my data analysis notes when trying to map out and develop this model.

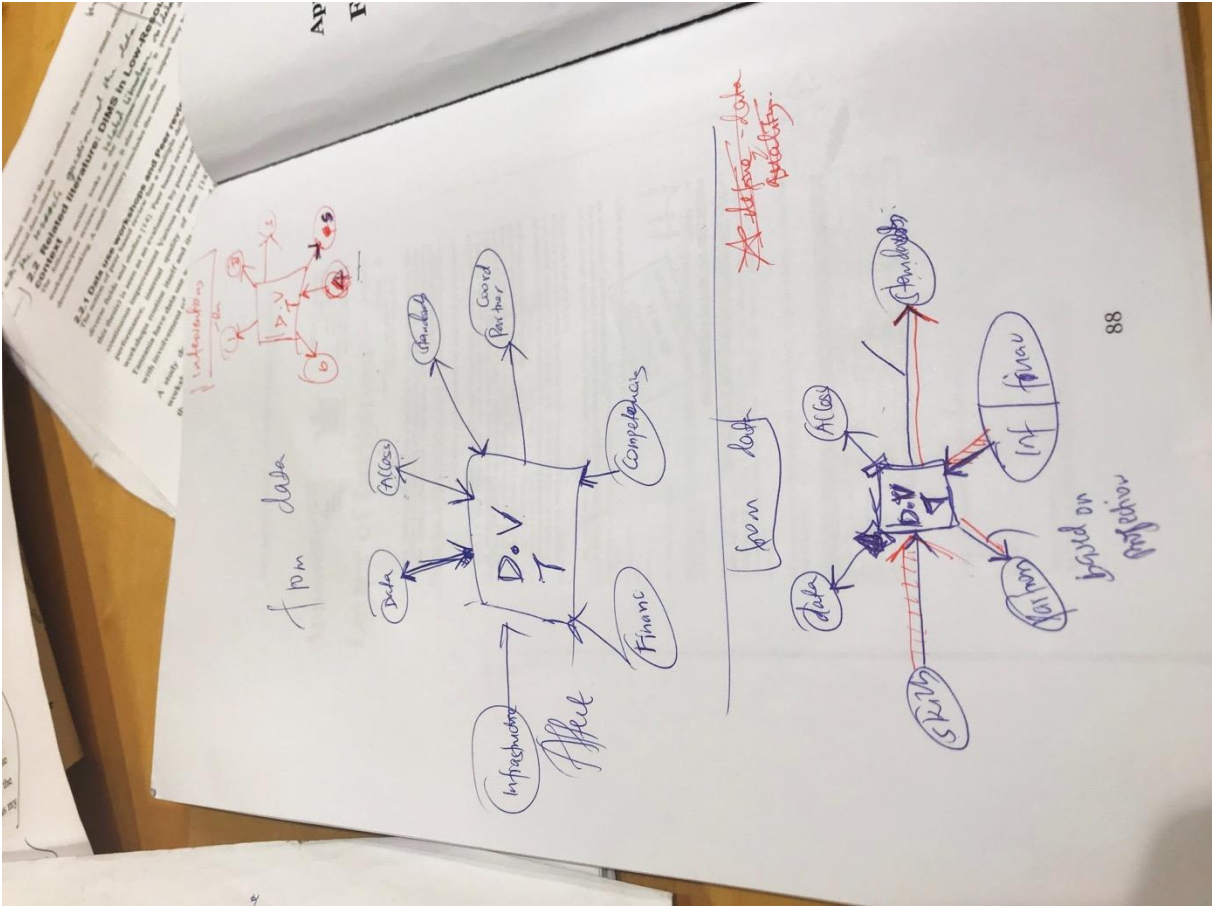


Figure 17; data analysis - live data tools model relation and development

Data analysis showed that there is currently limited use of data, along with some challenges to data use such as financial constraints and infrastructure limitations. It also revealed that the use of live visualization tools was likely to impact data use positively, although there were several challenges that were likely to limit their utilization. More on the findings/results is discussed in *chapter 5*.

4.5 Limitations

In general, the time of this study is considered as a limitation to the study. The limited time frame of the study made it possible to only attend one DIM as opposed to several. To get a better overview of DIMs, especially since they vary from district to district, the researcher

believes it was necessary to attend more. However, this was addressed by interviewing, at least one, informants from partner and national levels. Having attended several DIMs, the information they shared would have come from vast DIMs; various provinces and districts.

Due to the time frame, the number of informants interviewed was limited. This was addressed by interviewing informants from all the levels (facility to partner level) in order to get information on the overall context. In addition, since this is a qualitative interpretive study, where the participants responded to questions of an explorative nature, the number of participants doesn't affect the validity of the study. *"The product of any qualitative analysis is an interpretation, rather than a purely "objective" account."* (Kaplan and Maxwell, 2005). Instead, it's what they shared that's very meaningful and at the core of this study.

4.6 Ethical considerations

Ethical considerations are important when conducting a research. Qualitative case studies share interest in personal views and settings (Denzin and Lincoln, 1994, Chapter 17). Moreover, there is always a possibility of recognizing the participants (Goodwin, 2006). Per se, the principle of confidentiality need be addressed. Confidentiality means that the information given during interviews by informants will not be traced back to them, or made available to others (ibid.). It's been therefore necessary and important to keep the informants as anonymous possible – through storage, noting down of names with regards to the interviews, and use of generalized names like "facility staff" for quotation.

Another important aspect to consider is the mosaic effect – where bits of information are pieced together to create a fuller picture, and eventually identifying the person/informant. It's however, quite easy to identify the different informants and stakeholders in this study given that it has a limited scope; this is noted as challenge to confidentiality by (ibid.). This study however, does not include very controversial information. No informant raised concerns about being identifiable or any confidentiality issues.

The informants were given an overview of the interview, as described in *chapter 4.3.2.1*. Verbal consent for interviewing and recording was then given. No sensitive or personal data was collected, so no strong measures were used to secure and store recordings. Both recordings and transcripts were stored in the cloud, as were the pictures taken during the research.

4.7 Summary

This chapter explains the research methodologies applied to the research in this study. It also shows how these methods have been applied. The role of the researcher, and interpretative qualitative study are discussed in detail. The various methods used to arrive (data collection) at the empirical findings are outlined, and discussed along with how the data was analyzed and structured. Examples on the data analysis process are also given. Limitations of the research are next to be addressed. The chapter concludes with a description of the ethical guidelines and how they were handled. The data collected using all the methods described in this chapter, is presented in the next chapter (Empirical findings).

5 EMPIRICAL FINDINGS

In this chapter, I present the empirical data collected during the fieldwork. Data was mainly collected through observation, interviews and informal talks. The data is largely supplemented with quotes from interviews. The findings are grouped with related fields such as infrastructure, governance and funding, capacity of personnel etc.

5.1 Capacity of Personnel

5.1.1 The participants

The attendees of DIMs are from all the levels of the health system. Most of the attendees were health facility staff. They have different titles which were hard to understand at first, but were later on explained to me by one of the facility staff. They all had a role/position they represented such as nutrition health, Mother and Child Health etc. The partners/donors' representatives were also present. *Table 4*; Participants and their designations shows the participants, their designation and the level they represent.

During one of the informal talks with the DHIO, he informed me that anyone is invited to the DIM from the district. He normally encourages rotation of the facility staff attending the DIM in that, it's not always the same facility personnel attending the DIM. This is a way of exposing the facility staff to data use discussion, and thus understand the purposes why they collect data. The facility and district staff usually get a daily allowance when attending the meeting. The amount would vary depending on the location of the DIM and their role in the district.

Level	Designation
Facility	<ul style="list-style-type: none"> • Clinical officers • Nurses • Midwives • EHT • CHAs
District	<ul style="list-style-type: none"> • DDH • DC • DHIO • Data specialist • Nutritionist
Partners – World vision and UNICEF	<ul style="list-style-type: none"> • Consultants

Table 4; Participants and their designations

5.1.2 Computer literacy

Most members of the facility in attendance had a personal laptop and/or smartphone with them. This was as a result of recommendation/encouragement from the DHIO (to buy a personal laptop) a way of improving their computer literacy (and of the district at large). They were able to operate and carry out tasks on their laptops quite comfortably. However, this represents just a few of the health officers at the DIM. The level of computer literacy at the various facilities is therefore, hard to tell/judge based on this.

5.1.3 Data presentation, review and analysis

“We do not have many people who have the skill in terms of data analysis... Program officers even at the district level, they still have some lapses in terms of how they can analyze their data and how they can use it. Also, the facilities in charges, they also have that challenge” – district official

The health facility staff did not receive training on data presentation, review and analysis. Data interpretation was a problem as some of the facility staff didn't understand them. A number of times during the DIM certain indicators, would be explained to the facility staff. National targets were not also clear in some cases; all these results in data analysis challenges. The presenters were shy and looked away from the audience, in addition to them being

inaudible. They would quickly skip through slides but maybe this was a way of being fast and keeping time because all 21 facilities were supposed to present. However, the district level staff received training on data review and analysis.

“I think also some of those examples; some of the facilities were actually getting surprised of their own data they are presenting themselves.” – district official

In one case during a facility presentation, the presenter seemed confused on the figures they were presenting; whether they were percentages or actual figures. Prior to the DIM, and on a monthly basis, the facilities were supposed to review, discuss and analyze their data. However, this seemed not to be the case. This is echoed by (USAID Systems for Better Health, July 2016) where the facility staff say that there is no need of doing data review if it’s done only when there is a DIM. In some cases, the presenters were non-technical people and could not really answer the questions that arose.

5.1.4 DHIS2 Capability

Most of the facility staff were not aware or conversant with DHIS2. Some of the knowledge they had was that DHIS2 was a HMIS in use. Other health facility staff that used DHIS2 only used it for data entry. They did not have access or rights to perform other functions with DHIS2. Contrary to the facility staff, the district level staff were well conversant with DHIS2. They would perform various functions including creating dashboards and graphs, and access to data. Some of the quotes below show the informants responses to their DHIS2 capabilities.

“In terms of access, it’s limited. I’m the only who can enter in to the DHIS and pull out data. We don’t have function or dashboards where probably I can populate in advance... rely on my presence. If I’m not there then they will not do it.” – district official

“I think I have never used DHIS software.” – facility staff

“... Mainly it’s only on data entry and also generating of reports. Like the HIA1, HIA2, HIA3 and 4.” – facility staff

Limited access to data implies less availability of data to the health staff at the facility. In addition, they were dependent on the district level for access and advanced DHIS2 capabilities, such as dashboards. Data entry into DHIS2 was done at the district level mainly

by the DHIO. In general, the facility staff had little knowledge (use, access and know-about) on DHIS2.

5.1.5 Staffing

The issue of staffing and understaffing came up very often during discussions of the DIM. The facilities argued that understaffing contributed to the poor performances on some indicators. Others said they felt understaffed. The district argued that they had new staff sent to all facilities in the past few months, though this was not deemed enough by the facility staff.

The roles played by the facility staff seemed to be ‘overlapping’ and further implying work overload. For instance, the facility in-charges were responsible for facility operations, and also its finances. The same health staff responsible for providing health services was the same person supposed to attend DIMs. Taking such health facility staff out of the facility for long periods of times therefore, affected the service provided at the facility.

Moreover, some of the roles the facility staff could play was not clear. For example, the CHAs, were supposed to be going around the communities/village from household to household providing services. They were only supposed to spend 1 or 2 days at the facility. However, there were some cases where the CHAs were just stationed at the facility and were help in providing services there; rarely going to the community to provide services.

5.2 Process/ Routine for DIMs

5.2.1 Standard DIM agenda/framework

In the current Rufunsa District framework, DIMs take place over a period of two days. The language of discussion and presentation is English. The first day is made of district overview presentation by the DHIO, facility presentations and Q&A sessions. Facility presentations were done on PowerPoint presentations with one or two people presenting the data (see figure 18). In some cases, the person that prepared the PowerPoint was not the same person presenting.



Figure 18; Rufunsa District's facility presentations

“A lot of time at these meetings is spent reading numbers, like that’s what most of the presentations are people reading out numbers to you and it’s not very useful right because you’re not able to get at the actual root of what the issue....” – Partner representative

There were no quantifiable measures of progress in facility presentations; most of them were just numbers and figures that were just being read out. Reasons behind the figures and percentages were not presented.

The second day was meant to present the district’s scorecard, discuss and formulate action points. Due to the busy schedule of the DC, the agenda maybe adjusted to fit them in. It’s normal for them to be there during the first day and “open” the meeting. Part of the agenda attached in the appendix F. In addition, the DHIO had a member from each facility taking notes on the day’s proceedings. This would act as a future reference – both at the DIM and at the facility. Action points are distributed at the end with pledge to do monthly follow up.

“So there’s still a gap in that area and that’s what we are trying to work on to standardize these PIMs. So, at national level from the ministry side, there’s no standard agenda” - national level staff

There is no standard agenda or framework provided by MOH. PowerPoint frameworks are usually provided by provinces. They are then adjusted to fit the various districts. Therefore, the agendas of DIMs vary from province to province, and district to district. There is thus a form of standardization but not full standardization as in standardization from the national level. Full standardization was, at the time, a work in progress with no timeline as to when and if it will be achieved.

5.2.2 Measure of success and Purpose of DIMs

There lacks a way to measure the success of the DIMs. From the current system, DIMs are being held but there is no quantifiable way to actually measure whether it was a success, or not -all that is being done is holding DIMs for procedural and formality purposes. This was identified as a gap.

“To show performance and target for the next improvement areas.” – district official

“According to me, I feel it is for the continuation of care for the patients and also to see how best you can provide that care to the very patients whom we’re trying to save.” – facility staff

“The DIM is pretty much review meeting ... what I understand by it is a review meeting on how we’re progressing as a district and each facility on different indicators” – facility staff

“...It’s to get okay where are we now and where are we heading or where are coming from where are we now, where are we heading, and how do we get there.” – partner representative

There were different definitions and interpretations of the purpose of the DIMs (as seen from the above quotes). Even though some of the interpretation of the meanings are similar, they also tend to differ. This is attributed to the different roles they play in the district and facility. I noticed that the DIMs events, discussions, and activities fell under three categories: the past, the present, and the future i.e where we were (previous quarter(s)), where we are (this quarter), and where we want to go (next quarter(s)).

5.2.3 District Scorecard

A district scorecard was one of the data visualization tools presented. It was prepared prior to the DIM by DHIO's office. The same office would lead the discussion of the scorecard at the DIM. "...I start now making my presentation for the district. Then from there I will also make a separate score card for certain indicators. All this is actually done manually because when it comes to data analysis I usually do it in Excel." The scorecard was manually prepared using excel. They would export data from DHIS2 into an excel spreadsheet. Color coding all the indicators would then follow. The scorecard would then normally be presented by DHIO on the second day of the DIM. Figure 19 shows presentations and discussions of the district's scorecard. Figure 20 an example of scorecard, on excel, from Rufunsa district, quarter 3 and 4 of 2016



Figure 19; district scorecard presentation and discussion

RMNCAH&N DISTRICT SCORECARD FOR QUARTERS 3 OF 2016 AND 4 OF 2016									
District Name:		RUFUNSA							
Sl	Name of Health Facility	Pre-pregnancy		Adolescence		ANC1 within 1st trimester		ANC1 total	
		% of clients accessing long acting reversible contraceptives		% of total ANC1 attendants aged < 18 yrs		% of pregnant Women attending ANC1 within 1st trimester		% of pregnant Women attending ANC1 total	
		Q3 2016	Q4 2016	Q3 2016	Q4 2016	Q3 2016	Q4 2016	Q3 2016	Q4 2016
1	Rufunsa District			10%	11%	16%	24%	84%	99%
2	Bunda Bunda			0%	16%	3%	17%	58%	186%
3	Chifundo			9%	8%	71%	68%	106%	106%
4	Chimunsanya			2%	0%	28%	28%	83%	94%
5	Chinyunyu			4%	6%	10%	22%	88%	89%
6	Chitemalesa			8%	15%	9%	20%	83%	82%
7	Chiyota			3%	0%	10%	0%	129%	63%
8	Kankumba			0%	3%	12%	21%	126%	75%
9	Kanyongoloka			0%	12%	0%	27%	0%	97%
11	Luangwa Bridge			13%	6%	37%	28%	91%	97%
12	Lukwipa			7%	2%	5%	24%	24%	85%
13	Mpanshya Hospital			8%	46%	14%	22%	119%	137%
14	Mulamba			0%	2%	2%	7%	83%	144%
15	Mwachilele			7%	10%	20%	50%	100%	169%
16	Namanongo			9%	5%	0%	9%	81%	90%
17	Nyangwena			5%	18%	14%	41%	136%	134%
18	Rufunsa			12%	18%	4%	8%	32%	36%
19	Rutech			4%	8%	26%	40%	166%	159%
20	Shikabeta			7%	0%	13%	10%	47%	27%
21	Tapano			4%	4%	1%	6%	8%	20%

Figure 20; A section of Rufunsa District's scorecard for, quarter 3 and 4 of 2016.

“If you look at the way we discussed the score card yesterday, we do not need every facility to come with their presentation. All we can easily do it to have a score card. Using that... I think if on the first day if you noticed there were much of presentations and people were just listening. But when you look at the score card, it was so engaging where this indicator, we look at the program, and we try and find what could be the challenge and finally we have the solutions coming out.”- district official

Upon advice from a partner consultant, the DHIO changed from the normal way of presenting the scorecard. The Scorecard was thus projected and discussion of the main indicators was done. Best and poor performers were asked to explain their performances. This presented an opportunity for other facilities to raise questions to other facilities on the challenges they were themselves facing, and what they are doing to have a good performance. It therefore created a session of information exchange and sharing. The audience was more active than passive as opposed to the facility presentations the previous day.

5.3 Data quality and Availability

5.3.1 Data quality, availability, accessibility and use

Data reporting rates from the facilities for the given quota was averagely around 90% (see Appendix B). This was considered good enough for use in the DIM. However, during the DIM, DHIO emphasized on the importance of improving it even more. Moreover, data errors

were present. For example, one of the facility had different figures in a certain indicator, to the figures in the DHIS2. Upon investigating it, by use of previous trends from that facility on that particular indicator, it was recognized as a data entry error. This is because there was a very high jump in the figure recorded for that quota from the previous quotas. Conflicts in data were usually/often deferred to another time in the future.

“It is used for planning, also measuring performance. As well also data is also used to set national targets even the national level.” – facility staff

Informants were asked about how they felt data is being used and what purposes they feel it's being used for. Here a few challenges (gaps as they would call them) on data quality, data use and analysis were identified. How they felt the data was being used would vary depending on their designation. The facility staff did not understand the data, and thus they did not use it frequently. *“It was just a matter of fulfilling what is required of them”* (data collection and reporting) as one informant put it.

“The challenge I've noticed with data use is accessibility. We haven't created enough platform for our users to access it easily. As long as it's still in a manual form, I don't really expect much from the facility. I feel the data is not being to the capacity it's supposed to be used...” – district official

“So, program people who are supposed to make these decisions they're not demanding for data they're not thinking of programmatic questions or areas they need to improve on and then ask for data to make decisions.” – national level representative

Furthermore, access to data was largely limited to only the district office staff. Facility staff were dependent on the district office to disseminate processed data. Not even the officers for whom the data is intended had the necessary access. In addition, demand for data by the program officers, and the 'in-charge' personnel was rare; further showing the limited utilization of data. Presence of analyzed data (in the form of charts, graphs etc) was also lacking at the facilities. I didn't come along channels to communicate best case practices as a means of promoting data use. These might have negatively impacted data use, and data-driven decision making.

5.3.2 DHIS2 clean-up and Live DHIS2

“So, we’re struggling to make sure that we take DHIS2 to place whereby it can be suitable for analysis and in a user-friendly way. So, there’s a plan in place of course.” – partner representative

Zambia’s DHIS2 experiences a few challenges and errors that need to be ‘cleaned-up’. The Zambian DHIS2 needed clean-up; to remove some of errors present. An example of these errors is indicator calculation using comb categories and population data duplication. Another example is the lack of or presence of conflicting population data figures. Population figures are really important in the calculation of indicators – which are used to measure performance of various health services provided.

“one thing, which we can gain by using live DHIS2, is if you make it presentational or you make a demonstration you’re giving people a wide room to challenge, to ask questions, and view data into different dimensions. But if you’re using a PowerPoint is static... one of the reason is the one which I told you before like a flexibility and to becoming dynamic but the second thing is, a lot of people spend a lot of time to prepare this PowerPoint representation so using a live system is a time saving.” – partner representative

The entire team from facility, to MOH, to partners like Akros all support and welcome the use of live DHIS2 for DIMs. Apart from spending less time on making presentation, it will also increase data use in that more engaged data-based discussions will occur. They believe it will positively impact data quality and data use by improving the efficiency of DIMs.

5.3.3 Population data

“The population data, we got from CSO, Central Statics Office through their 2010 census bulletin. By then Rufunsa was not created yet... because the Rufunsa Constituency is what also became the Rufunsa District. Using that population, we are able to cut off from the total population which is allocated for Chongwe.” – district official

Lack of up-to-date population data is one of the challenges highlighted at the DIM. After new districts were created in Zambia, the facilities catchment area changed and it is therefore difficult to know the exact population each facility is serving. It’s assumed that this is the case in most newly created districts and facilities. Various facilities have raised concern about the data being in DHIS2 not reflecting the exact population at the facilities. The last national

census was held in 2010 (Central Statistical Office, 2017). Currently the Zambian DHIS2 is using projection data provided by the CSO. This is reflected when calculating indicators, where for example you have an over 100% value. All in all, this population data has affected the quality of the data; in terms of indicator calculation.

5.4 Infrastructure

5.4.1 Location of DIMs

According to Rufunsa's DHIO, the locations where the DIMs take place always vary (among districts). They usually happen at lodges or hotels with conference facilities. Where to hold them also is dependent on the funding available and number of people attending the conference. Due to this variation, the facilities and services offered by the various chosen locations will vary. For example, one hotel may provide internet and accommodation services while others will not.

In this case, the DIM happened at Chimuthunzi Lodge in Chongwe. Chongwe is a small town which is in Chongwe district and part of Lusaka province. The facilities and services offered at the lodge were quite basic (pen, paper, water, projector and foodservices.) During the 3 days of the meeting, lunch was always late and therefore this would normally eat into the time of the meeting making it begin later than anticipated.

5.4.2 Funding

Funding comes from MOH, donors and Partners. Some of the current donors/partners of MOH are UNICEF, USAID, EU. Funds were disseminated from the central level to the lower levels. How funds are used depends on the project and district prioritization. DIMs frequency depended on availability of funds. Failure to secure enough funds or secure them on time resulted in changes to their (DIM) timeline/occurrence. This was the case in Rufunsa where they only had one DIM the previous year.

“I wouldn't say that it's more partner funded. I would say that when the partners have come and they want to bring in that strengthening, and they have talked of wanting to support.... I would give you an example. In 2016, when the partners did not support DIM, we had our last DIM financed from the GRZ funds... The government's will is there to support and they want

to support it, but if there are more competing demands and then the funds are limited, we might want to prioritize.” – district official

There were split opinions on funding of the DIMs. Some informants felt that DIMs were majorly donor funded while other felt the opposite – more MOH funded or equal. Lack of funding for DIMs by MOH was attributed to prioritization of other health areas according to some informants.

“... there’s definitely some sort of difference in terms of the focus based on who’s funding what DIM and all those things and stuff like that...” – national level representative

In addition, funding by the partner/ donors was more biased and focused towards what their area of interest i.e they would fund their own area of interest (such health programs, districts) rather than the whole health and service delivery sector.

5.4.3 Internet connectivity and Electricity

There was no internet connectivity provided for the meeting or by the lodge. The only internet available was personal mobile internet. This was accessed by use of modems or personal hotspot. This, therefore, meant while some of the attendees (like the DHIO) had internet connectivity some of the attendees from the facility lacked connectivity.

“The challenges like in our hospital is electricity power. We do have the PCs around like the desktop and the laptops here and there but for them to function well the power is not sufficient enough and also the internet system quite expensive of course so that is the major challenge that which we have.” – facility official

Frequent power blackout was experienced. I was told this was the case in the whole country. It was called ‘load-shedding’ by the locals – an attempt to distribute the electrical power equally due to the low amount of electricity produced. The lodge however had a generator that would be powered up and provide electricity when needed. Most facilities in Rufunsa lacked electricity. They were using solar energy in most cases.

5.5 Quality Improvement

“When we come in to QI, QI will actually come and tell us what is the real root cause of this problem? Using that you will find that when we implement the QI project, next time we have

*the DIM, we actually have mostly an indication where a performance is maybe improving.” –
district official*

As discussed in *chapter 3.5.1*, QI is meant to improve quality of service delivery. QI is viewed as data use; in Rufunsa, each facility is expected to have QI project. Out of the 22 facilities, only 4 had QI projects. The presentation of the QI projects occurred the next day after the DIM second of the DIM. The routine was almost similar to the one used in the DIM, in that facilities presented their QI projects and followed by a discussion and feedback session. Figure 21 shows a QI project presentation session. A few members at facility level and district level are trained through Quality Improvement.



Figure 21; QI project presentation

Through the discussions and the feedback given by the DHIO, I observed that the QI projects still needed a lot of improvements and support. It was also somehow not clear to the facility level staff as to the main purpose of the QI projects. Some seemed to initiate QI projects simply because it was expected for them to do so by the district officials/level.

“That’s a huge challenge. I think its work overload. These are people who are only ... Their duty is not just doing data. They are also clinicians who are supposed to attend to patients.” – district official

QI projects faced a number of challenges such as funding and staffing. Most of the people expected to carry out and oversee these QI projects were the same as those present/responsible for the DIMs. There was thus a responsibility ‘overlap’, and work overload in some cases. These challenges resulted in the staff not being proactive at all these activities; clinical, management and administration.

5.6 Governance, Donors and Partners

“I think we have been receiving quite a lot of support because our immediate supervisors usually are people from the province. I think you saw some of them being in that meeting. They have been coming to give their technical support and then sometimes they will also I think ...” – district official

The DC was in attendance to give a closing speech at the DIM. Figure 22 shows the DC addressing the DIM. She gave a very strong speech on the health situation, and was very concerned with the overall situation in the district. In her speech, she covered some of the challenges she had encountered, in addition to giving suggestions on how to solve them. DHIO informed me that they always invite the DC, as this shows support from the MOH. General support from MOH to the district was sufficient according to district and facility staff.



Figure 22; DC addressing the DIM

5.6.1 Funding

Funding comes from MOH, donors and Partners. Some of the current donors/partners of MOH are UNICEF, USAID, EU. Funds were disseminated from the central level to the lower levels. How funds are used depends on the project and district prioritization. DIMs frequency depended on availability of funds. Failure to secure enough or secure them on time resulted in changes to their (DIM) occurrence. This was the case in Rufunsa where they only had one DIM the previous year. Donor funding coordination is also a mandate of the MOH. However, there is a challenge in this area; funding is hence not well coordinated.

“I wouldn’t say that it’s more partner funded. I would say that when the partners have come and they want to bring in that strengthening, and they have talked of wanting to support.... I would give you an example. In 2016, when the partners did not support DIM, we had our last DIM financed from the GRZ funds... The government’s will is there to support and they want

to support it, but if there are more competing demands and then the funds are limited, we might want to prioritize.” – district official

There were split opinions on funding of the DIMs. Some informants felt that DIMs were majorly donor funded while other felt the opposite. According to some informants, lack of funding for DIMs by MOH was attributed to prioritization of other health areas.

“... there’s definitely some sort of difference in terms of the focus based on who’s funding what DIM and all those things and stuff like that...” – national level representative

In addition, funding by the partner/ donors was more biased and focused towards their area of interest(s) i.e they would fund their own area of interest (such health programs, districts) rather than the whole health and service delivery sector.

5.6.2 Donor collaboration

“Well, I think that’s a challenge that we all face and in this kind of work... it’s a lot maybe not harder but we’ve noticed that partners just sort of do just do their own activities without really saying.” – partner representative

“We still have parallel databases. Not all databases are sitting in DHIS. I’ll give you an example of Smart Care. Smart Care is a parallel database. Imam for nutrition is a parallel database.” – DHIO

There is currently poor/limited partner coordination and collaboration. This can be attributed to the fact that each partner has their own focus areas/projects/programs and key indicators. In a way, in a way, it can be said that they are parallel programs and databases. This has led to redundancy of activities and events of facilities. For example, in a one district, two DIMs by two different donors were carried out. We also have cases of parallel databases, in addition to all the data not being in DHIS2. During the DIM nutrition data was missing from DHIS2 and therefore was not discussed. Nutrition data was however said to be in another database; owned by one of the partners.

6 RESULTS AND DISCUSSION

Before going on with the discussion of this chapter, a quick reminder of the objectives this research. This study is an *exploratory* study on data use, district decision-making and live visualization tools impact on data use. It therefore asks these two questions; One: find out *how is data being used, and what are the key obstacles to data use*; two: *What are the prospects of using live visualization tools to strengthen DIMs and data use?*

This chapter is divided into 3 sections: results, discussion and summary. The first section is the results section. It outlines the results of data analysis and relate the results to the research questions. The section - discussions section - uses the conceptual framework from *chapter 2.2* to discuss the key results. Identified challenges to data use are address in this section. Research question 2 is primarily (only) discussed in this section (chapter) to allow comprehensive discussions and avoid repetition. A Summary section concludes this chapter.

6.1 Results

Through data analysis it became clear how and for what purposes data is being used, what are the key obstacles and the prospects of visualization tools. I choose to highlight the key results and discuss them further in this section. I begin with the addressing research question 1 on chapters, while the discussions chapter (chapter 6.2) addresses both research questions

6.1.1 Data use

The agenda of the DIMs and its discussions, under my interpretation, were geared towards: one; where are we coming from (previous quarter(s)), two; where are we, and three; where are we going or do we want to go (next quarter(s)). This can be said about the responses by informants when asked what and for what purposes data is being used for. This structure therefore helped me unpack the data and identify how data is being used. I therefore, categorized their responses into 2 categories: one; where we were, plus where we are. Two; where we want to go. The two categories were then assigned names and are further discussed below. All in all, data was used in an effort to improve the quality of health services provided.

- **Performance review**

“...this data which advises us on the grey areas that, the district or the facility has. It is through this same data, it’s more like a mirror. It gives us a picture of who we are” – district official

This covers “where are we coming from” and “where we are” category. Collected data was used to evaluate the performance of various facilities, district, and provinces on health service delivery. This was done by the use of indicators. It was a way of identifying the areas that needed focus, interventions and improvement. For instance, at the facility level data was used to show performance for a specific quarter, compare that performance to the previous quarter, find out what progress has been made; what improved and what didn’t. Data was thus used to show the current situation.

- **Planning and resource utilization**

“Data to me I feel it is used for the issue of planning because how are you going to plan if you don’t have data?” – facility staff

Data was also used for planning and resource utilization decisions. After the performance review, came planning, resource allocation, resource prioritization. The district would use data to make planning decisions, and setting of targets for the quarter and years (e.g next 2 year). For example, which areas they should focus on or, allocate more resources. In addition, data was used to mobilize resources for the district. In order to get support from donors and partners, they would first need access to data especially in the areas they needed support in. QI projects would arise from performance reviews and would go into planning as means of overcoming the main challenges facing a facility.

6.1.2 Key challenges to data use

Data use was faced with quite a number of obstacles. Table 5 gives a summary of the obstacles and the adopted framework intervention they fit in. Each intervention has a few measures under them proposed by the framework as means of improving data use. Financial constraints and infrastructural challenges cuts across all interventions as they are the 2 core challenges that affect all the other challenges. The challenges with regards to the interventions and the measures are discussed further in *chapter 6.2*.

Challenges (chapter 6.1.2) Intervention and measures (chapter 0)

<p>Poor data quality</p>	<ul style="list-style-type: none"> • Improving data quality <ul style="list-style-type: none"> ➤ Implement, communicate data quality procedures ➤ Training and re-training
<p>Limited access, accountability and availability</p>	<ul style="list-style-type: none"> • Improving data availability <ul style="list-style-type: none"> ➤ Report templates, policies to support data communication and feedback techniques • Monitoring and evaluation, communicating data demand and use successes. <ul style="list-style-type: none"> ➤ Training ➤ Regular use of data in decisions making ➤ Positive messages about data informed decisions.
<p>Lack of standard guides, procedures and processes</p>	<ul style="list-style-type: none"> • Building capacity and competencies <ul style="list-style-type: none"> ➤ Training and re-training/follow up
<p>Poor partner coordination</p>	<ul style="list-style-type: none"> • Engaging data users and data producers <ul style="list-style-type: none"> ➤ Identification and collaboration
<p>Lack of key data competencies and staffing challenges</p>	<ul style="list-style-type: none"> • Building capacity and competencies <ul style="list-style-type: none"> ➤ Training and re-training/follow up. • Monitoring and evaluation, communicating data demand and use successes <ul style="list-style-type: none"> ➤ Training

	<ul style="list-style-type: none"> ➤ Regular use of data in decisions making ➤ Positive messages about data informed decisions.
Financial constraints	<ul style="list-style-type: none"> • Cuts across all the interventions
Infrastructural challenges	<ul style="list-style-type: none"> • Cuts across all the interventions

Table 5; Challenges, interventions and their measures

- **Poor data quality**

Data entry and data reporting errors contributed to the overall poor quality of data. Rufunsa was considered a best performing district, so it's data quality and reporting timeliness were considered okay for DIM discussion. *"...and then additionally all the data quality is bad. So those numbers probably don't even make much sense because they're not really cleaned,"* shared an informant on data quality. Some districts were noted to have data of bad/poor quality. Rural districts being the most affected. Poor data quality meant that people could not trust the data and thus they could not use data to make decision.

- **Limited data access, availability, and accountability.**

People don't have access. And when they do have district data reviews, it's usually the first time people are actually seeing the data; a lot of times – partner representative

Facility level staff rely on district staff for access to processed data. The facility level therefore generally lacks a way of viewing the reported data. They rely on the DHIO to fill and pull the data from DHIS2. This means if the DHIO is not available or not highly motivated and engaged, they won't get access to the data. Facilities can thus not see their data (inform of charts, graphs etc), track their performance and make programmatic decision.

"So, I asked him like, 'How often do you have people asking people their data?' What he said was, 'Depending on how often they have got meetings that they have to present right.'" – national level representative

In addition, to limited access, there is low demand for data by health program officials accompanied by less accountability by staff. There is lack of ownership, and most staff don't take responsibility and ownership for their data. In addition, only four facilities (out of 21) had QI projects. QI projects imply data use. This suggests that there is less demand and use of data for/in decision making.

- **Lack of standard guides, procedures and processes**

MOH has not provided a standard guideline for DIMs and data use. Moreover, there is no measure for a successful DIM; alluding to the fact that they are just carried out as a formality. Standardized processes such as agenda, guidelines, purpose of DIM that can be used to align outcomes and utilization of data are lacking. QI projects may be an exception to this with presence of procedures and QI committees at the facility level.

- **Lack of key data competencies and staffing challenges**

“Well, I think data analysis is being ignored. Especially most of us we don't take data seriously even when we are using.” – facility staff

Staff, especially facility level, lack the skills and competency to analyze, review data and make programmatic decisions. They even lack good presentation skills and most could be seen shying away from the audience during their presentation. If they can't fully analyze data then they are not fully able to make programmatic decisions based on this data.

- **Poor partner coordination**

MOH has a number of CPs. However, there is poor collaboration among CPs. This has led to a fragmented HMIS, and redundancy of activities. A fragmented system point to all the information is in one location (for example DIM) to support decision-making. An example is nutrition data which wasn't on DHIS2. It was hence not discussed at the DIM. The data was however available in one of the partner's database.

- **Financial constraints**

Districts receive funds from the national level. The district then assigns funds to the facility levels. Facilities are supposed to use these funds to make decisions (e.g operational decisions) such as on QI projects. Financial constraints have been experienced across various areas and

levels. Limited overall funding has affected when and how frequent DIM occurs, in addition to affecting the implementation of various projects and interventions. For example, QI projects have also been halted, discontinued or delayed due to the same.

- **Infrastructural constraints**

Infrastructural constraints, along with financial constraints, are the two main challenges cutting across along all the other challenges. Zambia is affected by infrastructural challenges such as roads, cellular coverage and power/electricity, hardware and software for HMIS. The main infrastructural challenges are thus hardware, power and cellular coverage. For instance, Rufunsa wasn't connected to power making it a challenge to provide hardware (or the choice of hardware) for HMIS at facility levels; not to mention the frequent power blackouts. Most health facilities don't have computer/hardware for accessing the HMIS. Rural areas do not have the best of cellular coverage. Use of cellular coverage to access the internet is common in Zambia. Poor cellular coverage translates to challenges in accessing the online DHIS2 (live data use).

6.2 Discussions

I first discuss the findings and results based on the conceptual framework. In addition, I address the prospects of live data visualization tools based on the conceptual framework and the challenges identified. I also present a model for the potential synthesis of live data visualization tools. Financial and infrastructural constraints are mainly implicit in my discussion in this chapter; they are discussed in a few cases.

6.2.1 Engaging data users and data producers

Linking up the work of data users and data producers, strengthens the information cycle. Their collaboration makes them aware about data processes, data collection, and data sources available. They thus have a chance of overcoming data use challenges and improve the sharing of resources (Nutley, 2012).

Zambia has poor partner collaboration. There is some form of collaboration between the MOH and its CPs. MOH has been able to bring in different partners to help with several areas in the health system such as health programs and HMIS strengthening. However, there is still a gap in the overall cooperation among the partners, and the partners with the MOH. There

are parallel databases that were not linked to DHIS2 (MOH's main HMIS). Different partners also carried out training on their systems and programs without collaborating with the MOH.

“Always we're saying it's a community with their mothers but their mothers are not here. Or the community people are not here to defend from their side.” – partner representative

MOH has made efforts to bring the health services to the community through the use of CHWs and CHAs. Despite that, little can be said about the community's involvement in the data use and decision-making processes. For example, there was no community representative (or any form of a traditional leader) in DIM. Involving the community; a data producer in this context should be fruitful. For example, the involvement of the traditional leaders in the CLTS project by Akros, and a study by (Kossi et al., 2012) where the community is taking part to improve their health status (in a sense creating accountability).

Financial constraints affected the overall collaboration between data users and data producers in this context. Lack of funds affected the frequency of DIMs and the implementation of identified intervention and plans. Infrastructural challenges such as frequent power blackout, cellular coverage affected access and utilization of DHIS2/HMIS.

6.2.2 Improving data quality

Data informed decisions making are crippled by poor data quality (Foreit et al., 2006; Braa et al., 2012). In addition to training and re-training on data quality techniques/approaches, there is a need to develop, implement and communicate data quality procedures (Nutley, 2012). Data informed decision will not occur without quality data; program efficiency and effectiveness will then suffer (Mavimbe et al., 2005).

Zambia is affected by poor data quality. Although this may not be the case across all the districts; some districts have data of better quality. Despite this, there is still a need to improve the quality of data for data informed decision-making purposes.

“... the issues of population based numbers versus head count numbers at the facilities you find the people saying we're not being done justice maybe a figure by CSO is big or too small as compared as to actually what is going on in the ground and things like that.” – national level representative

Some of the causes of data of poor quality include population data, data entry errors, and lack of regular data review. After the creation of new districts, the exact population a facility or some district are serving is unknown. There are cases where facility staff feel that the population data figure in DHIS2 is not a true representation of the situation on the ground. Indicator calculation is highly dependent on population data. Therefore, use of “*incorrect*” population figures can result in a misinterpretation of the current state.

“Day 2: disagreement of data; facility and DHIO have different data.” – Observation notes from the DIM

Data entry errors are experienced. There were several instances where the data that the facility has and the DHIO had was different. One of the reasons for the errors is data entry errors; since data entry occurred at the district level, and not at facility where the data was collected. Additionally, some facilities were also surprised by their data during DIM presentations; hinting to the lack of prior and regular review/check of their data. District staff having received training on data management, often emphasized and pushed for data of better if not best quality from the facilities; during the DIM. Most of the facility staff hadn’t undergone any kind of training on data management. This may have contributed to the poor data quality experienced.

6.2.3 Improving data availability

Data demand is crippled by poor data quality (Foreit et al., 2006; Braa et al., 2012). Well-designed information systems often comprise of information technology infrastructure, report templates and policies to support the communication of analyzed data through dissemination and feedback techniques. Data users’ ability to access and share data easily is always underdeveloped in these systems (Harrison and Nutley, 2010). There is hence the need to improve data availability in terms of synthesis, communication, access to support the use of the information in decision making (Aqil et al., 2009).

There is limited access to data, especially at the facility level. Most facility staff cannot access data from DHIS2. Those that use DHIS2, only use it for data entry purposes. The district officials have access to DHIS2 and the data. Data entry into DHIS2, data processing and analysis happens at the district level. After which processed data is meant to be disseminated to the facilities.

“...you find that even in the actual facilities right, even just the presence of basic charts or visualizations right, you find those are not there or if there are there they’re pretty much outdated it’s now just like a painting on the wall” – national level representative

Templates, charts and graphs used to communicate processed data are lacking from the facilities. Scorecard, that is meant to communicate the district’s performance, is manually (out of DHIS2) done on excel by the DHIO; along with the dependency on the DHIO for providing the analyzed data. An unengaged DHIO or unavailability, due to let’s say illness, may mean a breakdown in process. DHIS2 being the main source of processed data, infrastructural challenges such as power and lack of hardware to access DHIS2, have affected the overall access to data.

6.2.4 Building capacity and competencies

Data users often struggle competencies such as skills in data analysis, presentation, interpretation, synthesis and the creation of data-informed programmatic recommendations (Nutley, 2012). They therefore need training on analysis, critical review and data interpretation hence understanding the data they possess, what data they will need and when, so that they can demand it (ibid.). Limited follow up after training make the skills not to fully develop, and thus not well equipped to apply the new skills in the work setting (Clotteau et al., 2011) (Srinivasan, 1989) states that enabling people to work effectively, motivating them and sharpening their skills is the key to success.

“...when you trained someone for five days maybe in ART management, you assume that they’ve got competences to manage someone or maybe to manage an ART client. But then the gaps keep on being noticed in terms of how some of those people are doing.” – District official

There is a need for strong follow up and re-training programs for the staff. Facility staff lack training and skills on data analysis, presentation, interpretation and synthesis. Most of the facility presenters were shy. Training was given to the district staff such as the DHIO. Supervision and mentorship programs are in the process of being rolled out or were recently rolled out. Training facility staff on QI projects was recently carried out. A few facility staff were being chosen to receive this training.

Work overload and work overlap was common. Work overload suggests understaffing which is argued for by the facility staff. It may impede the decisions making process; a health staff wouldn't be away from the facilities for a long time (for examples trainings or district functions) as this would affect service delivery at facility.

6.2.5 Straightening organizations data demand and use infrastructure

The organizational setting; it's procedures, rules, processes, systems, and values that govern it. Processes have the ability of supporting or obstruct individuals' capacity in data making decisions. Clear guidelines for data quality and use of data will strengthen other interventions for data informed decisions. The use of a structured process helps decision makers make priority decisions, increase the demand for, the availability and quality of data (Wickremasinghe et al., 2016).

National standards/guidelines/templates on how to conduct DIMs were lacking in the Zambian context. Additionally, the measure of a successful DIM is lacking as well. Implying that the DIM maybe considered as a formality; not necessarily for the impact it has on data informed decisions. Different definition of the purposes of DIMs can be alluded to the lack of a national standard that aligns data use and decision-making processes; among other reasons such as training.

“There are no stipulated standards to say... Usually the province stipulates how our template is going to be. Almost all the time, we make our templates from the templates for the province.” – district official

There exists some form of guidelines/templates from the province. These templates vary from province to province, and district to district. The templates received are PowerPoint presentation that are adjusted and populated based on district and province. I never got to see any guidelines, policies and operating procedures on the use of these templates. Guidelines such as standard dashboards, scorecards for the different levels are missing or in the process of being created.

“Yeah, so we spend a lot of time reading figures and not enough time of the analysis interpretation and action based on that analysis and interpretation.” – partner representative

The current agenda and format of the DIM was criticized by most of the partner representative for its lack of emphasis on data discussion. The agenda, discussed in *chapter 5.2*, was mostly made of facility presentation - the first day. Little time was spent discussing the data, scorecard and action points.

6.2.6 Monitoring and evaluation, communicating data demand and use successes

Decision makers and stakeholders will use data if they put value in it (Lavis et al., 2006). Positive messages about data informed decisions making and training are among the ways of building value. Additionally, Regular use of data for decision making increases the demand for data (Foreit et al., 2006).

“I hope to be seen, to see it in the future is accountability of data, which is less practiced right now. Somebody is not responsibility for that data.” – partner representative

Most of the facility staff, having not undergone training on data use and analysis, placed no value in data. Some of the district officials that have undergone training seemed to put value in the data, and often made emphasis on the value, and importance of data in decision making and overall improvement in health service delivery. During facility presentation, there were cases where the facility staff couldn't really explain the data they were presenting. As mentioned in *chapter 6.1.2*, lack of data accountability may suggest the same.

Some provinces have some form of reward system for the best performance in the province, in a bid to boost data use at the facility level. There were no rewards/prizes presented during the DIM I attended. Although, I can argue that good performance may be geared towards receiving a price rather than placing value in the data. In the (Akros Inc., 2016), Rufunsa district was mentioned and recognized for its effort on good health practices - Rufunsa's DHIO had created a Whatsapp group as a channel for communication in the district.

6.2.7 Live data visualization tools

In this sub-section, I discuss the impact visualization tools may have on data use based on the challenges identified and the conceptual framework interventions. Figure 23 shows the model for synthesizing the potential for live data visualization tools based on the framework and the challenges identified in the Zambian context.



Figure 23; A model for synthesizing the potential of live data visualization tools use

From data analysis, I identified two groups of challenges. These are the;

- Reciprocal challenges

These are challenges that are likely to be impacted positively (benefit/improved) by the introduction and implementation of the live data tools. However, if they are not addressed or improve, they are likely to limit the implementation and utilization of the live data tools.

- Determinant challenges

These are the challenging and limiting factor to the introduction and implementation of the live data visualization tools (arrows pointing to the live tools).

Reciprocal challenges

“...going live are that we are going to have real time data in real time and it will be less tedious in terms of preparing for DIMs. It will be easier to prepare for DIMs. Then every time with a live database, the facility will have the dashboard where they can actually see how their performance is on a monthly basis or on a regular basis.” – district official

Introduction and utilization of live data visualization tools will likely improve data availability and access. It will provide some kind of platform for data presentation, analysis and access such as dashboards, graphs etc. Making it easier for the staff to process, synthesis, analyze and communicate data. Preparing for DIMs and the DIM is itself will benefit from live data access. For instance, data errors experienced in DIMs, can be resolved by accessing the live system; find the reasons for the error instead of deferring them to another time as the norm is.

“... not just improving access but making standard analytics like the dashboard, scorecard... and pushing those out. Making them accessible to DHIO, PHIO...”

To add on to that, these tools are likely to improve and add to the use of standard procedures/procedures and standardization, by making it easier to have and introduce standard data analytics such as the scorecards, dashboards etc. I believe a streamlined use of such tools is necessary to leverage them. Nevertheless, lack or limited of access and data availability may limit the use of such tools. If access to data is only limited to a few staff (e.g only DHIO) then the large health population would not be able to utilize them. Enough and efficient platforms and channels to access data and increase availability may need to be implemented along with the live data tools.

Lack of standard procedures and measures will affect the use of these tools. Different tools maybe used differently. For example, for various purposes and projects, irregular use or varying frequency etc. Lack of standard processes/procedures may thus lead to a not “streamlined” use of these tools – attributed to varying DIMs – and thus not getting the best out of them.

“Like I said I gave an example of Zanzibar during their presentations. They’re analyzing their data straight from DHIS2 I think that would cut down a lot of time and you can focus a little more on the action planning” – partner representative

An example of where such tools have been really helpful is Zanzibar (Braa et al., 2012); where they were utilized for data use workshop. An example from the Zambian context is day 2 of the DIM; where the agenda was tweaked to allow more time to discuss the district scorecard. During these sessions, data lead discussions occurred which all the parties explaining themselves – poor or best performance. It gave an opportunity for worst performance to ask for help from best performance and the participants at large. Such discussions will lead to data informed decision making.

“I have heard about it and to me I feel that’s the way you have to go about it... I feel this is long overdue, and if let’s say propagated to all the institutions then it will be able to result in a very good outcome.” – facility staff

Zambia is also blessed with motivated staff who are willing to learn and use these live visualization tools. All the informants welcomed the idea of introducing such tools, in addition to being optimistic that they would impact data use and decision making positively. Their data analysis, information use competencies are also likely to improve by using such live data tools; again, an example is Zanzibar (ibid.). Despite this, the staff lack of competency skills and experience with such live visualization data tools systems. This may thus be an obstacle to the introduction of these tools. It will require a strong training and re-training program to make such possible. Their introduction will imply putting a sustainable plan in place, which may take some time.

Training of personnel can be used as a means of additional training on data quality procedures and techniques. With improved data access, and some structured processes on the use these of tools in place, data quality is likely to improve. Bring down data entry to the, facility level instead of the district level, might eliminate some of the data entry errors experienced. Nonetheless, poor data quality or the continued availability of data of poor data quality will limit the utilization of these tools. As earlier mentioned (*chapter 6.2.2*) data, use occurrence requires data of good quality; even data discussion and DIMs.

With the use of live data visualization tools, collaboration between data producers and data users is likely to improve. This maybe a result of improved data access, present of standard analytics, processes and procedures. Specific areas such as pooled funding from CP could be useful as improved data review/analysis could benefit most, if not all, specific programs. Furthermore, program specific standard analytics, such as dashboards and data analysis

templates, could be developed through collaborations with CPs. It will be therefore easier to collaborate, share and use data among partners. On the other hand, continued poor partner coordination will limit the use of data visualization tools; especially if they are initiated by MOH.

Determinant challenges

“We might also have maybe like let’s say Rufunsa is not yet connected to power. Even to keep the machines charged might be a challenge.” – district official

These are infrastructural and financial challenges. Hardware, power and internet access challenges will also limit the use an introduction. Implementation and utilization of live data tools requires a steady amount of infrastructure to fully utilize them. An efficient and reliable way of accessing the internet will need to be identified and implemented. Solar power has been used where there is no electricity or to supplement it, at least in Rufunsa district. With financial constraints already being experienced, live visualization tools introduction presents even more expenses and costs; training costs, hardware costs, internet use costs etc. Financial constraints will thus limit the introduction and implementation of these tools.

6.3 Summary

In this chapter, I first look at the results of data analysis, which included the uses of data and the key challenges affecting data use. Data discussion based on the conceptual framework then followed. Discussion of the prospects of utilization of live data visualization tools is last to be discussed – based on the chosen framework and challenges identified. It also brings out some of the relationship between research question one and research question two. Figure 23 shows this relationship in the form of a model.

The model can be used to synthesize the potential of live visualization tools. The model identifies two group of challenges: determinant and reciprocal challenges. Determinant challenges limit the introduction of live data tools. These are financial and infrastructural challenges. Reciprocal challenges on the other hand, affect and are affected by the various challenges identified. These include poor data quality, lack of key data competencies by staff, limited data availability, access and accountability, poor partner coordination and lack of standardization/standard processes/procedures.

Data analysis revealed that data was used for two key reasons: performance review; and planning and resource utilization. The main challenges to data use were financial constraints, infrastructure constraints, and skills and capacity of the personnel. The implementation of live data visualizations tools was likely to impact both positively i.e. strengthen and improve them than the current situation. However, while the study findings suggest that live data tools could potentially improve data use through improving data access, availability and quality, such measures would also be challenged by general financial and infrastructural constraints. For instance, visualization would improve data use through improving data access, availability and quality.

7 CONCLUSION AND FURTHER RESEARCH

7.1 Summary of the research process

The study carried out in this thesis (an exploratory study) is with the objective of finding out how and for what purposes data is used, the key challenges to data use and the prospects of using live visualization tools to strengthen DIMs and data use. The research context for this study was Zambia. It's a qualitative research with case study as the chosen research method. Several data collection methods were used for data collection. The study was motivated by the lack of existing literature that problematize and critically assess the potentials of live data visualization tools to improve data use in public health decision making in low resource context. Literature such as (Braa et al., 2012) only highlight best practices of these tools, while (Moyo et al., 2014) addresses data review and not utilization of live data visualization tools.

To analyze the collected data, I adopted a conceptual framework by (Nutley, 2012). Empirical data revealed various challenges to data use such as financial constraints, infrastructural challenges, poor data quality etc. The prospect of introducing live data visualization tools also revealed that they were likely to impact data use positively even though they were challenged by finance and infrastructure constraints, in addition to personnel capability on such tools.

7.2 Reflections and conclusion

The findings of this study can be used to inform decision making in Zambia as a whole. As this study mainly looks at one district in Zambia, it can be used to inform decision in other Zambian districts and Zambia as a country. With Zambia looking to improve its data use, some of the challenges to data use are addressed in this thesis can be used to supplement other studies and assessments on the same. It hence can be used to support improvements in the DIMs and data use contexts.

More broadly, the study looks at peer-reviews and data use in a low-resource setting. Best practices and challenges have been highlighted in this thesis. The findings can then be used as a learning tool for other areas, countries and regions in a low-cost resource setting. As mentioned in *chapter 2* a lot has been written about decision making in low- cost resource

settings. This thesis can thus be considered under the same category; it highlights the challenges to data use and decision making.

The determinant challenges may be used as a readiness assessment tool. This initial assessment can be used to find out whether they limit the introduction of live data visualization tools. Afterwards, the reciprocal challenges may be mapped out and the relationships identified i.e whether they're limiting or not. Weighting/ rating/ranking of the reciprocal challenges can also be done. Then focusing on the weaker areas (of the reciprocal challenges) may follow these steps.

There has been a trend to go live; utilize data warehouse approach and DHIS2 tools such as dashboards and scorecards (Braa and Sahay, 2012). While (Braa et al., 2012) documents the best case and how use of live data visualization tools improved various aspects/areas in the data use workshop and personnel, this study goes a step further. It brings out the challenges and relationships of various data use, decision making, and data-use workshop elements. For instance, it shows the relationship between data quality and use of live visualization tools besides bringing out challenges to data use. It therefore can be used to inform the implementation and introduction of live data visualization tools in low-resource settings. Zambia is currently in the process of introducing DHIS2 at the facility level (Parramore, 2017). The findings from this thesis can thus be used to support the introduction and implementation of such data collection and analysis tools at district and sub-district levels.

7.3 Further Research

I consider what I have found as not “the truth”, but “a truth”. With more research, more aspects and versions of “the truth” will be revealed. Further research should go deeper into the facility and district levels data use. It would be interesting to explore the impact the introduction of the live data visualization tools will have on decision making and data use. Zambia has the ambition to implement DHS2 at facility level, some of the challenges I have identified are even more severe at this level, and thus a study at this level would be interesting.

In addition, utilization of live data visualization tools, in other low-resource settings needs further research. This can be used to shed light on their implementation, challenges and best practices; especially issues with sustainability. An example would be studies based on live

data visualization tools, such as dashboards and scorecards; their implementation at facility, district level, and how they impact data use.

With Zambia implementing reforms – decentralization being one of the reforms - exploring how this reforms influence and impact data use and decision-making, is another area that needs further research. Moreover, use of technology to enhance data-use workshop and decision making at the district level needs further study.

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APPENDIX

Appendix A – DIM opening presentation



RUFUNSA DISTRICT HEALTH OFFICE

FOURTH QUARTER 2016

DISTRICT INTEGRATED MEETING (DIM)

OBJECTIVES

OBJECTIVES

- To review 4th quarter performance in provision of health services in our Health Facilities and the District.
- Analyse our data for a better guide in the selection and prioritization of interventions directed at health care.
- Make recommendations aimed at improving service delivery.

Appendix B – Data quality reports

RUFUNSA HMIS QUARTER 4 COMPLETENESS AND TIMELINESS 2016

Period	Facility Name	HIA2 Reporting rate	HIA1 Reporting rate	HIA3 2016 Reporting rate	HIA1 Reporting rate on time	HIA2 Reporting rate on time	HIA3 Reporting rate on time
Oct to Dec 2016	<u>Rufunsa District</u>	96.7	95.2	100	93.7	95	0
	<u>Bunda Bunda Health Post</u>	100	100		100	100	
	<u>Chifundo Rural Health Centre</u>	100	100		100	100	
	<u>Chimusanya Health Post</u>	100	100		100	100	
	<u>Chinyunyu Rural Health Centre</u>	100	100		100	100	
	<u>Chitemalesa Health Post</u>	100	100		100	100	
	<u>Chiyota Health Post</u>	100	100		100	100	
	<u>Kankumba Rural Health Centre</u>	100	100		100	100	
	<u>Kanyongoloka Health Post</u>	100	100		100	100	
	<u>Kazemba Health Post</u>	0	0		0	0	0
	<u>Luangwa Bridge Health Post</u>	100	100		100	100	
	<u>Lukwipa Rural Health Centre</u>	100	100		100	100	
	<u>Mpanshya Hospital Affiliated Health Centre</u>	100	100		100	100	
	<u>Mpanshya Mission Hospital</u>		100	100	100		0
	<u>Mulamba Health Post</u>	100	100		100	100	
	<u>Mwachilele Health Post</u>	100	100		100	100	
	<u>Namanongo Health Post</u>	100	100		100	100	
	<u>Nyangwena Rural Health Centre</u>	100	100		100	100	
	<u>Rufunsa Rural Health Centre</u>	100	100		100	100	
	<u>Rutech Health Post</u>	100	100		100	100	
<u>Shikabeta Rural Health Centre</u>	100	100		100	100		
<u>Tengama Health Post</u>	100	100		66.7	66.7		

RUFUNSA HMIS QUARTER 4 COMPLETENESS AND TIMELINESS 2016

Period	Facility Name	HIA2 Reporting rate	HIA1 Reporting rate	HIA3 2016 Reporting rate	HIA1 Reporting rate on time	HIA2 Reporting rate on time	HIA3 Reporting rate on time
Oct to Dec 2016	Rufunsa District	96.7	95.2	100	93.7	95	0
	Bunda Bunda Health Post	100	100		100	100	
	Chifundo Rural Health Centre	100	100		100	100	
	Chimusanya Health Post	100	100		100	100	
	Chinyunyu Rural Health Centre	100	100		100	100	
	Chitemalesa Health Post	100	100		100	100	
	Chiyota Health Post	100	100		100	100	
	Kankumba Rural Health Centre	100	100		100	100	
	Kanyongoloka Health Post	100	100		100	100	
	Kazemba Health Post	0	0		0	0	
	Luangwa Bridge Health Post	100	100		100	100	
	Lukwipa Rural Health Centre	100	100		100	100	
	Mpanshya Hospital Affiliated Health Centre	100	100		100	100	
	Mpanshya Mission Hospital		100	100	100		0
	Mulamba Health Post	100	100		100	100	
	Mwachilele Health Post	100	100		100	100	
	Namanongo Health Post	100	100		100	100	
	Nyangwena Rural Health Centre	100	100		100	100	
	Rufunsa Rural Health Centre	100	100		100	100	
	Rutech Health Post	100	100		100	100	
Shikabeta Rural Health Centre	100	100		100	100		
Tengama Health Post	100	100		66.7	66.7		

Appendix C – Informed consent

INFORMED CONSENT

INTRODUCTION

You are invited to join a research study to look at data use, and the use of data visualization tools in DIMs. Please take whatever time you need to discuss the study with your family and friends, or anyone else you wish to. The decision to join, or not to join, is up to you.

In this research study, we are investigating challenges affecting data use, as well as how the use of data visualization will impact data use. All this is done using the DIM as tool; to gain a deep insight.

WHAT IS INVOLVED IN THE STUDY?

If you decide to participate you will be asked to contribute to your best knowledge the areas of DIMs, DHIS2, and data use in Zambia. We think this will take you 20-30 minutes.

CONFIDENTIALITY

I will take the following steps to keep information about you confidential, and to protect it from unauthorized disclosure, tampering, or damage: I and my transcriber(outsourced) will have access to the audio – the audio will be transcribed.

The audio and transcripts will be stored on the cloud.

YOUR RIGHTS AS A RESEARCH PARTICIPANT?

Participation in this study is voluntary. You have the right not to participate at all or to leave the study at any time. Deciding not to participate or choosing to leave the study will not result in any penalty or loss of benefits to which you are entitled, and it will not harm your relationship with UiO and Information Systems group.

CONTACTS FOR QUESTIONS OR PROBLEMS?

Call Peter Mogaka Ogega at +4796724016 or email pete.mogaka@gmail.com, if you have questions about the study, any problems, unexpected physical or psychological discomforts, any injuries, or think that something unusual or unexpected is happening.

Name:

Date:

Appendix D – Interview guides

Interview Guide

Interview Questions for all staff

1. What's your role in the DIM?
2. What is the purpose of the DIM?
4. What do you see as outcomes of the DIM?
5. What do you feel the DIM discussions lead to?
6. How do you describe follow ups from previous DIMs?
 - Data and from discussion from the previous DIM.
 - Feedback and follow up.
7. How do you feel data is being used?
8. How would describe the data being presented and reviewed?
9. For what purposes is this data being used?
10. How would you describe involvement and support of the MOH at local, district and national level?
11. How do you prepare for DIMs?
12. What happens if there is disagreement about the data presented?
13. How would describe your access and use of DHIS2?
14. There is a plan to introduce live data visualization tools, what's your take on that?
15. What challenges have you faced in regards to:
 - Data presentation
 - Review
 - Data use
16. Is there anything you would like to add?

interview questions for district, national and partner levels staff.

1. What population data are you using?
2. What do you believe would be necessary to utilize DHIS2 more for live data use?
3. What impact do you feel live DIM will have on data quality and use?
4. What are the pro n cons of going live?
5. How would you measure the success of a DIM?

Appendix E – Rufunsa district scorecard

RMNCAH&N DISTRICT SCORCARD FOR QUARTERS 3 OF 2016 AND 4 OF 2016																				
District Name: RUFUNSA																				
A	Name of Health Facility	Pre-pregnancy		Adolescence		Pregnancy														
		% of clients accessing long acting reversible contraceptives	% of total ANC1 attendants aged < 18 yrs	% of pregnant Women attending ANC1 within 1 st trimester	% of pregnant Women attending ANC1 total	% of pregnant Women Accessing 24 Visits to ANC	% 1st ANC tested for HIV	% of known HIVs at first ANC	% HIV positive pregnant women initiated on EMTCT	% of deliveries conducted by skilled personnel population based	% of deliveries conducted by skilled personnel based on institutional delivery	% of Institutional								
		Q3 2016	Q4 2016	Q3 2016	Q4 2016	Q3 2016	Q4 2016	Q3 2016	Q4 2016	Q3 2016	Q4 2016	Q3 2016	Q4 2016	Q3 2016	Q4 2016					
1	Rufunsa District	10%	11%	10%	24%	84%	89%	89%	73%	95%	82%	8%	4%	100%	89%	55%	52%	99%	89%	56%
2	Bunda Bwanda	0%	0%	0%	0%	88%	100%	100%	37%	100%	100%	0%	0%	0%	0%	55%	60%	100%	100%	50%
3	Chilundo	0%	8%	11%	69%	100%	100%	100%	121%	100%	100%	5%	0%	100%	0%	17%	25%	100%	250%	17%
4	Chimansama	2%	0%	28%	28%	83%	94%	12%	112%	85%	73%	7%	6%	83%	100%	100%	100%	100%	100%	100%
5	Chimwene	4%	0%	10%	2%	88%	89%	25%	115%	92%	93%	8%	7%	88%	100%	100%	100%	100%	100%	100%
6	Chimwalesa	0%	10%	0%	20%	83%	82%	28%	44%	98%	87%	0%	2%	100%	100%	24%	25%	83%	26%	6%
7	Chivwa	0%	0%	0%	0%	12%	0%	45%	168%	100%	121%	0%	0%	100%	0%	50%	52%	100%	100%	62%
8	Kankumba	0%	3%	12%	21%	100%	75%	15%	23%	100%	121%	0%	5%	243%	120%	52%	82%	100%	100%	62%
9	Kanyongoloka	0%	2%	0%	27%	0%	97%	0%	44%	0%	88%	0%	4%	0%	0%	0%	0%	0%	0%	0%
11	Lusaveza Bridge	13%	0%	0%	90%	91%	97%	13%	25%	100%	85%	0%	1%	20%	100%	100%	100%	100%	100%	100%
12	Lukwipa	7%	2%	0%	22%	24%	85%	207%	16%	107%	65%	14%	6%	100%	100%	100%	100%	100%	100%	100%
13	Mwambwa Hospital	0%	46%	0%	52%	11%	137%	23%	149%	100%	101%	6%	3%	100%	86%	30%	20%	100%	100%	30%
14	Muzamba	0%	2%	2%	7%	83%	144%	161%	139%	100%	98%	0%	3%	0%	33%	34%	79%	100%	100%	34%
16	Mwachibwe	0%	10%	10%	50%	100%	100%	7%	4%	83%	100%	0%	0%	100%	0%	24%	30%	75%	81%	20%
16	Nemanzago	0%	0%	0%	0%	81%	80%	34%	13%	100%	95%	0%	0%	100%	0%	20%	21%	100%	100%	20%
17	Nyanzweni	2%	18%	24%	41%	130%	134%	233%	93%	81%	102%	2%	2%	100%	86%	99%	79%	100%	100%	99%
18	Rufunsa	12%	10%	4%	8%	25%	80%	21%	78%	80%	75%	12%	0%	13%	0%	1%	8%	100%	100%	8%
19	Rutech	4%	8%	28%	40%	160%	159%	8%	0%	100%	110%	2%	0%	0%	0%	0%	0%	0%	0%	0%
20	Sihabeta	7%	0%	13%	16%	49%	28%	143%	38%	80%	24%	0%	0%	0%	0%	42%	44%	100%	67%	42%
21	Tenqama	14%	11%	12%	0%	81%	104%	0%	50%	93%	0%	0%	0%	0%	0%	6%	0%	100%	100%	6%

Appendix F – DIM agenda

Millennium Development Goal Initiative			
Accelerating the Reduction of Maternal, Neonatal and Child Mortality			
 REPUBLIC OF ZAMBIA	 EUROPEAN UNION	 United Nations ZAMBIA	
MDGi: A Joint Government of the Republic of Zambia-European Union-United Nations Programme			
PROGRAMME FOR DISTRICT QUARTERLY REVIEW MEETING-CHIMUTUNZI LODGE 7TH TO 7TH FEBRUARY, 2017			
DAY 1			
TIME	ACTIVITY	PRESENTER	CHAIRPERSON
08:00 to 08:30 Hrs	Registration	Secretariate	DHD
08:30 to 10:45	National Anthem & Prayer	All	
	Introductions	PC	
	Opening Remarks	DHD	
	Meeting Objectives	Planner	
	Guest of Honour Remarks	District Commissioner	
	Previous Action Points	Planner	
	District Presentation	DHIO	
Plenary			
	Tea Break		
11:05 to 13:00 Hrs	Facility Presentations & Discussions	Facility Representatives	MCH Coordinator
	Lunch		
14:00 to 15:20 Hrs	Facility Presentations & Discussions	Facility Representatives	Pharm Tech