Optimizing Perspectives: A Classic Grounded Theory of Stakeholder Perceptions on WSDB Influence in Uganda's Water Sector

By

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Dedication

To my beloved parents Haruna and Sharifa Chemisto. Your unconditional love and support are my inspiration. The struggles you endured caring for us provided me with an early understanding of perseverance and hard work.

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Publications

The research has so far yielded four conference papers. The first paper provided a review of literature related to the status Uganda's rural water and sanitation sector, and then examined implemented ICT initiatives. The review highlighted benefits and challenges for adopting ICT initiatives; and describes how ICTs are impacting governance, transparency, accountability, service delivery and development. The paper was presented at the 9th IDIA Conference in Zanzibar, Tanzania May 2015. Publication details are:

- Chemisto, M., Rivett, U. (2015). A Review of Sector Coordination and ICTs in Multi-Stakeholder Environs of Uganda's Rural Water Sector. Proceedings of the 9th IDIA conference, 8-9 November 2015, Nungwi, Zanzibar: 266-285 ISBN: 978-0-620-68395-0

The second paper draws on concomitant perceptions that ICT4D and ISDC studies postulate ICTs amplifying development. The paper sought to theorises on the developmental influence of the Water Supply Database (WSDB) which is an ICT initiative implemented to manage information paucity challenges in Uganda's water sector. This paper presents ontological, epistemological and methodological foundations underpinning the research. Specifically, Interpretivist approach, and adoption of Classic Grounded Theory (CGT) as a methodology for data collection and theory development. The paper was presented at IST-Africa 2020 Conference in Kampala, Uganda May 2020.

- Chemisto, M., Rivett, U. (2020). Understanding the Influence of ICT in Development: A Study of Uganda's Water Sector. IST-Africa 2020 Conference Proceedings, 18-22 May 2020, Kampala, Uganda. ISBN: 978-1-905824-65-6

The third paper presents the cultivated substantive theory called Optimizing Perspectives. A strong description of how the theory emerged using CGT is illustrated. The paper highlights relevance of using CGT in ICT4D or ISDC research, and effect of adopting CGT in theorisation studies that understand developmental influence of ICTs. The paper was presented at YEEES Conference held in Vechta, Germany.

- Chemisto, Musa (2021). Theorizing ICT Artefacts: A Classic Grounded Theory Exploration of WSDB Effect on Uganda's Water Sector. YEEES Conference Proceedings, 24-26 March 2021, Vechta, Germany.

The fourth paper discusses how the theory Optimizing Perspectives was generated from participant perspectives concerning the developmental influence of the WSDB. The paper examines the experience of adopting CGT and highlights relevance of using CGT in studies that contribute to understanding developmental influence of ICTs in SSA. The paper was presented at IST-Africa 2021 conference held on 10-14 May 2021.

- Chemisto, M., Rivett, U. (2021). Conceptualizing Artefact Influence: A Grounded Theory Exploration of an ICT4D Study in Uganda. IST-Africa 2021 Conference Proceedings, 10-14 May 2021. ISBN: 978-1-905824-66-3

Abstract

This exploratory and interpretive research analytically examines perceived influence of the Water Supply Database (WSDB) initiative on Uganda's water sector development, particularly the rural sector. The WSDB was deployed by the Ministry of Water and Environment (MWE) to manage country wide water source information submitted by District Water Officers (DWO) and regional Technical Support Units (TCUs). The MWE has integrated the WSDB to support sector governance, planning, budgeting, information sharing, setting measures for performance indicators and data based decision making processes for developing new water supply projects.

This research is the first in-depth study exploring the WSDB; hence justifying relevance and my enthusiasm. Instead of focusing on numerical concepts, this research qualitatively investigates and theorises from participant perceptions about the WSDB benefits and positioning as the MWE's primary information and communication technology (ICT) initiative. The perceptions are categorised from WSDB design, implementation, benefits and implicit contribution to recognise development influence.

Grounded Theory (GT), specifically Glaserian Classic Grounded Theory (CGT) approach was adopted to inform methodology choice, data collection, data analysis and theory development. Data was collected across two field studies from multiple stakeholder participants working in Uganda's water sector over a total period of six months. Participant perceptions expound the developmental significance of WSDB using benefits, optimism and subtle discontents.

As a result of CGT methodology, inductive thinking and interpretive philosophical assumption; I discerned that the main participant perspectives entailed MWE effectively leveraging the WSDB to increase citizen's access to water by managing functionality of water sources, tracking sector performance, governance and data based decisions to develop new water sources. This concept emerged from data analysis, coding

and categorization processes which cultivated the conceptual core category *Optimizing Perspectives* from codes, primary sub-core categories and secondary sub-core categories. Four primary sub-core categories and thirteen secondary sub-core categories cultivated discovery of *Optimizing Perspectives*. *Optimizing Perspectives* emerged as a substantive theory whose constructs, processes and categories summarily infer that the MWE is continually engaged in optimisation of WSDB to develop the water sector.

Other than the theory contribution, two main implications of adopting CGT methodology emerged from this research. First, findings are useful for understanding consequences of adopting CGT for artefact theorisation studies in Sub-Saharan Africa (SSA) for which the WSDB is an exemplar. Secondly, findings contribute to IS research which advance using CGT to theorise about the contemporary notion of ICT for Development (ICT4D) or Information Systems in Developing Countries (ISDC) studies that examine developmental significance of ICTs such as e-government systems in SSA.

A comparative analysis of *Optimizing Perspectives* with related theories was undertaken to bring new conceptual meaning, understanding and potential theory generalisation. *Optimizing Perspectives* makes a case for the construction of guidelines to inform social-technical analysis of development-oriented ICT artefacts. Finally, possibilities exist for CGT researchers to enhance studies about ICT artefacts and ICT4D or ISDC by adapting the theory *Optimizing Perspectives*.

Keywords:

Information Systems, Information and Communication Technology, Artefact, Water Supply Database, Classic Grounded Theory, ICT4D, Development, Sub-Saharan Africa, Concept, Category, Optimisation, Perspectives, Theory

Table of Contents

List of Tables

List of Figures and Illustrations

List of Abbreviations and Acronyms

ADSL	-	Asymmetric Digital Subscriber Line
BRICS	-	Brazil Russia India China South Africa
BSP	-	Basic Social Process
BSSP	-	Basic Social Structural Process
CBO	-	Community Based Organisation
CC	-	Constant Comparison
CGT	-	Classic Grounded Theory
CGTM	-	Classic Grounded Theory Methodology
CI	-	Community Informatics
CSO	-	Civil Society Organization
DC	-	Developing Countries
DI	-	Development Informatics
DWO	-	District Water Officers
EASSy	-	Eastern Africa Submarine Cable System
EGI	-	e-Government Infrastructure
G2B	-	Government and Business
G2C	-	Government and Citizens
G2G	-	Government to Government
GoU	-	Government of Uganda
GPs	-	General Practitioners
GT	-	Grounded Theory
HCI	-	Human-Computer Interaction
HCI4D	-	Human-Computer Interaction for Development
HDI	-	Human Development Index
iCOMMS	-	Information for Community Services
ICT	-	Information and Communication Technology
ICTs	-	Information and Communication Technologies
ICT4D	-	ICT for Development
IS	-	Information Systems
ISDC	-	Information Systems in Developing Countries
ISDN	-	Integrated Services Digital Network
ISP	-	Internet Service Provider
IT	-	Information Technology
JSR	-	Joint Sector Reviews
JTR	-	Joint Technical Review
LDC	-	Least Developed Country
MIS-Unit	-	Management Information System Unit
MoICT&NG	-	Ministry of ICT and National Guidance
MRT	-	Middle-range theory
MWE	-	Ministry of Water and Environment

NBI	-	National Data Transmission Backbone Infrastructure
NIISP	-	National ICT initiatives Support Programme
NITA	-	National Information Technology Authority
OC	-	Open Coding
PI	-	Performance Indicators
RCIP	-	Regional Communications Infrastructure Program
RWS	-	Rural Water Sector
RWSN	-	Rural Water and Sanitation Network
RWSSD	-	Rural Water Supply and Sanitation Department
SC	-	Selective Coding
SDGs	-	Sustainable Development Goals
SI	-	Social Informatics
SMP	-	Sustainable Manufacturing Practice
SMIs	-	Social Media Influences
SPR	-	Sector Performance Report
SSA	-	Sub-Saharan Africa
SWAp	-	Sector Wide Approaches
TC	-	Theoretical Coding
TCU	-	Technical Support Units
TEAMS	-	The East African Marine System
TM	-	Theoretical Memos
TSP	-	Theoretical Sampling
TSR	-	Theoretical Saturation
TS	-	Theoretical Sensitivity
UBOS	-	Uganda Bureau of Statistics
UCC	-	Uganda Communication Commission
UIXP	-	Uganda Internet Exchange Point
UN	-	United Nations
UNDP	-	United Nations Human Development
UTL	-	Uganda Telecom
UWASNET	-	Uganda Water and Sanitation NGO Network
VoIP	-	Voice Over Internet Protocol
WATSUP	-	Water Atlas Update Project
WASH	-	Water Sanitation And Hygiene
WESLD	-	Water Sector Liaison Department
WiFi	-	Wireless Fidelity
WSC	-	Water Source Committee
WSDB	-	Water Supply Database
WSS	-	Water Supply and Sanitation
WSS-MIS	-	Water Supply and Sanitation Management Information System
WUC	-	Water User Committee

Chapter One

1.0 Introduction

"The knowledge of anything, since all things have causes, is not acquired or complete unless it is known by its causes"

Ibn Sina, Avicenna (980 AD – 1037 AD)
Philosopher

1.1 Chapter Summary

This chapter provides an outline of eight major sections that establish the foundations for this research. The research was initiated as a product of a priori knowledge and experiences gained from being involved in Information for Community Services[1] (iCOMMS) research group projects that understand and examine Information and Communication Technology (ICT) interventions in the water sector of Sub-Saharan Africa (SSA). iCOMMS is an interdisciplinary research group focused on understanding the use, application, influence and impact of ICTs in Developing Countries (DC) especially in SSA.

The research started as a reflection of my background and enthusiasm; and is engrained from the idea that Information Technology (IT), ICT or Information Systems (IS) have been positioned as essential components for service delivery, welfare and development determinations by governments or developmental agencies in SSA (Avgerou et al., 2016; Avgerou & Walsham, 2017; van Biljon & Lotriet, 2014; Harris, 2017; Qureshi, 2015; Sahay & Walsham, 2017; Steyn & van Greunen, 2015; Walsham, 2012, 2017).

This research focused on participant perceptions and their concerns regarding developmental influence of the Water Supply Database (WSDB).

[1] http://www.icomms.uct.ac.za

The WSDB is an ICT artefact implemented by Uganda's Ministry of Water and Environment (MWE) to manage information in the water sector, particularly for the Rural Water Sector (RWS) under the Rural Water Supply and Sanitation Department (RWSSD). More about the WSDB is explained in *Chapter Two* (*sub-section 2.3*).

To undertake the research, I adopt a methodological approach that reflects on socio-technical aspects of the study to make a theoretical contribution, as noted by Sawyer & Jarrahi (2014, p. 30-31) assertion:

> "*sociotechnical approaches to studying ICT and IS provide useful intellectual guidance to advance our theorizing on technological artifacts, and how people's work practices and organizational arrangements are afforded by technological resources and inhibited by technological constraints*"

For the purpose of setting boundaries, and not to confuse readers with the multiple terms ICT, IT or IS; I only use ICT and IS in this chapter and throughout the thesis. I consider ICT as simply any scientific knowledge that supports creating, gathering, displaying, presenting, storing, transmitting, processing, manipulating and exchanging of information (Gigler, 2011; Tri & Nguyen, 2014; Waiswa & Okello-Obura, 2014). While IS encompasses ICT and IT because all technologies are socially positioned. I frame this research with IS concepts of Social Informatics (SI) or Community Informatics (CI). Kling (2007, p. 205) and (Kling, 2000, p. 246) elucidate SI as:

> "*the interdisciplinary study of the design, uses and consequences of information technologies that takes into account their interaction with institutional and cultural contexts*"

Similarly, Gurstein (2000) and Harris (2002) refer to CI as principles and practices concerned with design, deployment and use of ICTs for personal, social, cultural and economic development of communities.

In this chapter, the first section provides justification for undertaking the research. The second section gives a brief historical background of Uganda and it's water sector including WSDB, which is this research's focus. The third section provides an overview of ICT and WSDB, hence assisting in defining the problem. In the core sub-sections, I state the research question, objectives justifying aim or study relevance, methodological approaches and the philosophical assumptions that allowed me to undertake the study.

The chapter concludes by providing an outline of the thesis structure. All sections in this chapter and the entire thesis are prudently organised to provide coherent flow and interlinking.

1.2 Why this Research?

I commence this study by noting that IS research endeavours to communicate the concept that all technologies are socially positioned and embedded in shaping the social world throughout their design, implementation, usage, evaluation and adaptation (Andrade, 2009; Avgerou et al., 2016; Sawyer & Jarrahi, 2014). Generally, IS studies focus on how sociotechnical aspects influence organizational actions, processes, structures and changes. Emphasis on sociotechnical perspectives support empirical studies, conceptual approaches and theoretical understandings of organizations and societies (Avgerou, 2013; Avgerou & Walsham, 2000; Dasuki & Abbot, 2015; Mitev, 2000; Orlikowski & Baroudi, 1991).

In SSA, IS studies rationalise need to understand development-oriented effects of ICTs, and whether they contribute to *making a better world* (Davison, 2016; Quin, 2012; Qureshi, 2015; Walsham, 2017). Avgerou (2008) introduced the concept of Information Systems in Developing Countries (ISDC) to explain concerns and contributions of ongoing ICT or IS research in DC. I embraced Avgerou (2008, p. 135) declarations that:

> "*IS innovation in developing countries is about constructing new techno-organizational structures within a given local social context"*; and that ISDC research is expanding *"IS research agenda and developed new*

understanding of IS innovation phenomena, mainly through its attention to social context and strategic concerns associated with socio-economic development".

In the last decade, ICT studies relative to socioeconomic perspectives have witnessed tremendous growth; and there is considerable discussions about their socioeconomic benefits (Alderete, 2017; Avgerou, 2010; Gigler, 2011, 2015; Qureshi, 2015; Roztocki & Weistroffer, 2016; Steyn & van Greunen, 2015). In SSA, ICTs are now positioned as key components for development. The report by GSMA[2] states that ICTs especially mobile technology contribute over 6% of GDP in SSA; higher than any region globally and expected to rise to 8% by 2020. Countries have implemented ICT support policies and frameworks to act as enablers for citizen access to information and knowledge so that they can participate meaningfully in the community and economy (AfDB, 2013; MoICT, 2014; Svensson & Yanagizawa, 2009).

Bankole et al. (2011) explored the impact of ICT on human development by focusing on the relationship between four ICT investment dimensions (hardware, software, internal spending and telecommunication) and three key components of human development (*standard of living/GDP, education and health/ life expectancy*). Their analysis showed that the dimensions have an impact on development, and suggest theoretical propositions to explain impact of ICTs on human development. Relatedly, Bankole et al. (2013) examined interaction between analogous ICT investments and human development dimensions; and advocated for policy makers to do trade-off analysis between diverse ICT investment components to influence contextual socioeconomic development in some sectors.

Janowski et al. (2018) succinctly explain that ICTs such as e-government systems in DC are shaping and reshaping provision of public services by governments when fulfilling citizen needs, and governance by public administrators when coordinating in delivery of public services. Macome

[2] *Source:http://www.gsma.com/newsroom/sub-saharan-africa-leads-world/*

(2008) delineates ICTs in DC as enabling active participation in globalization processes which contribute to national development efforts. van Biljon & Lotriet (2014) reiterate that ICT4D research is contributing to understanding contextual challenges related to engineering, application and adoption of technologies in DC to impact policy and practice.

Bankole & Mimbi (2017) assert that researchers have shown the potential of ICTs transforming and reinventing governance based on the magnitude of ICT investments over the last decades. In addition, studies examining the influence of ICTs on governance have mainly focused on western countries, and there is limited empirical research in SSA.

In Uganda, Kuhimbisa et al. (2017) assert that increasing implementation of ICTs in government processes and services has resulted in their consideration as mechanisms for citizens to access developmental services.

Steyn & van Belle (2015) declare that ICT influence on development in SSA is still elusive. As an example, Steyn (2016) confronts research relating to use of mobile phone technology for community development and economic welfare for fisherman in Kerala by stating that such studies "*are often skewed due to extreme reductionism*", and have fundamental methodology and logical problems, plus contradictory conclusions. In addition, Mimbi & Bankole (2016b) study of ICT effect in transforming public value among BRICS countries denoted that high ICT investment is not a determinant for efficiency in creating public value.

I reflected upon these studies and their contemporaneous development-oriented concerns of understanding technology adoption to start this research. Additionally, limited IS research and theories about the water sector in SSA augmented my enthusiasm for this study. I aimed to reflect and theorise about consequences of implementing ICT initiatives on water sector development from the perspectives of participants. I focused on the WSDB, an ICT artefact implemented by Uganda's MWE to manage data issues. There are no in-depth studies or academic research focused on the

WSDB, and limited literature is published in reports such as Sector Performance Report (SPR)[3].

To be specific, there is a complete lack of philosophical studies and logical reasoning about the WSDB. The necessity to examine the WSDB relative to ISDC research was a strong motivation. In addition, individual ambition to make meaningful IS research or knowledge contribution about SSA and my own country Uganda was incentivising. I envisaged this as a scientific knowledge contribution about ICT interventions, specifically developmental influence of WSDB because no studies exist about this contextualisation.

Several reflective questions I asked myself were: (1) *How do stakeholders perceive the WSDB deployment*? (2) *What have been the effects or consequences of WSDB*? (3) *How is the WSDB acting as an information resource that is influencing the way the sector operates*? (4) *Can we credit the WSDB with growth based on decisions made using its information*? (5) *Is the WSDB providing consistent real time information*? (6) *How is the WSDB mediating stakeholder interactions*?

I classified this research as an exploratory because the study phenomenon has not been clearly defined in present research. Saunders et al. (2012) & Singh (2007) describe exploratory research as characterised by lack of proper understanding of the problem, limited research and uncertainty. Stebbins (2001) asserts that exploratory research is intended to develop definitions and propose best research design, data collection and analysis methods. Exploratory research is not intended to provide final conclusive evidence or answers to research questions, but rather a better in-depth understanding of the research problem.

I adopted Grounded Theory (GT) methodology, specifically Glaserian Classic Grounded Theory (CGT) to conduct this qualitative research. Glaser & Strauss (1967) described GT as the "*discovery of theory from data*" that is systematically obtained and analysed in social research. More about GT and

[3] SPR is an annual report published by Uganda's MWE (MWE, 2016, 2018, 2019)

Glaserian CGT approach adopted is discussed in *Chapter 3*. In the end, I refine and analyse research questions using CGT to provide answers and experiential understanding of WSDB influence from perspectives which are true assumed experiences of participants.

1.3 Study Background

1.3.1 Uganda's Water Sector

Because this study is about an ICT artefact in the water sector, I am compelled to briefly describe demographics about Uganda's water and ICT sector. Uganda is a landlocked country in East Africa bordered by South Sudan, Kenya, Tanzania, Rwanda and Democratic Republic of Congo (DRC). Fresh water sources provide livelihood to 90% of the population, but sustainable development of water resources to support community water access is blighted by challenges like rapid population growth, financial constraints, environmental degradation and geographical distribution (MWE, 2018, 2019; Naiga et al., 2015; O'Meally, 2011). According to MWE (2019), projections from Uganda Bureau of Statistics (UBOS) indicate an approximate population of 40 million, with 76% living in rural areas. Population growth of approximately 3% is one of the highest in the world; and is putting considerable strain on public service delivery not just for water, but in sectors such as health and education (UBOS, 2014, 2019).

In the early 1990's, over 60% of the rural population lacked access to safe drinking water; and this period was characterised by fragmented project support, limited use of local municipalities for domestic systems and inefficient service delivery (Danert, 2010; Fisher et al., 2005; Kimanzi, 2004; Robinson, 2002). Nonetheless, public institutions responsible for water service delivery have been consistently built over the years with local governments empowered to deliver water services since the Local Government Act 1997 & 2000 was implemented (Danert, 2010; MWE, 2011; Quin, 2012). The quality and number of improved connections to water sources has continuously improved. Considerable progress in the

development of water supply sector has been made despite challenges (MWE, 2016; Naiga et al., 2015).

MWE (2019) reports that estimated access to improved water sources in rural areas is at 69% (decreased from 70% in 2018) while urban areas is at 79.1% (Increased from 74% in 2018). Functionality of rural water supplies country-wide was at 85% similar to 2018 and down from 88% in 2016. Water sources for rural areas include protected springs (21%), shallow wells (23.4%), deep boreholes (44.3%), (11%) for piped water schemes that are gravity-fed or pumped and rainwater harvesting tanks. Urban areas are supplied by the government owned utility called National Water and Sewerage Corporation (NWSC) with piped water schemes. Boreholes, protected springs & piped gravity flow schemes are the most commonly accessed water sources in Uganda during the dry season (58%) while rainwater was a common source of drinking water during the wet season (27%) (UBOS, 2015). Total financing in the water sector was approximately Uganda shillings (UGX) 1,939.12 billion. Government on-budget funding was at 51.9% (UGX 1,008.15 billion), donor on-budget financing at 43% (UGX 825.52 billion) and the rest of funding (5%) provided by Civil Society Organizations (CSOs) in the water and environment sectors (MWE, 2019).

Despite steps taken to improve water service delivery and data submissions, challenges still remained particularly in rural areas. The MWE faces data submission challenges, while households face inadequate safe water sources. Submission of water related information from districts in the whole country is still fragmented, with some districts not submitting information on time (MWE, 2016; UBOS, 2015). Field visits to monitor functional or non-functional projects remains fairly fragmented, and MWE is not always able to follow up on some performance issues in a timely manner due to lack of reliable information (Asiimwe, 2016; MWE, 2016; Naiga et al., 2015). Since 2003, many districts have been split up and the creation of new districts has spread existing capacity, slowing and hampering progress (MWE, 2016).

To continually enhance sector growth or development, the MWE has supported ICT use to collect, analyse and report data; and for staff capacity building; thus strengthening monitoring, evaluation and reporting (Asiimwe, 2016; MWE, 2016; Quin, 2012). For this research, the words growth or development is demarcated by goal six[4] of the United Nations (UN) Sustainable Development Goals (SDGs), which ensures availability, sustainable management and access to water and sanitation for all.

1.3.2 ICT Initiatives as Solutions

In Uganda, the Ministry of ICT and National Guidance (MoICT&NG), Uganda Communication Commission (UCC) and the National Information Technology Authority (NITA) have championed ICT adoption with the goal of improving service delivery for citizens. MoICT&NG goal is to provide a responsive ICT legal and regulatory environment, ensure secure ICT access and use for all citizens, and increase citizen awareness or participation in government programs (MoICT&NG, 2017; MoICT, 2014). MoICT&NG and NITA have a developed the National ICT initiatives Support Programme (NIISP[5]) to provide funding and support for new innovative ICT projects that reflect the national development agenda (MoICT&NG, 2019). ICTs have been implemented in public institutions through e-government policies to improve service delivery (Waiswa & Okello-Obura, 2014).

To address information-centric challenges, the MWE and stakeholders implemented ICTs in-line with increased global spectrum of Water Sanitation and Hygiene (WASH) sector deployment due to the expectations that harnessing ICT to support development programs brings improvements in SSA (Breslin, 2013; Ndaw, 2015; Sheffield et al., 2014). ICTs in WASH are geared towards the welfare of communities Champanis et al. (2013); and they used in rural and urban areas to improve data collection, water testing, reporting, planning, complaints management, billing, revenue collection,

[4] https://sdgs.un.org/goals/goal6

[5] http://niisp.ict.go.ug/about

monitoring and management of water sources (Borralho, 2013; Champanis & Rivett, 2012; Hope et al., 2011).

In Uganda, initiatives like WSDB, Mobiles 4 Water (M4W), e-water Payment, Water Point Mapper (WPM), Field Level Operations Watch (FLOW), Pay Me for Water (PM4W) etc. were implemented to address information-centric problems (Chemisto & Rivett, 2015; Hellström & Jacobson, 2014; Ssozi-Mugarura et al., 2017). Reports now suggest improvements in functionality of water sources and MWE structures due to ICT (Asiimwe, 2016; MWE, 2017b).

However, there are challenges in determining contributions of ICTs in SSA. The high failure rate of ICT artefacts, lower levels skills and the prevalent '*digital divide*' hinder effective acquisition of essential knowledge (Kroczek et al., 2013; Mubarak & Nycyk, 2017; Nkohkwo & Islam, 2013; Okunola et al., 2017; Steyn & van Greunen, 2015). The high frequency of failure is attributed to sustainability, and this is a major concern for understanding long-term development effects. Poor sustainability is mostly attributed to inadequate understanding of diverse social-cultural settings (context for intervention), lack of interaction between stakeholders, political issues, inconsistent data update mechanisms and inadequate funding in SSA (Goldkuhl & Lagsten, 2012; Mishra & Mishra, 2013). In addition, Kirui et al. (2016) suggest absence of usability frameworks for DC as contributing to high failure rate of systems; and that frameworks can make apparent contextual issues that vastly influence probability of failure or success.

The WSDB which is the core focus of this study is an exemplar initiative implemented as a result of e-government policies. Thus, to fully examine the WSDB, I had to be cognizant of concepts like high failure frequency of ICT initiatives, low skills and digital divide as notions that might impact holistic study findings. I adopted the notion that is important to take local contexts and social-cultural environments into account when implementing ICTs (Dasuki & Abbot, 2015; Jacobs et al., 2018; Makoza & Chigona, 2012; Steyn & van Greunen, 2015).

My practical understanding is that we cannot ignore why an ICT initiative is required, how it was deployed (design and implementation processes), usage, management and effect on individual workflow processes. Contexts about ICT implementation need to be carefully examined and evaluated.

Before embarking on this research, experiences championed my belief that ICTs improve conditions within their domains of implementation. During this research, limited ICT4D or ISDC literature related to the development-oriented influence of ICT initiatives on Uganda's water sector strongly motivated me. I selected the WSDB to investigate this context because it was implemented by MWE to grow the sector through collecting and analysing timely information for decision making. The idea was to understand perspectives about its development-oriented influence, and then theorise based on the perceptions. More about WSDB is discussed in chapter two.

1.3.3 The Concept of ICT4D in this Research

In SSA, countries have increased ICT adoption to aid socioeconomic development across all sectors of their economies such as education, agriculture, health and WASH; and It is highly unlikely that any sector now functions without ICT. Majority of ICTs support computerised automation of back office processes, e-government services, internet access, mobile telephony and management processes to support digital opportunities for citizens (Baguma, 2017; Bankole et al., 2011; Ekeng-Itua, 2018; Ponelis & Holmner, 2015).

ICTs are influencing a level of development, with empirical studies suggesting influence on human development (Ndagire & Baguma, 2018) (Avgerou & Walsham, 2017; Baguma et al., 2017; Nkohkwo & Islam, 2013). Almost all development programmes contain some form of ICT, more than double the proportion experienced during the 1990s. ICTs are now basic necessities; with appropriate policy implementations revitalised towards universal access for all citizens in rural areas and urban (Jacobs et al., 2018; MoICT, 2014; Olatokun, 2008; World Bank Group, 2011).

In health, Mimbi & Bankole (2015) elucidate that SSA countries have invested significantly in health systems, and their effect is apparent. Findings from over 27 countries denote those that performed efficiently in ICT investment did similarly well in health systems. Additionally, health systems improved life expectancy at birth and reduced infant mortality rates. Their recommendation is countries invest significantly in ICTs to improve health systems and to achieve socio-economic development.

In education, Oyerinde & Bankole (2019) investigated efficiency and productivity of ICT infrastructure utilization. Their findings showed efficient ICT utilization and steady increase in positive growth productivity in Europe and Arab States, and not SSA.

In Uganda's Judiciary, Kuhimbisa et al. (2017) examined increased adoption of ICT as mechanisms for citizens to access and participate in justice services or processes. Their findings showed that other than improved staff productivity and information sharing, ICTs improved citizen engagement and satisfaction with judicial services.

In South Africa, Alhassan & Scholtz (2019) investigate the role of ICT in achieving Sustainable Manufacturing Practice (SMP). Their findings reveal that manufacturing stakeholders are leveraging ICT advancements such as Artificial Intelligence and smart production systems to drive SMP. In addition, ICT is playing a significant role that deserves consideration as a driver for SMP.

Since I sought to examine perspectives about an ICT initiative that sought to bring development to the water sector. I define ICT4D in the context of this study by adopting Walsham (2017, p. 18) definition which is:

> "*academic field concerned with the use of ICTs for international development*"

ICT4D postulates that better information and communication furthers development in a society; and refers to ICT use in socioeconomic

development and human rights (Mthoko & Khene, 2018; Qureshi, 2015; Walsham, 2017). Some articles categorise ICT4D under Development Informatics (DI). ICT4D is now a major theme in specific journals and conferences examining concepts relating ICT to socio-economic development (Alderete, 2017; Harris, 2017; Toyama, 2011; United Nations, 2016).

Lehong et al. (2018) relate Open Knowledge Repository (OKR) platforms supporting research collaboration with ICT4D research. Platz & van Biljon (2016) present a maturity matrix for ICT4D Knowledge Repository (KR) which enables people to share and capitalize on knowledge bases to enhance their development capacity.

However, van Biljon et al. (2018) contend that there is little "*consensus among scholars on what development means, who and what needs to be developed, and for what purpose*". Thus, ICT4D studies should seek to examine and position how governments, NGO, scholars, civil societies and citizens make sense of how ICTs improve the human condition.

For this research, it was important that I first delineate the word '*development*' in relation to ICT. '*Development*' is wide-ranging term; and it has continually evolved from interrelation to economic growth to a contextually integrated view of the quality of people's social lives especially in DC (Beardon et al. 2004; Gigler, 2015; ICSU & ISSC, 2015). Sen (1999) simply defines development as "*a process of expanding the real freedoms that people enjoy*"; and these freedoms are political, economic, social opportunities, transparency and security. Roztocki & Weistroffer (2016) defines it as change processes occurring when improvements in social and economic conditions happen to individuals, organizations or countries. Stec et al. (2014) describe development as the overall activity that is consciously or subconsciously undertaken to improve society.

Based on Sen (1999), access to information is one such *freedom* activity entitled to people because it builds capacity and change. ICTs facilitate information access, which we delineate under SI i.e. consequences and interaction with cultural contexts of institutions and societies (Gurstein,

2007; Kling, 2007). Access to information is a widely accepted ICT benefit, achieved through communication and sharing (Bertot et al. 2010; Johnston et al. 2015; Waiswa & Okello-Obura, 2014). More studies detail direct and indirect benefits such as employment opportunities, healthcare services, education, governance, accountability, transparency and citizen empowerment (Ndagire & Baguma, 2018; Ponelis & Holmner, 2015). ICT benefits have been recognised as having a degree of impact on individual lives of communities and transformative human development (Gillwald et al. 2012; Steyn & van Greunen, 2015; Thompson & Walsham, 2010).

Qureshi (2011, p. 249) succinctly describes influence of ICT usage as enabling:

> "*development to take place through access to new markets, increased competitiveness, and access to knowledge and skills if applied to address local conditions and individual challenges*".

Agencies like UN Development Programme (UNDP) assert that ICTs enhance political engagement or participation; and are now global engines of socioeconomic growth (Ndaw, 2015; UNDP, 2016). Steyn et al. (2010, p. 79-80) concisely states that ICTs are now a:

> "*vital engine of growth for the world economy. It is also enabling many enterprising individuals, firms and communities, in all parts of the globe, to address economic and social challenges with greater efficiency*"

ICT4D studies such as Telecentre research continue to link ICT to development despite discourse that evidence is anecdotal (Bailey, 2009; Beardon et al., 2004; Davison, 2016; Latchem & Walker, 2001; Pather & Gomez, 2010). Heffernan et al. (2016) argues that differences be made when discussing specific development on communities; while Kleine (2010) and Raiti (2007) state that identifying specific development goals is complicated because it is difficult to measure or quantify impact; as there is no "*magic bullet*". Kaul et al. (2008) pose the notion that it is almost impossible to quantify development if people do not have access to basic necessities like

"*food, health, water and electricity*"; and even if computers were to appear in every household, nothing much would be achieved without basic necessities. Similarly, the Economist (2005, p.11) explains computers and ICTs as "*not useful if you have no food or electricity and cannot read*".

Studies eager to implicitly or explicitly define measures for contextual ICT developmental effects are driving researcher enthusiasm. Indeed, increasing ICT4D literature in the last decade confirm interest (Avgerou & Walsham, 2017; Mthoko & Khene, 2018; Siphiwosami et al., 2016). ICT4D questions from Ponelis & Holmner (2015); Qureshi (2015, p. 511) and Walsham (2012, p. 91) confirm heightened research interest in DC. These include: -

> *Are ICTs related to development?* and *Are we making the world a better place using ICT*?

Recent ICT4D studies have proposed theoretical frameworks linking ICTs to developmental and individual capabilities (Avgerou & Walsham, 2017; Gigler, 2015; Roztocki & Weistroffer, 2016). Walsham (2010) proposes a framework for analysis of ICT-based development initiatives. The framework is based on four conceptual development categories: *better lives for the poor*, *Improved government services*, *Enhanced internal economic activity* and *Improved civil society*. Johnston et al. (2015) adopt Walsham's framework and contextualises it to South Africa. These studies confirm ICTs as sociotechnical interventions that augment development programmes.

van Biljon & Alexander (2015) proposed an ICT4D framework that highlights underrepresented ICT4D aspects and encourages information presentation. van Biljon (2018, 2020) additionally proposes a framework about Human Computer Interaction for Development (HCI4D) to support knowledge conscription between researchers in HCI and ICT4D. This framework positions HCI4D in knowledge transfer, and enriches ICT studies in DC.

Toyama (2011, p. 75) suggests an ICT4D amplifier theory, and refutes theories that suggest that ICTs deliver development by elucidating that ICTs only improve existing development efforts. Amplifier theory notions are:

(1) "*technology cannot substitute for missing institutional capacity and human intent*" (2) "*technology tends to amplify existing inequalities*" (3) "*technology projects in global development are most successful when they amplify already successful development efforts*"

Relatedly, Mimbi & Bankole (2016a) examine use of ICTs to fight corruption in SSA; and their findings suggest that ICTs to fight corruption must be effected in parallel with approaches that can improve GDP and education.

For this study, I am enthused to recognise progressive influence of the WSDB, and make a theoretical contribution. I was motivated to examine Heffernan et al. (2016) assertion that "*the rapid growth of ICT4D research has resulted in an emphasis on the applications rather than on theory*".

I emphasise sociotechnical and developmental influence considerations to theorise. My understanding is that determining consequences and growth influence of ICTs majorly depends on concepts such as *adoption*, *access*, *usage* and *sustainability*. I admit to having optimistic assumptions about development-oriented influence of ICTs, and I was very cautious not introduce my prejudices into the study. I think ICTs like all technologies has benefits, but we should be reasonable in defining contextual development contributions from strategies in which they are adopted.

In this research, specific focus on the WSDB was because I wanted to theorise based on a singular ICT intervention, and rather avoid universalistic focus on all ICTs which would complicated the study. My theoretical findings would then be generalizable for ICTs in the water sector, particularly in SSA.

1.4 Research Problem

The discussions in the sub-sections above enunciate questions concerning ICTs, and their scholarly consequences or development contributions. Persuasive quotes such as one below which scrutinise ICT consequences guided my problem definition.

> "*Despite the considerable contributions of existing research in this domain, there is a lack of substantive research that examines the relationship at the country level between ICT access and ICT use, on the one hand, and ICT access and socioeconomic development, on the other*" (Alderete, 2017, p. 44).

During study commencement, I recognised that there is limited literature and a lack of in-depth literature or theorisation studies regarding continued adoption, implementation and influence of ICTs on growth or governance in multiple economic sectors of Uganda; which includes the water sector.

Generally, this was great motivation for this research given the fact that Uganda's water sector has been undergoing incredible ICT deployments over the last decade, and the impact of these systems has not been well or clearly studied or theorised (Asiimwe, 2016; Ssozi-Mugarura et al., 2015).

An e-government initiative (WSDB) implemented by Uganda's MWE represented an ideal opportunity to conduct this research given that there are multiple stakeholders involved in Uganda's water sector, and I would obtain varied perspectives. I also decided to conduct an ICT4D study in SSA, because Uganda is classified under Least Developed Country[6] (LDC) category with a low Human Development Index[7] (HDI) in SSA.

I embraced Jacobs et al. (2018) and Walsham (2017) emphasis on the significance of understanding local contexts and cultures instead of derived perceived grander perspectives about ICTs. Due to the need to contextualise this research, I adopt and cite Walsham (1993, p. 4-5) consideration about contextual IS influence that affirms:

> "*an understanding of the context of the information system, and the process whereby the information system influences and is influenced by its context*"

[6] https://www.un.org/development/desa/dpad/least-developed-country-category-uganda.html

[7] http://hdr.undp.org/en/countries/profiles/UGA

I contextually examine the WSDB's perceived developmental influence, and not only about its information processing benefits. I see context about WSDB influence as being related to positive benefits that have indirect development effects. Additionally, I strongly advocate evaluating any IS based on context and not exterior predispositions.

IS is critical in the study of empirical and behavioural concepts intersecting between computer systems, humans and organisations (Burton-Jones & Gallivan, 2007; Straub & del Guidice, 2012). IS research views theorising as a way to explain how users structure information, invoke new ways of using IS to build richer models or theories (Hassan, 2014). Indeed, the uncertainty surrounding WSDB, limitations in literature and the nature of the research problem influenced me. I decided to undertake this exploratory study about WSDB due to ICT4D or ISDC theories bidding to relate ICTs to socio-economic development.

Exploring and theorising based on the WSDB artefact is this study's aim. Two emergent themes are explored:

1. The first theme explored WSDB design, deployment, usage, positioning, challenges, sustainability and evolution. This spoke to how the MWE uses WSDB to manage water supply information.
2. The second theme explored WSDB influence on sector development due to mediated information, and reflected WSBD adoption by stakeholders.

In the end, this research prepared to theorise about WSDB's developmental influence. I acknowledge that demonstrating a direct link between the WSDB and water sector progress is an immense challenge. Nevertheless, the thought provocativeness of research phenomenon was exciting. The next step was to pick a research approach and methodology to undertake the research based on my philosophical assumptions; and thus, contribute an ICT4D or ISDC theory focused on Uganda's water sector.

1.5 Research Focus

The research focuses on examining participant perceptions and their concern regarding developmental influence of the WSDB. The WSDB is an ICT artefact implemented by Uganda's MWE to manage water sector information. The research's focus is to examine perceived development influence of the WSDB and its effect on mediated information; and then develop theory from participant perspectives. The research is designed to theorize from construed perceptions.

This research is enthused by IS studies which elucidate theorising about ICT adoption from first-hand (empirical) user perspectives (Kim & Lee, 2014; Nkohkwo & Islam, 2013; Yoo, 2017). The WSDB is still an under-researched entity, and multi-stakeholder access represented an ideal situation to conduct an exploratory interpretive study.

To undertake the research, I adopt a methodological approach that reflects on socio-technical aspects of the study to make a theoretical contribution. Limitations in literature influenced choice of an inductive approach and CGT method; as rationalised by Andrade (2009) and Rowlands (2005). Research of this type in SSA literature is still emerging, and this study intended to contribute scholarly work.

My preliminary expectations were that the WSDB has influence on the MWE and water sector in general because of its continued positioning as a sector wide information repository. In addition, I reflected upon sustainability; which is how the MWE has successfully managed WSDB evolution. Consequently, theorisation is based on perceptions related to processes of WSDB design, implementation, usage, access, positioning, consequences and sustainability; which are all obtained from perspectives related to participant experiences.

Finally, this research's major contribution is to develop a substantive theory by examining participant perceptions about developmental influence of the WSDB on Uganda's water sector.

1.6 Research Objective and Question

Under ICT4D or ISDC research, the prevailing query is about identifying seminal factors that show how ICTs postulate development-oriented practices. Numerous IS studies now examine developmental influence of ICTs (Mthoko & Khene, 2018; Qureshi, 2015; Walsham, 2017). The notion of examining how ICTs contribute to community welfare and development motivated this theoretical study. However, I avoid making the assumption that the WSDB is now the development solution to provision of water access to rural and urban communities in Uganda.

In the initial sub-sections, I briefly introduced the WSDB, and throughout the initial research processes, I was conscious of the questions: *How impactful has the WSDB been to the MWE*? and "*How can we relate the WSDB with growth in the water sector*? Reflective questions like these intended to reveal an understanding of people's perception about the WSDB.

Indeed, the ultimate objective of the study is to understand WSDB's influence on development or water sector governance by the MWE; and to generate theory from subjective or objective perceptions. The theory is envisaged to provide a rational understanding of how we can adopt development-oriented artefact initiatives, and to inform design and implementation. Müller & Olbrich (2011) describe such theory as significant for providing a scientific concise account or predication of '*what*, *how*, and *why*'. I sought to make a theoretical contribution using a methodological approach that provides for such a possibility. Theory generated can then be used to inform contextual design of development-oriented artefacts.

Because I was interested in understanding influence of WSDB, the guiding research question is:

> *How do stakeholders perceive influence of the WSDB on development in Uganda's water sector*?

Despite Glaser (1978, 1992) asserting that research adopting CGT methodology does not need research questions or literature reviews. Having a guiding research question to initiate this research was important in providing for conceptualisation of what the study is uncovering. Other CGT studies in such as Adolph (2013); Andrade (2007); Bailey (2009); Elliott & Higgins (2012); Fraser-arnott (2016); Piko (2014) and Tossy (2012) adopt and recommend guiding questions.

Considering the research problem and guiding research questions, study objectives included:

1. To identify participant perceptions regarding the WSDB influence on development in Uganda's water sector
2. To discover perceptions regarding MWE positioning of the WSDB, its usage and effect on governance
3. To understand how these WSDB challenges are continually resolved to inform better understanding of WSDB growing use and evolution.

In essence, the research objectives and question were significant for the interpretation of WSDB's influence, and to provide theoretical understandings conceptualised from participant realities, experiences, perceptions and trepidations. The objectives and research question influenced selection of a methodology that allows theorisation, and facilitates investigation using a contextually appropriate research design method. I chose CGT because it is an insightful generalised methodology that theorises from data, and aims to generate theory through inductive examination of qualitative data.

1.7 Research Approach and Knowledge Contribution

I adopted GT to undertake the research because it provides a means to generate new theory or understandings from data. Matavire & Brown (2008, 2013) show that different GT approaches have been adopted in IS: Classic, Evolved, Mixed Methods and Analytical. After examining all approaches, I selected CGT as most suitable because it: (1) generates theory from collected

data and not a priori theories, (2) discovers participants concerns and perspectives, and (3) contextually suited this research. I agreed with Heath & Cowley (2004) and van Niekerk & Roode (2009) assertion that choice of GT approach must be done with care or context of the study.

In addition, CGT provides for an inductive approach to knowledge contribution and a qualitative data collection process. GT is described as the best-known inductive research approach that is an empirically based social science process for constructing scientific theories (Danermark et al., 2002; Goldkuhl & Cronholm, 2019).

This research is underpinned by an interpretivist philosophical undertaking. Interpretivism is an understanding of reality through exploration of different meanings held by different human subjects, and multiple realities are determined by each individual's perspective (Lee, 1991; Rowlands, 2005; Stockdale & Standing, 2006). The interpretive paradigm views human systems as socially constructed; and analysis of phenomena follows an investigative process that evolves through examining participants everyday reality and activities (Burrell & Morgan, 1979).

Because research similar to this study in Uganda is lacking, I considered this study exploratory. An investigation is categorised exploratory if it is undertaken for a phenomenon that has not been well studied (Stebbins, 2001). Indeed, literature regarding influence of ICTs in Uganda's water sector is very limited. In addition, the effect of WSDB on the water sector has not yet been well examined and this research intends to contribute.

Multiple instances with participants was designed to contribute profound explanations from different perspectives. All methods and knowledge construction strategies adopted were intended to empower participants, and for the researcher to analyse critical information obtained. In this regard, the research design or methodological approaches was emergent and applicable as discovery of concepts influenced research investigations.

1.8 Chapter Summary

This chapter is organised in six major sections which present the principle problem guiding the study, research focus, motivation and methodological or knowledge generating approach. The first section details why I undertook the research. The second section then presents the study background by introducing Uganda's water sector, ICT deployments and the call for this ICT4D or ISDC study in context of this research. The third section covers discussions about the research problem. The fourth section describes the research focus specifically concerning WSDB artefact. The fifth section explicates objectives and guiding research question; and the final section presents how the study was undertaken by briefly stating methodological and philosophical approach for knowledge contribution.

1.9 Thesis Structure

This thesis comprises of eight chapters. Chapter 1 introduces the study, research problem and guiding question and objectives in chapter one. In the second chapter, I present the WSDB artefact and contextual factors that justify this research as an ICT4D or ISDC study about Uganda's water sector. I carefully describe interview sites including the diverse participants and their roles. The chapter elucidates the research's relevance and context.

The third chapter provides theoretical description of philosophical assumptions and guiding methodology. I present my interpretivist perspective backed by ontological and epistemological assumptions. The chapter provides justification for choice of CGTM, and how inductive thinking coupled with qualitative data cultivated the substantive theory.

Chapter four sets CGT methodological course of action i.e. research design, field study approach, qualitative data collection, coding and ensuing analysis processes, and using CGT practice guidelines for inductive and interpretive philosophy. The chapter describes methodological reflections that enlightened my research journey.

Chapter five presents the cultivated theory *Optimizing Perspectives*, and a holistic analysis process that allowed me to generate the theory. The chapter explains codes, concepts and categories constructing *Optimizing Perspectives*, and includes quotes of related transcripts interviews to make evidence based analysis.

Chapter six provides a comparative literature review of *Optimizing Perspectives* with a selection of related theories.

Chapter seven presents experiences of using CGTM by exploring opportunities, limitations and challenges. I discus implications of using CGT for this research about WSDB artefact. The chapter is critical because it authenticates theory findings by evaluating my experience of adopting CGT.

Finally, chapter eight concludes thesis, and is relevant for understanding the research and theory which is the main knowledge contribution.

Chapter Two

2.0 Study Contextualisation and WSDB

"IS innovation in developing countries is about constructing new techno-organizational structures within a given local social context"

Chrisanthi Avgerou
IS Scholar

2.1 Chapter Summary

In this Chapter, I provide a description of the area of study while highlighting the context about WSDB deployment, use, adoption and positioning by the MWE. The chapter is motivated by Goldkuhl (2012, p. 138) declaration that scoping IS research knowledge is about defining:

"*the context of IS and the dialectical relations between IS and context*"

The chapter begins by providing a brief description of Uganda and it's emerged ICT sector; plus the continuous ICT growth and consequences on various sectors. I provide a description of the MWE and district locations where interviews were conducted. In the third section, I present the WSDB and its developmental history which includes its objectives, reasons why the MWE is imperative on WSDB use, challenges associated and how the WSDB aims to support development through provision of country-wide information. Consequently, the chapter provides justification for doing the research and reflects on WSDB's contributions on the water sector; especially on data submission and decision making processes.

2.2 Uganda and Its ICT Sector

Uganda's national census which was last done in 2014 tallied the population at 34.6 million; and the population has reportedly continued to

grow rapidly at 3.0% annual growth rate. Projections from Uganda Bureau of Statistics (UBOS) approximate a population of over 40 million (MWE, 2019; UBOS, 2019). Demographics from UBOS (2019) approximate 76% of the population resides in rural areas while 24% in urban[8] areas. 3.0% population growth is one of the highest in the world; and is putting considerable strain on public service delivery not just for water, but in sectors such as health and education (UBOS, 2014, 2016, 2019).

Uganda ranks 159th out of 189 countries on Human Development Index; and 17th amongst 40 countries classified under low human development (UNDP, 2016, 2019). Using three national Poverty Indicators[9] (P0, P1 and P2), Uganda's second National Development Plan (NDP II) for the 2015/16 - 2019/20 period states that poverty reduced from 24.5% in 2009/10 to 19.7% based on the 2012/13 survey (UBOS, 2016). The poverty reduction corresponds to poor persons decreasing from 8.4 million in 2005/06 to 6.6 million. Overall, 18 percent of the population in Uganda is chronically poor[10]; with over 21% of chronically poor households residing in rural areas (UBOS, 2016; World Bank, 2016). The figures support an inference that poverty in Uganda is reducing but is mostly concentrated in rural areas; which is similar to most countries in SSA (UNDP, 2019; World Bank, 2016).

ICT4D studies are actively seeking or corroborating to position an argument that ICTs are now significant components for social-economic development and poverty alleviation strategies particularly in SSA (Avgerou et al., 2016; Avgerou & Walsham, 2017; Walsham, 1995b). This notion creates assumptions that ICTs potentially contribute to social-economic growth or amplify development conditions (Jacobs et al., 2018; Roztocki & Weistroffer, 2016). Alderete (2017) and Ponelis & Holmner (2015) state that plugging ICT

[8] The Local Government (LG) Act CAP 243 empowers the Ministry of Local Government to declare an area urban if it satisfies: a minimum 25,000 people for town council; 100,000 people for municipality; and 500,000 people for a city; has a master plan for land use; has available water sources and is able to meet the cost of providing services. In addition, the local government act declares all district headquarters as towns urban (World Bank, 2012).

[9] The P0 indicator is "headcount"; P1 indicator is the "poverty gap" and P2 indicator is the "squared poverty gap" (UBOS, 2016).

[10] Hulme & Shepherd (2003) defines chronically poor as an individual or a household that has been living in deprivation for a period exceeding five years.

to development efforts is an attempt by DC to resolve basic life needs such as poverty alleviation, fighting illiteracy and diseases.

In Uganda, institutions such as MoICT & NG, UCC and NITA are championing ICT use with the aim of improving service delivery for all citizens. Their goal is to provide for responsive legal and regulatory environment that ensures secure ICT usage for all, increased employment and growth opportunities, and improved awareness and citizen participation in government programs (MoICT&NG, 2017).

These institutions are prioritizing ICT use to enhance service delivery and potential social economic development. This perspective justifies my objective to examine, contextualise and theorise about WSDB influence on development in the water sector.

2.2.1 ICT Policy in Uganda

Because I scrutinise the consequence of implementing WSDB initiative that seeks provision of information to bring development and improve welfare in the water sector, I am compelled to describe ICT growth in Uganda as spearheaded by the government. The Government of Uganda (GoU) through institutions like MoICT&NG and NITA believes that ICT has potential to revolutionize the way government operates; and to enhance the relationship between Government and Citizens (G2C), Government and Business community (G2B) and Government to Government departments (G2G)[11].

Over the last 20 years, the GoU has enacted multiple policies, laws, acts and frameworks that enhance or promote ICT use for service delivery. These policies have been implemented to integrate ICTs into political and social areas as well as the development agenda (MoICT, 2014; NITA-U, 2009, 2016; Waiswa & Okello-Obura, 2014).

[11] This is obtained from MoICT&NG link: - https://ict.go.ug/initiatives/e-governance/

In 2006, the MoICT&NG was formed to provide leadership, coordination, advocacy and support ICT matters; and was assigned the responsibility for GoU communications. The MoICT&NG is responsible for information and National Guidance, the Media Council and Uganda Broadcasting Corporation (MoICT&NG, 2017; MoICT, 2014). According to MoICT&NG (2017, p. iii), the MoICT&NG policy and strategy includes: -

> Mandate: "*To provide strategic leadership and supervision in ICT, Information and National Guidance for sustainable development*"
>
> Vision: "*A knowledgeable and productive society driven by Information, Communications Technology and National Ideology*"
>
> Mission: "*To increase access and usage of ICT infrastructure and services throughout the country, ensure effective communication of government policies and programmes and promotion of a national ideology for socio economic transformation*"

Secondly, an Act of Parliament created NITA in 2009 with the mandate to coordinate, regulate, promote and monitor development of ICT in the context of social and economic development of Uganda (NITA-U, 2009, 2016). Working in collaboration with GoU Ministries, departments and agencies, NITA has taken a leading role in developing standards, frameworks, policies to promote innovative IT solutions or initiatives, and guide development with the IT industry. Working with IT innovators, NITA has developed a database that enables identification of expertise and innovators to improve collaboration. Through GoU, NITA acquired a loan from the World Bank under the Regional Communications Infrastructure Program (RCIP) to: transform public service delivery so that lives of Ugandans are improved; build a platform to facilitate provision of national IT services; accelerate e-Transformation initiatives in GoU; and put in place build-once-reuse-always IT infrastructure for used by GoU (NITA-U, 2016).

Thirdly, UCC Uganda was established by the Uganda Communications Act 2013 as a regulator in the development of a modern communication sector (*telecommunications, data communication, radio communications, postal communications and broadcasting*). UCC is responsible for licensing

operations of cinematograph theatres and video or film libraries (MoICT&NG, 2017; UCC, 2013).

In addition, policies implemented include: e-Government Policy Framework (MoICT, 2010), Analogue to Digital Migration Policy (MoICT, 2011a); Telecommunications policy (UCC, 2005) and Rural Communication and Development Policy (UCC, 2009). Three Cyber Laws have been developed and implemented; and these include the Electronic Transactions Act, Electronic Signatures Act, and Computer Misuse Act. These laws provide for use, security, safety, facilitation and regulation of electronic communications and transactions; and encourage e-Government service use (FreedomHouse, 2016; NITA-U, 2016).

For GoU, the National Development Plan (NDP) sets out an agenda to use ICT as a reliable means of communication for developmental information (Government of Uganda, 2010). ICT is envisioned as a communication method for transmission or dissemination of information through which modernization and development can be attained (MoICT, 2011b, 2014). Through telecommunication networks, proliferation of mobile phones has taken centre stage, and mobile coverage has presented opportunities to address information gaps by transforming the way information is shared among stakeholders and communities (MoICT&NG, 2017). Uganda has fully migrated from Analogue to Digital Migration[12] since June 2016.

The GoU and development partners have promoted e-Governance, ICT innovations and capacity building using commendable financial resources (MoICT&NG, 2019; Waiswa & Okello-Obura, 2014). In 2017, the MoICT&NG started NIISP to fund and support new ICT innovations seeking to bring development and reflect on the NDP (MoICT&NG, 2019). At regional and district level, an exemplar e-Governance project is DistrictNet[13] which

[12] Analogue to Digital Migration is were broadcasting services offered on older analogue technology are replaced with digital based networks (MoICT, 2011a; UCC, 2016).

[13] DistrictNet is an e-government initiative started to provide transparency at local government levels and to improve provision of public information using ICT (van Reijswoud & Jager, 2009).

interconnects all regions (Kazooba, 2009; van Reijswoud & Jager, 2007, 2009).

To realise e-Governance, the GOU with support from international partners like the Chinese government embarked on laying the National Data Transmission Backbone Infrastructure (NBI) which is a fibre optic cable network. Over 1,548km of fibre optic cable has been laid across the country interconnecting major towns (Obot, 2009; Waiswa & Okello-Obura, 2014).

The GoU is leveraging ICT for data management, improve decision making processes and socio-economic development efforts or transformations. All e-government projects by the GoU have been implemented with a desire to bring positive change. However, I contend that effect of ICTs should be evaluated with reference to development priorities to determine influence.

2.2.2 ICT and Telecommunication Sector growth

Previously, I described Uganda and its ICT policy implementations because the country has taken such a big lead in supporting ICT innovations and deployments to enhance development. It is therefore worth reviewing Uganda's ICT infrastructure, and its continued progress to justify this research's context.

The last decade has witnessed formation and implementation of laws and acts whose objectives are to develop a modern communications sector that includes telecommunication, broadcasting, radio communications, postal communications, data communication and infrastructure (UCC, 2013). ICT evolution is closely linked to telecommunication growth, private sector participation and government led regulation and leadership.

GoU first introduced cellular telephony to the telecommunications industry in 1995, 1998 and then 2001. Privatisation of state agencies in the early 1990's put the Ugandan government into a regulatory and leadership position, while the private telecommunication companies invested heavily into the telecom and cellular sector. Investment by public and private

cellular and telecommunications companies permeated the entire ICT sector allowing it to experience rapid growth. Entry of national and international operators provided local and international communication services for fixed-line (landline) and mobile phones as well as providing a range of Internet or data services through Integrated Services Digital Network (ISDN), Asymmetric Digital Subscriber Line (ADSL), Voice Over Internet Protocol (VoIP) and leased lines (InternetWorldStarts, 2017; MoICT, 2010, 2011b; NITA-U, 2016).

As early as 1999, Uganda was among the first countries on the continent to have the number of mobile subscribers being more than fixed-line users (*18:1 ratio*) (InternetWorldStarts, 2017; MoICT, 2011b). Recent years have seen substantial progress reported on ICT infrastructure; with successful reforms attributed to mobile network expansion (Ranganathan & Foster, 2012). Currently, there are over 22 telecommunications service providers that offer voice and data services. Mobile telephone users have grown to 21.6 million active subscribers and 18.8 million internet users in 2021[14]; representing almost half the population. The MoICT&NG has supervised countrywide ICT infrastructure expansion, tele density, telephone and internet subscriber increase and e-services (MoICT&NG, 2017). The ICT sector has grown exponentially because of private sector participation and investment (MoICT&NG, 2017; MoICT, 2014).

To realise e-Governance and broadband connection, the GoU with support from international partners embarked on laying the National Data Transmission Backbone Infrastructure (NBI) or the fibre optic cable network throughout the country. NITA is implementing NBI and e-Government Infrastructure (EGI) projects. The NBI's objective is to interconnect all major towns onto the fibre optic cable network, including Ministries and Government Departments (NITA-U, 2017). NBI has laid over 2,430 km of fibre optic cable interconnecting major towns. The NBI project is being implemented in phases (*1 to 5*), with phases I, II and III already competed

[14] Statistics from MoICT&NG website at: - http://ict.go.ug

and commercialised to generate revenue. NITA is now offering specific e-government services over NBI (NITA-U, 2017).

NBI is quite extensive as shown by *Figure 1* (NITA-U, 2017).

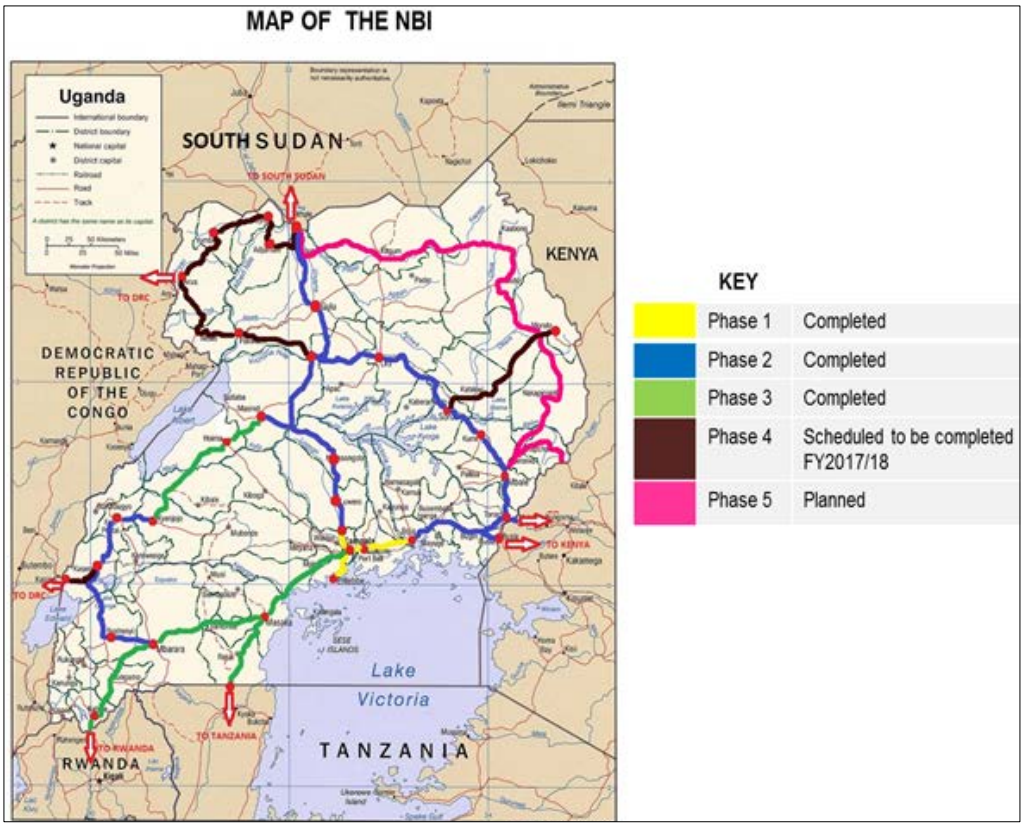


Figure 1: Countrywide rollout of NBI Fibre cable in Uganda

Rapid ICT expansion through telecommunication and NBI has translated into augmented information sharing across all public offices, improvements in service delivery, tax or revenue collection, employment opportunities and social-economic contribution (MoICT&NG, 2017; NITA-U, 2016).

2.2.3 Internet and Computer Usage

The backbone internet connection in Uganda is privately owned. Before 2009, there were no international submarine fiber optic connections in East Africa; but since then, three systems connecting East Africa have been launched (Ranganathan & Foster, 2012). Uganda's international submarine fiber optic cable is connected through EASSy, TEAMS and SEACOM running

on the East and Southern Africa coast (FreedomHouse, 2016; Ranganathan & Foster, 2012). Access to bandwidth through international fiber-optic cables instantly quadrupled Uganda's internet speeds. Over 23 Internet Service Providers (ISPs) are now connected to Uganda Internet Exchange Point (UIXP) (FreedomHouse, 2016).

ICT infrastructure expansion has occurred despite Uganda having some of the highest prices in the world for fixed broadband and telephony services. Internet and broadband services are sold at just under USD $300 a month per 1MBps; which remains very expensive and unaffordable to the poor (ITU, 2016; MoICT&NG, 2017). NITA-U (2016) states that Internet broadband prices dropped quickly from US$ 1200 to US$ 266.76 in a period of four years, and it is continuing to drop rapidly. MoICT&NG[15] states that active mobile users have grown tremendously to 21.6 million users in 2021; up from 20.5 million in 2015. However fixed-line telephone infrastructure is low, leading to low fixed-line broadband services (Lancaster & Lange, 2016).

UCC (2015) survey showed that another reason for low internet access is due to low computers access. Uganda has among the lowest ratios of personal computer access in the world; less than 10% of individuals owned a computer and only 32.9% of institutions owning computers. Households with computers was at 2.4% in Urban and 0.3% in rural areas (UCC, 2015).

MoICT&NG (2019) and UCC (2016) report internet access in Uganda continues to grow; with internet subscribers increasing by over 20% from 2014. UCC estimated an internet penetration rate of approximately 42.5%, which includes mobile data alongside fixed-line internet subscriptions. Internet subscriptions increased to 18.8 million users in December 2021[16] compared to 13.8 million in 2015.

Growth in internet users is attributed to increasing use of mobile broadband for browsing, with 4G, 3G and 2G coverage reaching 81% of the population

[15] http://ict.go.ug

[16] Statistics from MoICT&NG website: - http://ict.go.ug

despite slow internet speeds that average 1.9Mbps compared to global average of 6.3Mbps (FreedomHouse, 2016; UCC, 2016). Ugandans generally use mobile infrastructure to provide voice and broadband internet services. Uganda Telecom (UTL) Freenet service and special internet tariffs from telecom providers has helped increase internet usage, as has strong growth of fixed-line networks and cyber cafes (InternetWorldStarts, 2017). NITA has been providing free Wireless Fidelity (WiFi) access to the public within the certain urban sections (UCC, 2016).

All GoU ministries, departments and offices have been setup with internet and computer facilities (MoICT&NG, 2017; MoICT, 2014). e-Governance initiatives have been launched to bring ICT and Internet services to rural areas of the country, partly funded by highly successful operators through a universal service fund; and DistrictNet is an exemplar of e-Government initiative (InternetWorldStarts, 2017; van Reijswoud & Jager, 2009).

The emergence of internet cafes or telecentres set up by state agencies like Post Office Uganda and private entrepreneurs has contributed to growing internet access and computer use. These computing centres are multipurpose public facilities providing internet access, computer training and other ICT services to low-income communities in urban and rural areas.

2.2.4 ICT Initiatives in the Water Sector

Like many countries in SSA, Uganda, has been implementing ICTs in the WASH sector to improve service delivery. ICT deployment is supported by a national ICT policy whose goal is to promote development and effective utilisation of ICT for policy makers. ICT adoption in the water sector is changing the landscape; with ICTs being used to improve safe water access for communities. The GoU envisaged that improving ICT services would enhance service delivery and citizen engagement. However, the MWE does not have a framework or specific policy that addresses and regulates the use of ICTs in WASH. The current policy covers general ICT use such as email,

telephone, connection of equipment to the ministry network and back-up of information (MoICT, 2011a, 2014).

Uganda reported efforts to improve the functionality of water sources and the reduction of response times for water complaints by using ICTs to monitor water sources. ICTs have allowed people in rural areas to have their demands or requests transparently available (MWE, 2014, 2019; Ssozi-Mugarura et al., 2015). Examples of ICTs in the water sector include: - E-water Payments using mobile phones, Water Point Mapper (WPM), Field Level Operations Watch (FLOW), Mobiles 4 Water (M4W) and WSDB (Chemisto & Rivett, 2015; Hellström & Jacobson, 2014; Ssozi-Mugarura et al., 2015).

Despite commendable ICT contributions, there are challenges associated. Numerous ICT systems store collected information which is managed by different organizations; hence creating data integrity concerns for databases like WSDB, FLOW, WPM, M4W and PM4W. Secondly, some ICTs have had sustainability challengers despite significant investment; with some phasing out or failing to scale e.g. M4W and PM4W.

In that regard, the MWE proposed to develop the Water Information System (WIS) and Data Warehouse to integrate data from all databases to improve planning and management. However, not much about WIS has been done due a particular focus on WSDB improvement (Asiimwe, 2016; MWE, 2016).

2.3 The WSDB Initiative

I begin this section by describing context and scope of IS studies in order to respectively contextualise the WSDB artefact. Walsham (1993, p. 4-5) describes aim and scope of IS research as examining understandings of:

> "*context of the information system, and the process whereby the information system influences and is influenced by its context*".

Contextualising IS provides understanding of social contexts of research area (Goldkuhl, 2012). I adopt Avgerou (2008, p. 143) description of ISDC as expanding:

> "*IS research agenda and developed new understanding of IS innovation phenomena, mainly through its attention to social context and strategic concerns associated with socio-economic development*".

The WSDB was built with a contextual understanding of social, economic and cultural challenges or conditions associated with Uganda's water sector. The WSDB manifested from Water Atlas Update Project (WATSUP) as an IS designed to initially store collected information. The WSDB[17] provides information about water source coverage, functionality and distribution using geo-referenced (GPS coordinates, satellite or Google maps) data about point and piped water sources especially for rural areas.

The WSDB was designed for country-wide access by stakeholders so that information is used for development plans and capacity building by MWE, development partners, NGO's, civil society and private utilities (MWE, 2014). WSDB data is submitted by District Water Officers (DWOs) and Technical Support Units (TSUs) who are MWE staff working in districts. This data includes Point Water Sources (Boreholes, Springs and Gravity flow schemes) and Piped Schemes from National Water & Sewerage Corporation (NWSC). The WSDB data includes trend analysis, real-time and annual review reports presented as tables, graphs, charts and maps. See *Figure 2*.

[17] wateruganda.com

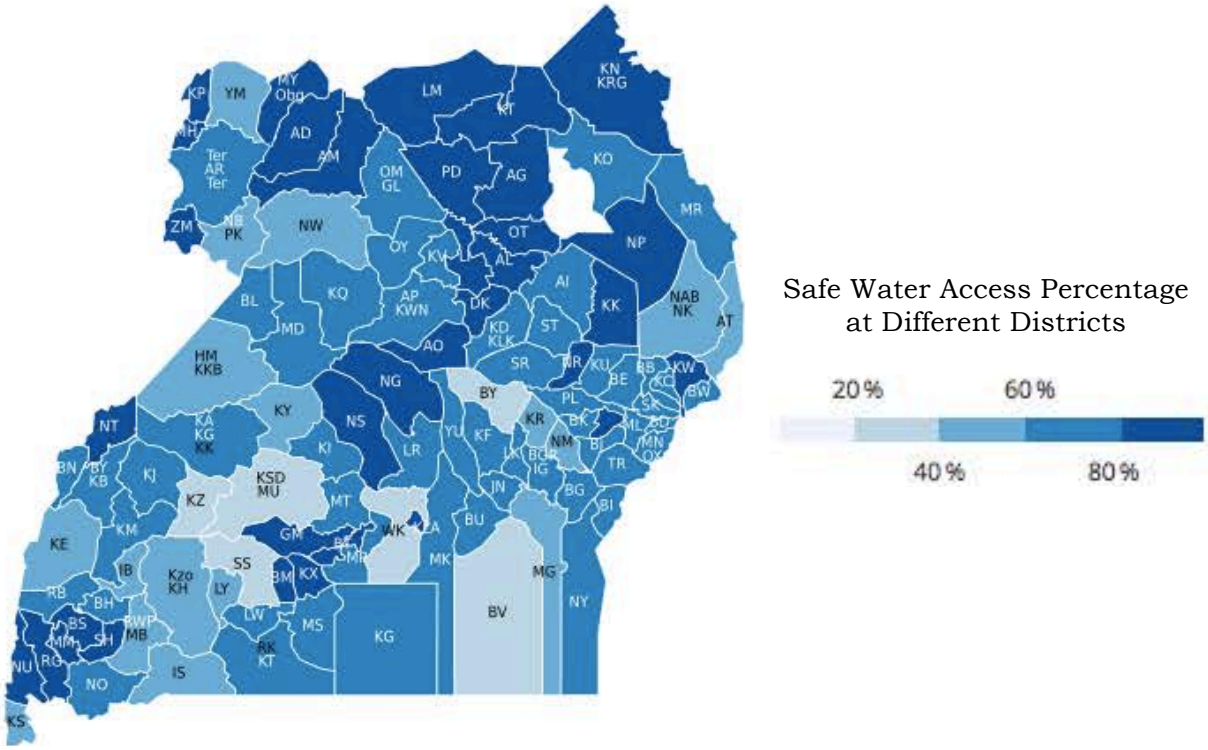


Figure 2: WSDB generated safe water access map 2019/2020 (Source: http://wsdb.mwe.go.ug/index.php/reports/national)

As a result of WSDB success, WESLD plans to develop a Data Warehouse to integrates other databases, and for archiving and downloaded documents.

As stated in chapter one, the WSDB provided an opportunity to explore consequences of its deployment and perspectives about its influence on water sector development.

2.3.1 WSDB History

The history of WSDB starts with WATSUP initiation in the financial year 2009-2010. WATSUP was started because the MWE lacked accurate, reliable and up-to date records of existing water sources that could be used to estimate safe water coverage; establish new water sources; disseminate information to stakeholders; make timely decisions and annual performance measurement (MWE, 2017b). To revitalise Water Supply and Sanitation Management Information System (WSS-MIS), WATSUP was launched to integrate country wide (rural and urban) data submitted by DWO and TSU. MWE (2010, p. 8) explains WATSUP as launched for:

> "*Government and non-Government stakeholders for purposes of planning, policy formulation, strategy development and resource allocation at national and both inter and intra district levels. Water source information is further key in monitoring and follow-up of sector activities as well as in measuring performance of the entire sector*".

Information collected during WATSUP was stored in a database which was called WSDB. The WSDB manifested itself from WATSUP as an artefact with countrywide water source information; which was then used to compile the Uganda Water Atlas (UWA). UWA report provides information about existing safe water coverage, functionality and distribution of water sources. UWA has been updated annually to give accurate information on the status of safe water sources, and the current UWA 2017 was published in 2018 (MWE, 2017b).

The Management Information System Unit (MIS-Unit) under Water Sector Liaison Department (WESLD) at the MWE implemented the WSDB, and they are responsible for its design, operation, maintenance and update.

As described earlier, lack of exploratory studies about WSDB since its implementation motivated me to explore its perceived developmental influence on the water sector.

2.3.2 Data Submission and Entry

DWOs and regional TSUs submit manually filled forms to the MWE for entry into the WSDB. The forms are accessed through email, download from portal and printed copies sent. Forms range from 1 (one) to 4 (four), but the most important are forms 1, 2 and 4. Form 1 records new water sources constructed, form 2 records piped water schemes and form 4 is a data update form recording functional or non-functional water points.

Once submitted, forms undergo data validation, approval and finally data entry into the WSDB. For any inconsistencies, forms are sent back so that discrepancies are corrected. See *Table 1* for WSDB summary data.

National WSDB Summary Report – FY/2019/2020		
1	Total No. of Sources	138,876
2	No. in Analysis	138,876
3	No. Communal Managed	66,187
4	No. WSC Established	60,550
5	No. WSC Functional	53,724
6	No. WSC with Woman in Key Position	50,836
7	Management	89%
8	Gender	85%

Table 1: WSDB summary about Uganda's rural water sector

The items Management and Gender listed in *Table 1* are examples of Golden Indicators used as sector performance measures established by the MWE. Management is the percentage of communally managed water sources with active Water & Sanitation Committees; while Gender is the percentage of Water & Sanitation Committees with at least one woman holding a key position (MWE, 2017b).

2.3.3 WSDB Challenges

Given that the overall objective of WSDB was to provide dynamic storage and information access; it is now perceived not only as an information repository but as a centralised data sharing and exchange IS. WSDB has significantly improved country wide submission of water supply data to over 96% (MWE, 2014, 2017b).

However, just like any IS, the WSDB has challenges. The most common challenge is delay in data submission. DWOs are required to make quarterly (after three months) data submissions. Not all forms are submitted in a timely manner, leading to data integrity issues (MWE, 2014, 2016). The WSDB relies on timely data submitted, and late submission is a major data integrity issue. WSDB is now used to make critical decisions that affect

water access in communities, and decisions about functionality, operation and maintenance of water points can be affected by untimely data.

Data integrity issues in the WSDB has led to some stakeholders such as NGOs to develop their own databases. The MWE understands the need to have up-to-date data because they recognise their own explicit demand; coupled with demands from stakeholders.

Another challenge is the shortage of infrastructure to support WSD access at some districts. Lack of computers access particularly in some rural districts affects use. Some DWOs stated that they do not have computers in offices and this has affected their ability to access and validate WSDB data. The MWE has committed to equipping all staff at districts with computers, and this process is on-going.

Electricity outages represent another challenge. Some districts consistently experience electricity blackouts while others districts are not yet connected to the national electricity grid. Electricity outages often happen, and yet generators are expensive to run. Electricity increases DWOs computer downtime and this in turn affects WSDB usage. Electricity limitation is being solved by the GOU through rural electrification project (REA, 2013).

Lack of internet in some rural areas impacts WSDB access. Monitoring of online access to the WSDB shows daily use by few staff in rural districts. Lack of internet access raises consequences that govern contexts that this research examines; particularly perceptions about WSDB influence.

MWE staffing limitations impact data collection. Currently, several districts in Uganda have one DWO which is geographically challenging because districts have an average size of 1,800km^2. Traversing entire districts is challenging for DWO who are responsible for monitoring, planning and collecting water source information. DWO state that they are not appropriately facilitated to collect data; and they rely on Water User Committees (WUCs) and some NGOs for data. There are financial and transport challenges, and DWOs are not fully compensated to monitor daily

water point functionality. This has resulted in inconsistent reporting of some water sources as being non-functional for more than five years without decommissioning (MWE, 2014, 2019).

Errors in data submissions processes is another challenge. Some DWOs submit erroneous data due to mistakes made during filling of manual forms.

From the above challenges, we can state that the WSDB relies on proper ICT infrastructure and logistical tools for access. These challenges continue to impact WSDB usage. Despite the challenges, this research was able to obtain participant perspectives exploring how they perceive WSDB influence.

2.4 Interview Locations

In this section, I present a description of the locales where I conducted interviews. Interviews occurred in five districts namely Kapchorwa, Kween, Mbale, Kampala and Kabarole. There are over one hundred and forty five (145) districts in Uganda[18]. Interview sites were selected from different regions of the country to provide unique features that contribute valuable information. Statistics show that communities were diverse. More details about interviews and participants are presented in *Appendix A.1*, *A.2* and *A.3*. The WSDB which is the focus of this study is accessible country wide through: *http://wsdb.mwe.go.ug*. Knowing this address allowed me to ask questions about WSDB in different locations.

All interviewed participants where familiar with the WSDB and had previously used it during training sessions or for data access. Five districts were chosen to enrich the study with perspectives from different locations, and to enlighten myself with regional conditions of participants in their settings. Avgerou & Walsham (2017) and Ponelis & Holmner (2015) emphasise the importance of contextual sensitivity when examining influence of ICT interventions. The different interview locations provided a contextual picture of data collection areas, and assisted my thoughtful

[18] https://www.ec.or.ug/electoral-commission-statistics

process during analysis and thesis write up. *Figure 3* shows districts where I conducted interviews or field studies, and reflects their contexts.

Figure 3: Red coloured areas depicts interview locations

Different districts reflect context, quality of the study and collected data. *table 2* presents summarised details about each district in terms of population, water supply coverage, domestic water points etc. This data was obtained from the WSDB[19]. For Kampala, some data is missing because NWSC stores it. NWSC ICT systems were not the focus of this study.

District	Setting	Population Served	Domestic water points	Water Access	Piped water schemes	Managing water sources	Water point functionality
Kapchorwa	Rural	104,805	661	79%	8	98%	72%
Kween	Rural	89,300	516	83%	4	85%	91%
Mbale	Urban & Rural	394,778	1,548	69%	1	90%	88%
Kabarole	Urban & Rural	258,053	1,137	79%	3	70%	82%
Kampala	Urban	1,669,819	N/A	84%	2	N/A	N/A

Table 2: Showing interview districts and their characteristics

[19] WSDB data accessed on March 28, 2020

Table 3 presents geographical information about each districts, and distances travelled during the research.

Location	District Size (Km2)	Distance & Time Travel to Kampala	Altitude (Metres above sea level)
Kapchorwa	355	295 km (5hours)	1,915 m
Kween	851	300 km (6hours)	1,900 m
Mbale	519	240 km (4hours)	1,156 m
Kabarole	1,814	320 km (5hours)	1,480 m
Kampala	189	N/A	1,200 m

Table 3: District geographical information

Table 4 presents interview participants, roles and their organisations.

District	Organisation	Number of Interviews	Interviewee Role
Kapchorwa	MWE	3	DWO and NGO Staff
Kween	MWE	4	DWO and Assistant
Mbale	MWE	8	DWO and Staff
Kampala	MWE, UWASNET and NGO	13	Data Analysts, Managers, MIS staff, NGO staff and Engineer
Kabarole	MWE and NGO	2	DWO and NGO Staff

Table 4: Showing details about participants

2.4.1 Kapchorwa District

Kapchorwa is a rural district located in the eastern part of Uganda. It has a geographic elevation of 1,915 meters above sea level, and it is approximately 295 kilometres from Kampala. It takes over six hour's to drive. Only one road to the district is tarmacked, and it is the main road. Kapchorwa has beautiful, mountainous and rugged landscape because it is situated along

the slopes of Mt. Elgon[20]. Many households live far from water sources, and collect rain water to supplement their water needs because rainfall received is one the highest in Uganda. *Figure 4* depicts rural Kapchorwa landscape.

Figure 4: Beautiful landscape and sparse homesteads amongst farms in Kapchorwa

Kapchorwa has a population of 104,580, with 44% of the population living around district headquarters (UBOS, 2014, 2019). The native Sebei people speak main language called Kupsabiny. English is taught in schools and a minor population speaks Lugisu. Kapchorwa town council is the main district headquarters, municipal office, administrative unit and commercial center. There are open markets on Sunday which attract local traders from neighbouring rural areas and districts. Subsistence agriculture[21] is the main economic activity because of fertile soils; and food[22] crops grown include millet, potatoes, beans, cowpeas, groundnuts, simsim, cabbage, maize, matooke and sunflower. Cash[23] crops like cotton, coffee, barley and Wheat are abundant. There are numerous fruits and vegetables. Domesticated livestock include cattle, goats, sheep and chickens are main animals reared.

[20] Mt. Elgon is an extinct volcanic mountain bordering Uganda and Kenya.

[21] Subsistence agriculture is when farmers grow food crops for consumption at home (MWE, 2010)

[22] Food crops are plants grown for human consumption in homes (UBOS, 2016)

[23] Cash crops are plants grown for commercial value rather than consumption (UBOS, 2016)

Most of the population lacks electricity (over 80%); and blackouts are commonly. The mobile telecommunication services are available although the network is reportedly poor in some areas because of the rugged mountainous landscape. Landline telephones services aren't available. Computer and internet access services are accessible through mobile data, few internet cafes and computer secretarial centres.

Access to water sources[24] is provided by the MWE and NWSC. NWSC has 1 pipped water scheme covering the district's municipal center while the rural areas are under MWE's RWSS department which builds boreholes, springs, wells, dams, valley tanks, rainwater harvesting tanks, water kiosks and tap stands (MWE, 2016, 2017c).

Data from WSDB shows that access to water sources in rural areas is at 79% (from 60% a decade ago), functionality of water points is at 72% and management of water points is at 98%. The municipal town reports access to improved water sources at 80%; despite a total coverage of only 51%. *Figure 5* depicts rural water points sowing a community borehole and piped gravity flow water scheme. Pictures were acquired from the DWO.

Figure 5: People fetching water from a community borehole and gravity water point

Different counties and sub-counties have varying water access rates. According to WSDB, the rates in Kapchorwa vary from 51% in Western

[24] Rural households are considered to have safe drinking water if there is a safe water source within 1.5 kilometers whereas urban households is less than 0.2 kilometers (Naiga et al., 2015)

Division Sub-County to 95% in Tegeres Sub-County. Kapchorwa has 9 piped schemes and 629 domestic water points which serve the population. 51 water points are non-functional and considered abandoned.

Sipi falls is the most famous tourist attraction. Sipi river which is composed of 3 (three) falls is a major community water source for household use, farms and livestock. *Figure 6* shows one of the majestic Sipi falls.

Figure 6: The main 100m Sipi falls in Kapchorwa

Other than the MWE and NWSC, water points are built and managed by NGO's and private utilities who work hand-in-hand with DWOs. The role that NGO's and private utilities play cannot be ignored; and NGO's like SNV, WaterUganda, ActionAid etc. have implemented several water points which have enhanced water supply services to communities in Kapchorwa.

I interviewed participants in Kapchorwa to understand the water situation and WSDB from their perspective. I made observations and notes.

2.4.2 Kween District

Kween is a rural district in the eastern Uganda bordering Kapchorwa and Bukwo, and was created in July 2010. Kween is by far the most rural district among my interview locations. It is devoid of any urban area and the people endure tougher living conditions. The district is reported to be at an elevation of 2,433 meters above sea level. Kween lacks basic public services

such as landline telephones, proper roads and public sewage systems. Electricity services were recently connected to the district in 2018. Over 90% of the population lacks electricity, and I charged my phone at a neighbour's home during my stay. A tarmac road network has just been built in 2020.

Mobile telecommunication services are available although many areas have poor network services because of the mountainous landscape. The roads in Kween are not paved, and weather seasons[25] change their conditions. Roads are muddy during rainy season and dusty during the dry season. There are no regular public transport services, and people walk long distances or travel using trucks that transport agriculture foods. Motorcycles called BodaBoda[26] are common transport modes. I used a BodaBoda between Kapchorwa and Kween. The road was dusty and after 10 kilometres, my clothes were dust engulfed.

Kween is over 300 kilometres from Kampala, and it takes over 6 hour's to drive. Kween is situated along the northern slopes of Mt. Elgon, and it has a beautiful landscape. *Figure 7* shows a picturesque view; the waterfall in the middle of the mountain is a major water source for homesteads and farms.

Figure 7: Sparse homesteads amongst farms and a waterfall in Kween

[25] The seasons weather changes in Uganda are categorised as rainy and dry season (MWE, 2014).

[26] BodaBoda are privately owned motorcycles used for public transport in Uganda

Kween is one of the least populated districts in Uganda; and population is reported to be 95,623 (UBOS, 2014). Kupsabiny is the main language spoken by the native Sebei people and English is taught in schools. The district headquarters are located in Binyiny which serves as the main administrative area. For majority of the people, small scale economic activities are from subsistence farming in agriculture and stockbreeding. Kween has the same food crops, cash crops and livestock just like Kapchorwa. Local traders have open markets in the villages while some farmers transport their agriculture produce to nearby towns via road.

Water access in Kween varies from 62 % in Kwanyiy to 95 % in Ngenge Sub-County. There are 495 domestic water points, 1 piped water scheme and 45 abandoned non-functional water points (MWE, 2017c). MWE, NGO's and private utilities provide water access using boreholes, springs, wells, gravity schemes, dams, valley tanks, rainwater harvesting tanks and water kiosks (MWE, 2016, 2017c). Access to water sources is at 79% while functionality and management of water points is at 90% and 84%. *Figures 8 and 9* show community rural water points in Kween. *Figure 8* shows a new gravity water point being built next to an old existing point.

Figure 8: Gravity community water points

Figure 9: Communal borehole in Kween

The DWO stated that not only does the mountainous terrain affect access to water; but some water sources are seasonal (available only during rainy

season). The DWO stated that the recent allocation of land to Mt Elgon National Park renders some water sources illegal to use for communities because they belong to the wildlife in the park.

Interviews in Kween were conducted before political elections, and I observed a lot of campaign posters and political talks. However the DWO said that he wasn't worried about politics because he is more focused on water problems. Kween was one of the first districts I conducted my interviews because I was interested in learning and contrasting its situation with other districts. At the time, the DWO did not have access to computer and internet services; and shared with offices at the district headquarters.

Kween compliments the context of this study, and it contributes to understanding WSDB access issues.

2.4.3 Mbale District

Mbale is the largest urban district around Mt. Elgon region, and it is the commercial center of surrounding districts because it represents a big market due to the confluence of road network to northeast districts. Mbale is located in the eastern part of Uganda, and it is approximately 245 kilometres northeast of Kampala with an elevation of 2,433 meters above sea level. It takes over four hours driving from Kampala. The population is 492,804; with an urban population of over 101,900 people (MWE, 2016; UBOS, 2014). Lugisu (Lumasaba) is the main language spoken by the native Bagisu people, although other Ugandan languages are prevalent.

In 2020, Mbale town was upgraded to a city[27]. Agricultural is the primary economic activity, with similar crops to Kween. *Malewa* which is smoked and dried bamboo shoot is a common food delicacy enjoyed by the native people. There are several university campuses which include Islamic University in Uganda, Uganda Christian University, Uganda Martyrs and Livingstone International University.

[27] https://www.monitor.co.ug/uganda/news/national/7-new-cities-start-july-1-1887418

Mbale has beautiful mountainous landscapes. The nearby Wanale Mountain overlooks the town and is a major tourists attraction for hikers and homestays. Wanale falls is a tourist landmark and is a major water source for communities. *Figure 10* depicts a picturesque view of Wanale Mountain.

Figure 10: Wanale mountain with Wanale falls in the centre

The nearby Kakoro rock formations and paintings whose date of origin has not yet been fully established, though some affirm 2,000years are must see tourist attraction. See *Figure 11*.

Figure 11: Kakoro Rock formations

Mbale has urban piped water schemes in town and rural water schemes. *Figure 12* shows typical rural water points used by the communities.

Figure 12: Communal rural waters point in Mbale

MWE (2016, 2017b) reports water access vary from 27% in Nakaloke to 95% in Wanale Sub-County. There are 1,462 domestic water points which serve 378,728 people in rural and urban areas. There are six piped schemes with NWSC providing piped services to the town and surroundings. There are over 206 discarded non-functional water points. Average access to water sources is approximately 70% while their functionality and management is at 89% and 87%. The kids in *Figure 13* playing around the water point live in houses in the background.

Figure 13: Community rural water points in Mbale

In addition to DWO, the city has a water department and an engineer who is responsible for water access in urban areas. I only interviewed the DWO

because he is appointed by MWE. The DWO was equipped with one computer which is shared with other staff at the time of field study. Findings from Mbale interviews compliment study perspectives.

2.4.4 Kabarole District

Kabarole district is located in western Uganda, and it is approximately 304 kilometres northeast of Kampala with an elevation of 1,480meters above sea level. The city is called Fort Portal[28], and serves as municipal and commercial center. Kabarole's population is approximately 474,216 people; with an urban population of 56,500 people (MWE, 2016; UBOS, 2014). Rutooro is the main language spoken by the native Batooro people, followed by Lukiga. Driving from Kampala takes over five hours.

The main tourist attractions include palace of the Kingdom of Toro[29], beautiful landscape of Rwenzori[30] mountain overlooking Kabarole and several crater lakes. Agriculture and animal husbandry are the main economic activities. *Figure 14* is a view of rural Kabarole.

Figure 14: Picturesque view of rural parts of Kabarole

[28] Fort Portal is the urban center for Kabarole and is named after British explorer Sir Gerald Portal

[29] The Kingdom of Tooro is one of several kingdoms in Uganda with over 200 years lineage.

[30] Mt. Rwenzori is the highest mountain in Uganda and it is a snow capped

Water sources are provided by the MWE, NWSC, municipality, NGO's and private utilities MWE (2016, 2017c). Access to water points was reported to be 73% while their functionality in rural areas was at 84%. Access to water varies from 8% in Kijura TC to 95 % in Bukuuku Sub-County. The district has 1,873 domestic water points which serve over 378,728 people. There are two piped water schemes provided by NWSC. Over 313 non-functional water points are considered abandoned. Smart boreholes that use tokens have been implemented as a collaboration between MWE and NGOs to manage water consumption in some communities and to test how functionality of rural water points can be improved. See *Figure 15*.

Figure 15: Solar powered smart borehole

Urban areas have 90% access to safe drinking water, electricity (although blackouts are quite common) and telecommunication services. However, most surrounding villages or hamlets do not have access to these services.

The DWO in Kabarole stated that there is one computer in office which is shared, although the DWO has a personal laptop. The DWO is constrained by financial, internet and computing services which affect work performance (monitoring and managing water points). Participants described access to WSDB as challenging due to data integrity issues and infrastructure challenges such as lack of electricity, poor telecommunication network coverage and inadequate ICT infrastructure.

2.4.5 Kampala

Kampala is Uganda's capital city and commercial hub. Its centrally located near lake Victoria which is Africa's largest lake. The population is over 1.6 Million people and because it's majorly urban, the water sector is managed by NWSC. NWSC operations serve over 1.3 million people with an access rate of 84 %. Interviews were conducted at MWE and UWASNET.

2.4.5.1 MWE

Since the overall objective was to examine the WSDB, I went to the MWE to interview staff working under RWSSD, ICT support and MIS-Unit. The staff provided perspectives about WSDB and how the MWE functions and manages the water sector. MWE was previously called Ministry of Water, Lands and Environment. The name change coincided with a new mandate:

> '*Responsibility of the development, managing, and regulating water and environment resources in Uganda*' (MWE, 2017a).

MWE now takes lead in management of sustainable water sources, environmental resources and water service delivery. The MWE has several directorates. This research was carried out at the Directorate of Water Development which is responsible for planning, implementing and supervising delivery of urban and rural WASH services. The directorate has four departments but the researcher worked with the RWSSD which manages the WSDB.

Interviews with participants were conducted to understand perspectives about WSDB influence and how MWE delivers, manages, operates and develops water supply services. Interviews focused on how data is submitted to the WSDB, and its influence on sector growth through monitoring and management. WSDB is reported to improve reporting, and has influenced decision making and policy matters; particularly analysis of water coverage.

Certainly, what struck me was the vast number of forms submitted by DWO from all districts to the MWE. Data in the forms is validated and entered

into the WSDB. I was told that validation and data entry was a tedious exercise that required allot of effort on a daily basis. Staff at MWE constantly evaluate and check for error before input data to the WSDB.

Annually, the MWE publishes SPR which relies on WSDB and summaries data about the water sector. MWE (2019) which was the latest SPR states that: national safe water coverage in rural areas was at 67% (up from 65% June 2015); functionality for rural water sources is 86%, (from 88% in June 2015). Water sources in rural areas include protected springs (18%), shallow wells (23%), deep boreholes (44%), piped water schemes (gravity-fed) or piped water schemes (pumped) (11%), valley tanks and rainwater tanks.

I observed MIS-Unit staff read, analyse and examine the forms. I enjoyed the experience of observing and interviewing while staff interacted with WSDB; and listened to how they described significance of the system. Definitely, computers were very much available in all offices visited. Visiting the MWE was a notable experience because of vital observational perspectives gained.

2.4.5.2 UWASNET

Uganda Water and Sanitation NGO Network (UWASNET) is a national umbrella organisation for CSOs in the water and environment sector. UWASNET aids GoU to meet its targets of providing universal access to safe sustainable water and improved sanitation by partnering with development organisations and private stakeholders in WASH (UWASNET, 2017a, 2017b). Established in 2000, It has strengthened coordination, monitoring, accountability and facilitated cooperation between CSOs and utility companies in WASH. UWASNET publishes an annual report titled "*NGO's in the Water and Sanitation Sector Performance Report*". Data for the report was received from 76 CSOs which represents 51% of the 150 active members. UWASNET keeps records about investments in WASH sector.

I went to UWASNET in order to understand how they engage MWE, member usage of WSDB, experiences with WSDB and how UWASNET coordinates stakeholders. I discovered that UWASNET registers all NGO's, CSOs and

private utilities; and they are provide accredited WSDB access by MWE. UWASNET assists members to submit their data about functionality, operation, maintenance and management of water points.

At UWASNET, I was shown forms that are used to submit water source data. I attest that going to UWASNET gave me a clearer picture of how the WSDB has evolved into a system that provides data to all WASH stakeholders.

2.5 Summary Infrastructure in the Districts

In all interview locations, there were obvious similarities or differences between rural and urban districts. Contrast is evidenced in WSDB access, geographical infrastructure, water sources, ICT infrastructure, electricity availability and DWO challenges. *Figure 16* depicts observed difference in physical infrastructure. The left-to-right arrows shows infrastructure quality between rural and urban districts.

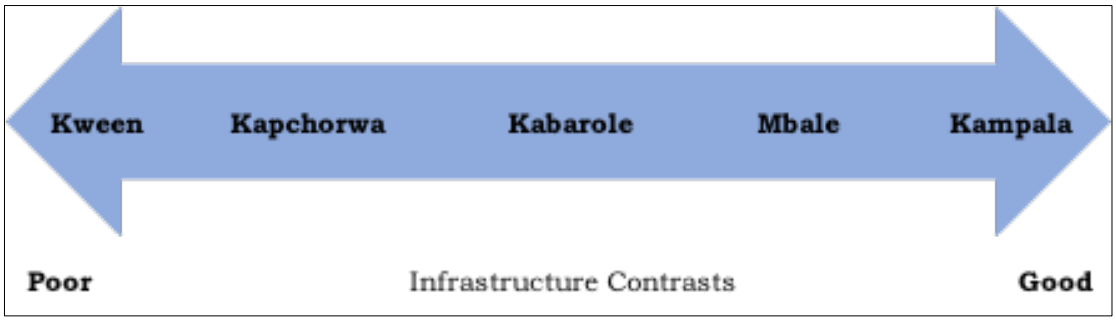


Figure 16: Observed difference in physical infrastructure among districts

Rural districts had common geographical challenges. Mountainous terrains meant that implementing water points was often challenging. Travelling and getting to different water points and communities was difficult because of poor transport issues. *Table 5* depicts infrastructure contrasts.

Service	District				
	Kween	**Kapchorwa**	**Mbale**	**Kabarole**	**Kampala**
WSDB Access	Non	Non	Access but not use	Access and use	Access and use
Telephone/ Network	Poor Network and no landline services	Poor Network and no landline services	Good in towns but poor in some places. Landline services exist in towns	Good in towns but poor in some places. Landline services exist in towns	Good telephone services exist
ICT/ Computer access	Non	Can access but	Have access	Have access	Have access
Internet Access	Non	Can access but service very poor	Can access with average services	Can access but average services	Can access and service is good
Electricity access	Very poor	Very poor	Average in towns but poor in rural areas	Average in towns but poor in rural areas	Good electricity service
Physical Infrastructure e.g. roads	Very poor (no tarmacked roads)	Very poor (only one tarmacked roads)	Poor in rural areas but Average in the town center	Poor in rural areas but Average in the town center	Good road network

Table 5: Showing infrastructure contrast in all the districts

Throughout the study, I was determined to identify how WSDB influence on water sector growth is perceived despite reported challenges such as delays in data submissions, expensive management costs and ICT infrastructure issues at MWE.

2.6 Chapter Conclusion

This chapter has provided a detailed context of WSDB and interview locales with the aim of understanding perspective about its influence on the water sector. Although there are over one hundred and forty five (145) districts in Uganda, only five (5) districts were chosen to enrich the study with perspectives from different locations, and to enlighten myself with regional conditions of participants in their settings. Interviews were undertaken in districts namely Kapchorwa, Kween, Mbale, Kampala and Kabarole.

Districts were selected from different regions (East, West and Central) of the country to provide for multiple features that would contribute valuable information. Districts from Northern Uganda were not considered because I was not given contacts and consent for participants from Northern Uganda.

Description of districts where interviews occurred showed that although there were common characteristics, each has unique qualities that necessitated contextual consideration for subsequent inductive and interpretive analysis. Contextual description paint a picture of how exploratory analysis of technological artefacts in development environments can be perceived and assessed.

This chapter consequently contributes to understanding rationale for adopting the research method described in the next chapter, and persuasively relates methodology adopted, study scope and relevance. This chapter is very reflective towards entirety of this research and its findings.

Chapter Three

3.0 Philosophical Assumptions and Methodology

"An art, which has an aim to achieve the beauty, is called a philosophy or in the absolute sense it is named wisdom"

Al-Farabi (870 AD – 950 AD)
Philosopher

3.1 Chapter Summary

This chapter provides an explanation for the philosophical assumptions and research methodology chosen; including a justification for adopting CGTM. The chapter is reflective of the notion that there are three assumptions with research in general; that is epistemological, ontological and methodological; and it is essential to explicate philosophical stance regarding any identified research problem that is to be examined. Chapter deliberations provide a platform that emphasise the research methodology; as well as epistemological and ontological assumptions from which Guba & Lincoln (1994) assert that they should inform the choice of methodology or methods.

The chapter justifies choice of CGT method to undertake the study; which is to build new theory explaining phenomena from the perspectives of those experiencing that phenomenon. Theory generated is not required to prove, disprove, extend or pay homage to legacy or extant theory; and CGT researchers acknowledge that it is relatively possible for other researchers to generate different interpretations of the same data (Glaser & Holton, 2004).

Glaser & Strauss (1967, p. 225) assent that GT researchers '*readily agree that their own theoretical formulations represent credible interpretations of their data, which could, however, be interpreted differently by others*'. Glaser (1978) recognises this complexity by stating that human social research is intricate and multifaceted. Glaser & Holton (2004) reject the intention to

prove, disprove or extend new theory with other theories by stating that contrasting the newly developed theory prevents modifying it by using other theories as a kind of data.

This chapter explicates justification for adopting CGT, while discussing three distinct GT approaches that were considered. The chapter is organised in such a way that I first introduce the research process adapted including explanations for my ontological and epistemological assumptions; and justification for adopting Interpretivism. The chapter does not dwell on the ontological question of '*what is*' and '*how it is*' when examining perceived '*reality of being*'. I reasonably consider my ontological assumption based on what Blaikie (2007) & Crotty (2012) describe as a specific social inquiry about the nature of reality, entity properties of the social world and philosophical foundations. IS studies advocate researches to explicitly state their ontological, epistemological and philosophical assumptions so that critique or appraisal of research's extent of adherence can be examined (Guba & Lincoln, 1994; J. Mingers, 2004).

The chapter elucidates assumptions underpinning the research; and I further explicate how CGT as a methodological approach for analysis and theory building aided my inductive and interpretive thinking process. I further provide justification for adopting Interpretivist approach, and give details of data collection processes plus brief ethnographic views.

To advance the discussion, the next sub-section begins with what I categorised as my research process.

3.2 Research Process

It is noted that IS research embeds a rich tapestry of diverse research methods, paradigms and approaches. Contributions from varied views to IS discussions is productive for scientific research (Gregor, 2006; Hassan, 2014). Becker & Niehaves (2007) reiterates that IS discipline tends to adopt distinct research approaches, and researchers' worldview influence their

meta-theoretical assumptions, which intrinsically link to the methodological approach.

In this study, the idea of diverse research notions became essential while explicating my philosophical and methodological position. Checkland & Holwell (1998) argue that IS research processes should be clearly stated and documented for readers to understand how outcomes were generated, because hypothesis-testing and repeatability cannot be matched when studying social phenomena. In principle, researchers must state their ontology, epistemology and methodological assumptions, and the framework of ideas within which it makes sense.

To conduct this research, I adopted two research processes. First, I adapted a research process from Orlikowski & Baroudi (1991) and Crotty (1998); which is adopted by Andrade (2007). I liked this research process because it delineates phases before examining study phenomena. The research process is epitomised by four compounding components that are: theoretical perspective which includes philosophical stance, epistemology which is the theory of knowledge, methodology or plan of action, and methods or techniques to gather and analyse data. See *Figure 17*.

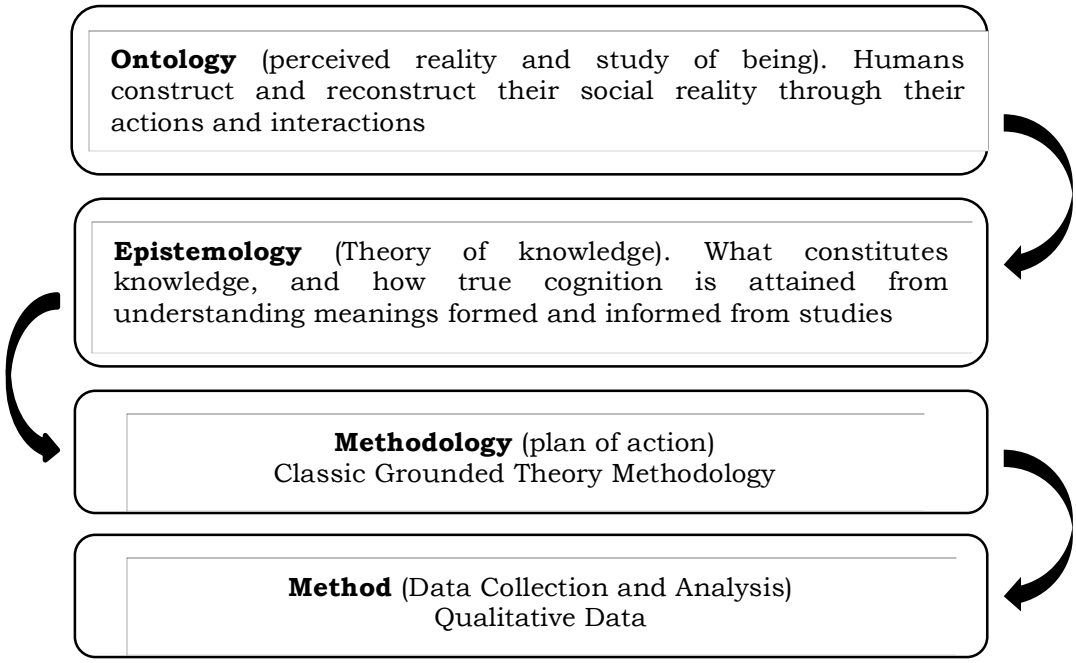


Figure 17: My adapted research process sequence

Secondly, I adapt and enhance an argument proposed by Tossy (2012), to justify choice of CGTM for conducting the research and developing theory. *Figure 18* depicts the processes and procedures undertaken to develop and analyse any CGT . I improved this argument to suit my research, and present a rationalised justification for study paradigms and assumptions.

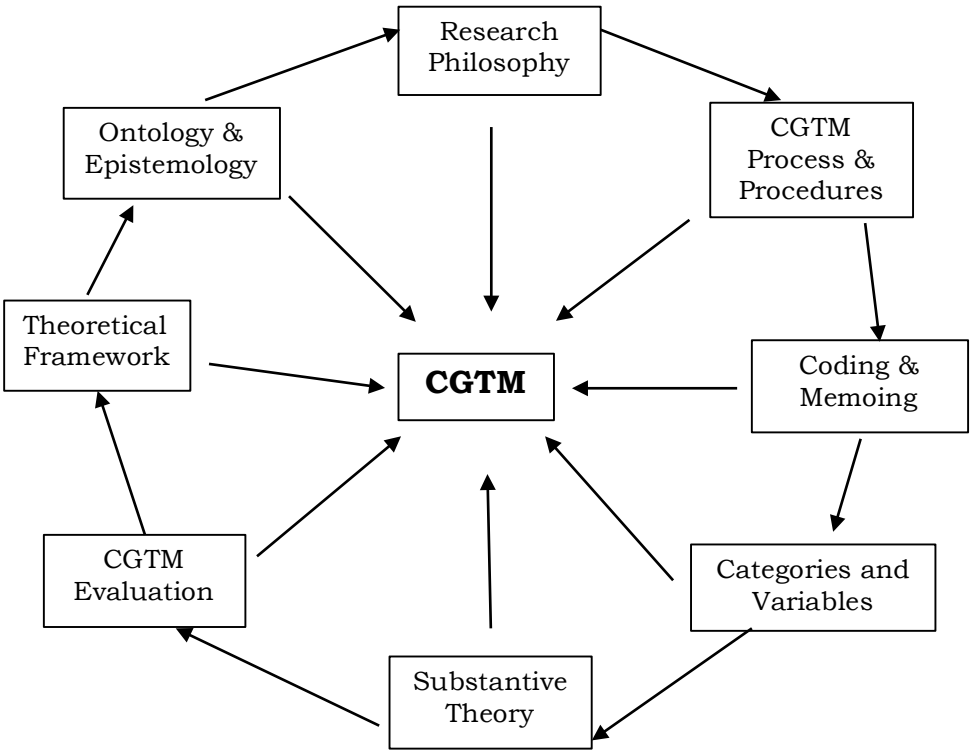


Figure 18: My enhanced CGTM argument structure

Figure 18 depicts nine major sections which I begin with explicating philosophical assumptions, fundamental CGT practices and procedures, challenges of using CGTM, process of how theory was generated and criteria for evaluating CGT research and theory developed.

Before planning my field work and data collection process, I was cognizant of the fact that my beliefs and opinions should not influence the research process and methodological procedures. Being conscious of my beliefs meant that I began the research by explicating ontology and epistemology assumptions; and this provided a discussion of philosophy underpinning methodology and theory.

3.3 Ontology and Epistemology

This section discusses ontological and epistemological assumptions related to the study. At first, I define ontology and epistemology; and secondly, I specify my ontological, epistemological and methodological presumptions at work. Presuppositions about the nature of the world and knowledge are of two kinds; namely ontology (*objects of knowledge*) and epistemology (*conditions for knowledge*) (Bhaskar & Danermark, 2006). Ontological assumptions unveil the crux of object under study or why it exists; while epistemological assumptions provide guidelines for what can be known about the object that can be socially constructed (Peters et al., 2013). Ononiwu (2015) asserts that when questions related to ontological and epistemological premise of '*why*' and '*what*' are answered, methodology suggests strategies to know whether object exists.

Evident positivist and interpretivist discourse is described as paradigm wars that are epistemological battles (Becker & Niehaves, 2007; J. Mingers, 2004). Mingers (2001, p. 242) defines paradigms as "a construct that specifies a general set of philosophical assumptions covering, for example, ontology (*what is assumed to exist*), epistemology (*the nature of valid knowledge*), ethics or axiology (*what is valued or considered right*), and methodology". Tan (2010, p. 99) elucidates that "terminologies such as paradigm, mode of enquiry, method, technique, strategy and approach are often used interchangeably in multidisciplinary research depending on a researcher's philosophical world view (i.e. the method's ontological, epistemological, and methodological perspectives)". Paradigms inherently consist of ontology, epistemology and methodology, which jointly form the nature of research inquiry (Guba & Lincoln, 1994).

IS theorists innovatively induce and blend middle-range theories at different levels of abstraction with philosophical positions on ontology and epistemology of action and technology (Avgerou, 2013). Danermark et al. (2002, p. 125) describes Middle-range Theory (MRT) as consisting of limited sets of assumptions from which specific hypotheses are logically derived and

confirmed by empirical investigations that explain a specific social phenomena. Additionally, MRT is a certain type of theory "aiming at bridging the gap between general theories and empirical observation"; and "concrete enough to enable tests to be verified or falsified against empirical data, by certain procedures".

As defined by antecedent citations, this research held the same view that paradigms inherently consist of ontology, epistemology and methodology. Thus, my interpretivist perspectives are at the heart of this research; and in essence its foundation. I agree and adopt Goldkuhl (2012) declaration that ontology and epistemology are linked to interpretivism because knowledge obtained from understandings or meanings is crucial for assumptions about the structure of the world.

3.3.1 Ontological Assumptions

Crotty (2012) defines ontology as the "*study of being*" or the science or analysis of '*what is*' and '*how it is*' concerning the process or nature of existence and structure of reality beyond the realm of pure imagination. Fitzgerald & Howcroft (1998) philosophically explicates ontology as a term for assumptions about "*perceived reality*" which entail people making claims about what is knowledge. As a perceived formal representation of knowledge, ontology examines sets of concepts within a domain, and the relationships between those concepts; while as a study of being, ontology studies fundamentally question what kinds of realities exist. Tan (2010, p. 99) explains that "*ontology entails people making claims about what is knowledge*", while "*epistemology is how people know it*". To do scientific research, ontology and epistemology assumptions act as guidelines, which then inform methodology choice (Bhaskar & Danermark, 2006). Guba & Lincoln (1994) assert that methodologies rest on ontological and epistemological commitments.

Checkland (2013) argues that we do not have access to what the real world is (ontology), but we only access descriptions of the world (epistemology);

and approaches such as '*System Thinking*' are epistemological ways of describing the world although they do not tell us what the world is. Crotty (2012) describes the ontological question of 'reality' as being objective (single and external to the individual) or subjective (with multiple realities that exist as subjective constructions of the mind). Guba & Lincoln (1994) correlates that reality as assumed, and position of the knower must be one of objective detachment to discover "*how things really are*" and "*how things really work*".

I do not dwell on the ontological interrogation of '*study of being*', but I rather adopt Blaikie (2007) description of ontology as "*assumptions that a particular approach to social inquiry makes about the nature of social reality*". Social reality is locally constructed by humans through their action and interaction. Because of my interpretivist inclination, I agree with Orlikowski & Baroudi (1991, p. 13-14) explanation that ontologically, "*interpretive perspective emphasizes the importance of subjective meanings and social-political as well as symbolic action in the processes through which humans construct and reconstruct their reality*"; and that interpretive studies assume the "social world (*that is, social relations, organizations, division of labour*) are not "*given*" rather, the social world is produced and reinforced by humans through their action and interaction. Organizations, groups, social systems do not exist apart from humans, and hence cannot be apprehended, characterized, and measured in some objective or universal way".

I do not acknowledge the presence of an objective world; but I rather see the world delimited by specific contexts. In context of this study, ontology reveals its relevance through analysis of an artefact through which acquiring knowledge refers. I agree with Peters et al. (2013) that ontological assumptions unveil justification for objects under study, why it exists and its impact. To examine my research problem, I find myself asking Guba & Lincoln (1994, p. 108) ontological question "*What is the form and nature of reality and, therefore, what is there that can be known about it*". The ontological assumptions to my worldviews follow an interpretive philosophical stance; which is the foundation of this study.

3.3.2 Epistemological Assumptions

Epistemology is a branch of philosophy concerned with the "*nature of knowledge, its possibility, scope and general basis*" (Hamlyn, 1995, p. 242). Epistemology "embodies a certain understanding of what is entailed in knowing, that is, *how we know what we know*" (Crotty, 1998); and is "*understood as the science of analysing the way human beings comprehend knowledge about what is perceived to exist*" (Becker & Niehaves, 2007, p. 201). Epistemology can be generalized as what constitutes knowledge and how it is attained while addressing questions of how to arrive at true cognition (Bailey, 2009; Foth et al., 2007; Koshy et al., 2010).

Epistemological stance underpinning IS philosophy consists of theoretical assumptions associated with positivism, interpretivism, critical realism and pragmatism (Goldkuhl, 2012; Orlikowski & Baroudi, 1991). This study embraced an interpretivism which I describe in *sub-section 3.5*. Brief descriptions for the other three assumptions are:

1. Positivism assumes an objective reality where absolute knowledge is possible, and theories are selected to justify discernment of such reality. Use of quantitative methods is a major way of denoting knowledge in IS studies due to precise measurement (Mingers, 2004; Ononiwu, 2015).
2. Danermark et al. (2002; Mingers (2004) and Tona & Carlsson (2012) explain critical realism as an alternative approach that reconciles modern philosophical debates. Critical realism advocates for research to express the complexity of the real world by advocating use of multi-pluralistic approaches, and mediates positivism and interpretivism aspersions to douse philosophical debates.
3. Goldkuhl (2012) explains pragmatism as concerned with action, change and the interplay between knowledge and action. Pragmatism advocates intervention into real world problems, and not merely observing.

In pursuing this research, epistemology made me ponder upon how I could create knowledge. I espouse Tossy (2012) assertion that epistemological

questions should be grounded in knowledge to communicate reality that exists. I contrived contextual epistemological perspectives due to the fact that the research was being done in Uganda.

Due to my Interpretive stance, I espoused Orlikowski & Baroudi (1991, p. 14) declaration that interpretivism is grounded on "*epistemological belief that social process is not captured in hypothetical deductions, covariances, and degrees of freedom. Instead, understanding social process involves getting inside the world of those generating it*". I affirm to Walsham (1993) proclamation that epistemological stance on interpretive approach is that knowledge of reality is gained only through social constructions such as meanings, tools, documents etc. Interview meanings in this research, were analysed for knowledge construction.

Exploring my research objectives and questions required exploitation of two epistemological orientations adapted from Kling et al. (2000); and include:

1. *Normative orientation* refers to studies aiming to advocate alternatives for design, implementing, use and policy making about ICT. It influences practice or policy by providing empirical evidence illustrating outcomes occurring when people work with ICTs in varying social contexts. It shows that IS are effectively utilized when users have a voice in design.

2. *Analytical orientation* refers to studies which aim to develop theories about ICTs in varying institutional and cultural contexts; and to empirical studies that contribute to such theorizing. Analytical research develops concepts and theories to generalize from understanding of ICT use in one particular setting, to other ICTs use in different settings.

I adapt these two epistemological orientations to foster need to identify, explain, justify and provide relevance for epistemological stance in this research. Epistemological assumptions indicate that research discoveries are literally created during research investigations; and epistemology is "*concerned with providing a philosophical grounding for deciding what kinds*

of knowledge are possible and how we can ensure that they are both adequate and legitimate" as Crotty (1998, p. 8) proclaims.

In the end, epistemological assumptions provided reasoning and guidelines about WSDB object or artefact which is believed to exist, and its influence on the water sector can be socially constructed to cultivate knowledge.

3.4 Methodological Approach

As a result of ontology and epistemology discussions above, I have to clarify research procedures followed; in other words choice of methodology or method. Mingers (2001) claims that because methodology deals with precise strategies to understand phenomenon or objects we think exist, questions related to ontological and epistemological assumptions must be answered beforehand. Ontology grounds epistemology while epistemology in turn grounds methodology; thus adopting methodology for a specific study is among the first steps because decisions about methods being appropriate to ontological and epistemological assumptions are prudently deliberated. Rowlands (2005, p. 82) claims that the "*research problem should be the most significant influence on the choice of a research methodology*"; hence researches must adapt and develop methodology to suit study phenomenon.

The term '*Methodology*' has various definitions. Checkland (2013) generally defines it as a study of methods. Strauss & Corbin (2007) define it as "*a way of thinking about and studying social reality*". Rowlands (2005, p. 83) describes it as "*the nature of ways of studying phenomena*". Mingers (2001, p. 242) definition is "*a structured set of guidelines or activities to assist in generating valid and reliable research results*" which consist of multiple methods, approaches and techniques designed a priori during research processes.

Misperceptions exist between the terms 'method' and 'methodology'; notwithstanding their interchangeable use (Becker & Niehaves, 2007; Iivary et al., 1998). Tan (2010, p. 99) defines methods as "*a set of procedures and techniques for gathering and analysing data*", while Mingers (2001) describes

methods as techniques followed to conduct research such as collecting and analysing data. Both authors assert that methodology combines different methods embodying various paradigms developed for a specific study.

Kaplan & Duchon (1988) and Ngwenyama (2014) describe methodology as a general and less prescriptive than method; and methodology influences choice of method. But due to specific studies and contexts, it is difficult to completely delineate boundaries between method and methodology or between methodology and general approaches such as qualitative.

My understanding of methodology is more generic; referring to structured guidelines assisting in generating reliable research results of an actual study. I considered CGT as methodology because it encapsulates philosophical, contextual, multiple dimensions, different undertakings, social and personal situations during various research stages. However, I categorised qualitative approach as a method adopted to cognize the social world and definitive purpose of this research. I deem method as a strategy of enquiry that changes from fundamental assumptions to research design and data collection.

In this study, CGT methodology was chosen to examine participant perspectives about the study phenomena. Findings and concepts generated are encapsulated into a substantive theory which is a consequence of methodology adopted. More about my CGT is in *section 3.8* and *chapter 4*.

3.5 Interpretivist Paradigm

Because this study involves a phenomena which entails WSDB influence; an understanding of participant perspectives was required because they actively experience WSDB use and recognise its effect. This is coherent with research revealing experiences of human social constructs which are depicted as inter-subjective (J Mingers, 2001; Schwandt, 1994). Thus, to examine perceptions, I considered two traditional approaches (*Positivist* and *Interpretivist*).

Positivism has long been dominant in IS despite recognition that positivist studies fail to effectively explain intricate perspectives about human social interactions like in development (de Gialdino, 2009; J. Mingers, 2004; Stockdale & Standing, 2006). Rowlands (2005) and Walsham (1995a) claim that interpretivist studies consider positivist research as insufficient because examining human social phenomena require complex contextual thinking. Interpretivism emphasises peoples meanings as appropriate descriptions of the social world; which is a limitation of positivism.

Researchers contend that examining IS in specific sectors, organisations or countries is very complex, subjective, ambiguous, and inconsistent. Because this study deals with people's perceptions, I adopt an interpretivist approach to underpin the study. According to Klein & Myers (1999), IS research using interpretivism focuses on people's meanings and values to unique contexts they are trying to understand. Interpretivism studies adopt the position that "*knowledge of reality is a social construction by human actors*", and emphasise explanatory insights or lived experiences from participants. Interpretive studies produce "*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, pp 4-5).

From an ontological and epistemological perspective, interpretivist approach is linked to the way the philosophies constitute the world and it's knowledge (understanding or meanings) (Goldkuhl, 2012). Orlikowski & Baroudi (1991, p. 14) states that "*ontologically, interpretive information systems research assumes that the social world (that is, social relationships, organizations, division of labours) are not given. Rather the world is produced and reinforced by humans through action and interaction*". Klein & Myers (1999, p.69) further assert that research is "*interpretive if it is assumed that our knowledge of reality is gained only through social constructions such as language, consciousness, shared meanings, documents, tools, and other artefacts*"; and researchers searching for knowledge immerse themselves with subjects (participants) to interact with, and to understand phenomena.

I had scrutinised participants' accounts to analyse and then reflect on words manifesting from underlying meanings. I adopted CGT and qualitative research to provide an account of meanings because the approaches lean on text rather than numbers. Klein & Myers (1999) endorse interpretive stance as allowing realisation of cognitive, truthful and genuine account of the study through researchers engaging in fieldwork to interact and obtain required information from participants.

Interpretive aspects that nominally informed this research were seven fundamental and interdependent principles by Klein & Myers (1999); which are strongly recommended for design and evaluation studies. See *Table 6.*

No	Principle	Summary
1	Hermeneutic Circle	Suggests human understanding as achieved through iterating between interdependent meanings of parts and whole. This principle is fundamental to all others.
2	Contextualization	Critically reflects social and historical background of research settings, so that readers can see how situation under investigation emerged.
3	Interaction Between the Researchers and the Subjects	Reflects on how research materials such as data are socially constructed from participants and researcher interaction.
4	Abstraction and Generalization	Relates idiographic details revealed from data interpretation by applying principle one and two to theoretical concepts describing nature of human understanding and social action.
5	Dialogical Reasoning	Sensitivity to likely contradictions between theoretical presumptions guiding research design and findings.
6	Multiple Interpretations	Requires sensitivity to potential differences in interpretations amongst participant narratives expressed in several descriptions.
7	Suspicion	Sensitivity to likely prejudices and systematic distortions in narratives collected from participants.

Table 6: Interpretive principles nominally informing the research

To obtain convincing accounts, I gave plenty of time to fieldwork and data analysis so that I could discover intrinsic findings, and construct knowledge in a way that is intelligible. I subscribed to Orlikowski & Baroudi (1991, p. 5) assertion that interpretive researchers "*attempt to understand phenomena through accessing the meanings*" generated from participants.

Because interpretive findings are interpreted and constructed, Guba & Lincoln (1994, p. 108) caution that "*no construction is or can be incontrovertibly right*", and constructions "*must rely on persuasiveness and utility rather than proof in arguing their position*". Different researches can cultivate different interpretations, but my goal was to provide convincing evidence based explanations or arguments about obtained findings and constructed theory.

I aimed to provide exploratory findings about WSDB's developmental influence. While I make clear the ontology and epistemological preference in the previous sections, research eventualities due to study phenomenon and intended findings contributing towards adopting interpretivist approach.

3.6 Inductive Inference

Since I adopted CGT, I was predisposed to apply an induction for inference or knowledge development. Rowlands (2005) claims IS research using GT consider inductive reasoning more favourably for theory construction. Additionally, studies following interpretivist paradigm adopt more inductive strategies, because induction suitably fits interpretivist orientation rather than positivist. Inductive research often leads to social construction of reality, whereby knowledge or theory is developed from emerged meanings of data (Gregor, 2006; Maccani et al., 2017; Mitev, 2000).

Before justifying choice of inductive approach, I am first compelled to state the four distinctive modes of knowledge inference. These include: deductive, inductive, abductive and retroductive; and each specifies different thought operations for analysing solutions to research problems. Each differs in developing knowledge, and provide multiple ways to debate, reason and

connect scientific studies using a researcher's creative, imaginative, interpretative, reasoned and abstractive cognizance for making intellectual conclusions (Chiasson, 2005; Osei-Bryson & Ngwenyama, 2011; Trochim, 2006). They are recognised as foundational practise for science researchers to develop, test and apply concepts or theories (Danermark et al., 2002).

This study adopted an inductive inference mode which is described throughout this *sub-section*. Deductive reasoning is sometimes called the 'top-down' approach because researchers start at the top with broad information and work their way down to specific conclusions (Danermark et al., 2002; Osei-Bryson & Ngwenyama, 2011). Danermark et al. (2002) asserts that the deductive research process starts with established theories, and hypotheses are derived from these theories, which are then tested on empirical material.

Abductive reasoning is an approach to hypotheses generation based on a method of logical inference to studying facts and devising a theory to explain the stated facts. During abduction, the first step before examining unexplained phenomenon, is to propose hypothetical mechanisms, that if existed would cause the phenomenon to be explained (Mingers et al, 2013).

Retroductive reasoning entails moving from the observable events contextualized in abduction to discovering seminal mechanisms that make such an event possible. Retroductive research moves from observed experiences to hypothesizing underlying mechanisms that are explicable for the phenomenon (Danermark et al., 2002; Mingers et al., 2013).

However, In IS, induction and deduction are the dominant inference modes because recent work considers them more favourable for theory building (Gregor, 2010; Trochim, 2006). Initially, I focused on inductive and deductive approaches because they are prevalent in IS literature. I was inclined to select inductive approach as soon as I chose CGT for methodology.

Induction is described is a bottom-up approach that moves from specific observations, patterns and provisional hypothesis to broader generalisations (Trochim, 2006). It does not constrain a researcher to prior theory, but it instead recognises theory development by moving from individual cases to universal phrases or broader generalisation (Rowlands, 2005). Single statements are generalized because it is a posteriori method that concludes from individual cases to universal law (Becker & Niehaves, 2007).

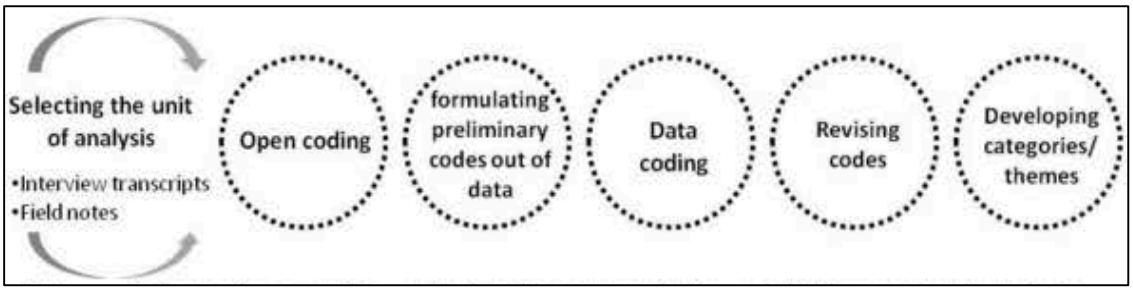


Figure 19: Inductive research process (source: (Cho & Lee, 2014))

Inductive studies begin with no theories or hypothesis to test because fated theoretical perceptions may bias or limit findings (Maccani et al., 2017; Trochim, 2006). Researchers begin with unprejudiced studies without being bound to specific theory, and then elaborate empirical theory grounded in data by developing codes, categories and concepts directly from data (Cho & Lee, 2014; Koshy et al., 2010).

Gregor (2006, 2010) describes inductive theory building and mid-range theorising as valuable and native to IS. According to Gregor (2006), the goal of theory is to analyse, explain, predict, or prescribe using generated constructs. Gregor (2006) and Hassan (2014) explain that theories explain study phenomenon, and increase our understanding of the world with new insights. Gregor (2006) describes IS theories as concerned with examining use of artefacts in human-machine systems and social phenomena emerging from the interaction.

Gregor (2010) and Rowlands (2005) claim the main advantage of adopting induction is that meanings can be interpreted to suit to wider contexts; while the main limitation is interpretations are never analytically or

empirically definite. Gregor (2010) proclaims inductive processes as favouring theory development rather than testing, and derived statements obtained inductively cannot be tested directly through observations.

Danermark et al. (2002) denotes GT as the most recognised inductive approach, because it makes theory generation systematic by taking inductive logic as starting point. Because I wanted to develop new theory from data without being bound to specific theory, an inductive approach coupled with CGT was appropriate. Due to lack of prior theory about the WSDB influence, I postulated inductive logic to be useful. Additionally, limited literature supported choice of induction because it is reportedly suitable when knowledge about phenomena is limited, fragmented or unknown (Cho & Lee, 2014; Rowlands, 2005).

I adopted an inductive thinking process to analyse, interpret and categorise data to develop theory. CGT methodology compliments inductive logic.

3.7 WSDB as Case Study Artefact

Due to the claim that influence of ICTs in multiple sectors of Uganda's economy is still under-researched as stated in Chemisto & Rivett (2015); Waiswa & Okello-Obura (2014); my course of action began with selecting an ICT initiative to examine. The idea was to make an interpretive understanding of technology perception in a setting that has consequence on citizen or community wellbeing. I chose WSDB as a case ICT. No in-depth research had been conducted on the WSDB since its implementation, and yet it is now positioned by MWE as a central IS for the water sector.

I categorised this research as exploratory, and exploration of the WSDB as a case analysis of an ICT initiative. I wanted to examine real-life contexts within which the WSDB was implemented, and its perceived consequences on water sector growth. Yin (2013) advocates adopting case approach for specific research when study phenomena is not clear or has not been sufficiently theorized. The philosophical and methodological approaches

were important for generating theory, which meant that I would directly be involved in the experience of data collection, analysis and theory building.

I conducted interviews with participants working in the water sector about the WSDB technological intervention. See *Figure 20* for participant groups.

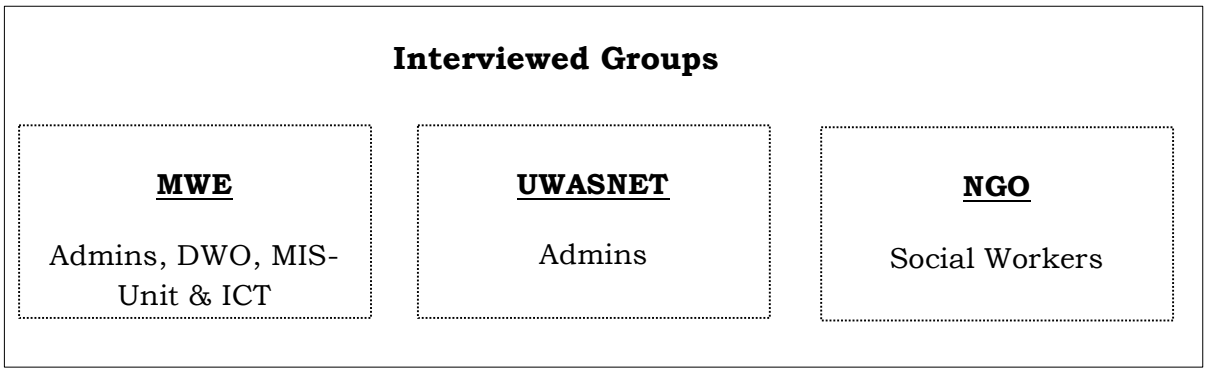


Figure 20: Different participants groupings

I acknowledge that focusing on WSDB which is one of the many interventions may be considered limited; but I needed to limit my scope on ICTs; and WSDB is the only system currently positioned by MWE for all stakeholders and is freely accessible countrywide.

I reiterate that this research was designed to explore WSDB influence. The research does not test any hypothesis or theoretical framework, but methods adopted contribute to a deeper understanding of the investigation.

3.8 Grounded Theory Methodology (why and which approach)

In preceding chapters, I discuss among others motivation for undertaking this ICT4D study, philosophical approach, methodology and inductive plus interpretive approach for knowledge contribution. Those intellectual discussions presented erstwhile knowledge of how to tackle the research. Overall, the goal was to have a theoretical contribution in retrospect of appropriate method or paradigm. Gregor (2006) explains the significance of theory by stating that theories explain study phenomenon, and increase our understanding of the world with new insights that analyse, explain, predict, or prescribe phenomenon using cultivated constructs.

Since I aimed to provide a theoretical explanation through analysis of participant views and perceptions, the method for analysing collected data is GT. GT is the "*discovery of theory from data*" that is systematically obtained and analysed in social research (Glaser & Strauss, 1967). Tan (2010, p. 99) describes GT as a "*rigorous set of procedures for producing substantive theory*" and researchers analyse qualitative data simultaneously using *"techniques of induction, deduction, and verification to develop theory*".

GT is now adopted in diverse areas to generate emic perspectives and theory grounded in realities of participant experiences (Goldkuhl & Cronholm, 2019; Levina, 2021). Its major advantage is that it produces theory related to study phenomenon, and is appropriate when little or no previous theory exists, or when theory that exists is too abstract to be tested (Cho & Lee, 2014; Elliott & Higgins, 2012). Gurd (2008) declares GT as useful for new situations, gaining new insights in well-known settings, but may not be suitable to already well-developed knowledge areas.

In IS, GT is increasingly being used to examine, explore, explain, draw contexts and theorise from perspectives, experiences and narratives of practitioners (Hughes & Jones, 2003; Matavire & Brown, 2013). Orlikowski (1993) was among early IS scholars to adopt GT, and justified its usage for situations where no previous theory exists, incorporates complexities of organizational contexts in understanding phenomena and is uniquely fitted to studying change or processes. GT provides for inductive examination of data in subject areas that may be difficult with traditional quantitative methods (Elliott & Higgins, 2012; Priest et al., 2002).

The consequence of developing theory was the major reason I adopted GT. I adopted CGT to collect data and determine meanings or interpretations so that I can put forth theoretical explanations and cultivate theory.

3.8.1 Why CGT Approach?

Since Glaser & Strauss (1967) proposed GT, variants have emerged due to different philosophical assumptions defining ways in which it can be applied

(Gurd, 2008; Urquhart, 2007). Matavire & Brown (2013) claim that methodological rather than ontological or epistemological aspects are cited as the main source of difference; and continuing GT adoption is a positive development that is contributing and strengthening the theoretical core. The approaches have subtle differences in methodological usage.

Having clarified reasons for embracing GT, a new question regarding which GT approach to adopt arose. I considered three namely Glaserian, Straussian and Constructivist. Straussian approach emphasises rigorous and prescriptive routines, and proposes axial coding after open coding during data analysis of categories (Strauss & Corbin, 1994, 2007). Charmaz (2006, p. 184) emphasises constructivist awareness and a pragmatist underpinning, while emphasising researcher interaction and involvement with participants to construct theory.

I explicitly state my position concerning the reasons why choice of CGT is suitable for this study. CGT extends GT by explaining concepts such as theoretical sampling, sensitivity, coding, memos and constant comparison. Glaser (1978) emphasises openness and creativity in data interpretation by suggesting selective coding to focus analysis around one core category, then assigning other categories lesser roles (*primary* and *secondary*).

Andrade (2007) found CGT's selective coding as flexible and more convincing during research about consequences of ICT intervention. Higgins (2007) & Higgins et al. (2008) backed CGT because it emphasises letting issues emerge from participants; it is flexible and gives freedom to follow leads using a variety of data collection methods as ideas emerge; and allows discovery of a hidden pattern of behaviour fitted with idea of developing theory of practice. Elliott & Higgins (2012) accentuates that CGT allows researchers to start interviews with broad and open statements which permit participants to talk freely; thus letting concepts emerge from them.

Additionally, CGT ensures an inductive and interpretivist approach as a means of un-covering core participant concerns or perspectives, and not those derived from existing literature. During data analysis, reviewing codes

for similarity and undertaking comparative literature reviews provided useful means of demonstrating that the theory is grounded in data.

The notion of allowing data to speak to me, and letting concepts emerge innately rather than imposing preconceived notions was a great appeal. I decided that this study will be guided by CGT principles. I adopted CGT because I could not find any previous theory related to my study area. More about my CGT approach and its processes is discussed in *chapter four*.

3.8.2 Evaluating Rigor and Quality

According to Glaser (2002), studies that follow fundamental CGT principles and procedural steps propose theories grounded in data; and that these theories are an interpretation of valid explanations of participant concerns or perspectives. Glaser (1978, pp. 4-6) reiterates criteria to evaluate rigor and quality of CGT studies or theory generated. The criteria must be met by theory purported to be generated from data. Thulesius (2003, p. 27) claims the theory "*is neither right nor wrong, it just has more or less fit, relevance, workability and modifiability*", and rather a valid interpretation of data. Readers of the GT study "*should evaluate them against these criteria*".

No	Criteria	Description
1	Fit	Emergent codes and core categories have to fit with data used to develop theory. Fit constitutes an essence not to use preconceived codes or categories from extent theory.
2	Work	Theory and categories must explain and interpret what is happening in a substantive area and predict future.
3	Relevance	Significance of the research and theory or core category to the substantive area. Participants should recognise the core category or theory because it is drawn from their data
4	Modifiability	When new data emerges, the theory or categories can be refined. It should be possible for ensuing researchers to modify the theory without nullifying it, hence ensuring theory relevance to the substantive area from which it emerged

Table 7: Criteria to evaluate GT studies (source: (Holton, 2008))

C*hapters four* and *five* describe my CGT practices, approach, and processes detailing how are I transparently generated theory that is grounded in data, fits, works, is relevant and is modifiable.

3.8.3 Other Quality Features

In CGT, complete adherence to the methodological procedures is significant towards developing a rich theory. Studies must follow all procedural steps, and do not force data to generate theory that is relevant and parsimonious to concepts in the data. Parsimony allows fit of theory while accounting for variations in data (Glaser, 2002; Holton, 2007, 2008).

Transparency and accountability throughout the research process is a quality feature ensuring rigor. Readers should clearly see how the research progressed from raw data to codes, categories, core category and then to substantive theory. Transparency and accountability entails presenting an audit trail of notes, memos, rationale for certain decisions, reasoning during analysis, demonstrating arguments for and against certain concepts, and theory backing (Glaser & Holton, 2004; Urquhart, 2007).

3.8.4 Critique of CGT

GT adoption in IS continues to draw critical debate from scholars and practitioners alike due to confusion or misperceptions. The debates are often about philosophical origins, methodological usage, misalignment and limited theory generalisability (Bryant & Charmaz, 2010; Goulding, 1998; Urquhart, 2007). These debates have resulted in multiple GT approaches like those discussed by Matavire & Brown (2013).

Philosophical origins and orientation of GT has differing positions. Some position it as positivist or objectivist method, while others interpretivist and constructionist (Bryant & Charmaz, 2010; J Mingers, 2001). Some point to Symbolic Interactionism (SI) as origin of GT (Goulding, 1998). Because SI is adopted by Qualitative Data Analysis (QDA); and GT adopts qualitative aspects, critics inaccurately accept it is a derivative of QDA. Glaser (2005)

claims that GT makes use of qualitative data but it is not QDA. Regarding positioning, GT is simply an alternative method guided by needs of a specific research rather than philosophical or paradigm preconception that:

> "*can be used on any data type and with any theoretical perspective....no one theoretical perspective can possess it*" (Glaser, 2005)

On methodological use, Gurd (2008) claims that GT is useful for new situations or gaining new insights in well-known settings, but may not be suitable to areas of knowledge that are already well developed. Additionally, interpretive findings developed may not be generalizable because other researchers can have different interpretations.

From my experiences, I identified three major problems that are open to debate: (1) *issues with understanding methodology use*; (2) *learning how to untangle my own biases*; (3) difficulty in choosing a GT approach to adopt for novice researchers. Methodological use first requires one to select a specific GT approach. I read numerous literature before deciding to adopt CGT. CGT requires experience, and I received some mentorship from an experienced professor at the University. Ability to navigate biases or preconceptions that could ensue during data conceptualisation requires skill, meticulous adherence to CGT tenets, and is inherently complicated.

Despite complexities, IS researchers refer to CGT as valuable and robust for revealing perspectives and concerns related to human-technology interaction. CGT is increasingly used in IS because the discipline deals with ICT or IT artefacts in social, cultural and economics contexts (Matavire & Brown, 2013; Urquhart, 2007). Matavire & Brown (2013) reiterate that GT is an appropriate methodology to develop theory grounded in participant experiences because it reveals patterns and concepts about phenomena bound to time, settings and people involved. The theory developed is robust because it is innate to data collected about the empirical study.

3.9 Chapter Conclusion

This chapter explains my philosophical assumptions and methodological foundations underpinning this research. First, it presents the research process adapted; and thereafter ontological and epistemological assumptions. The chapter details the interpretivist paradigm posited for the nature of the study, and the mode of inference which is inductive.

Finally, the chapter examines CGT which is the methodological approach selected based of my philosophical underpinnings. In the next *Chapter four*, I put into practice methodological foundations provided in this chapter to discuss the research design or approach, data collection and subsequent data analysis processes using CGT. The chapter embodies the discovery journey taken which enlightened my knowledge of CGT practices.

Chapter Four

4.0 Research Design, Approach and Processes

"Knowledge exists potentially in the human soul like the seed in the soil; by learning the potential becomes actual"

Al-Ghazali (1056 - 1111)
Philosopher

4.1 Chapter Summary

As stated in *Chapter 3*, this research adopted CGTM; and this chapter proceeds by explaining the research design and methods. These include CGT tenets followed, research area, participants interviewed, data collection and analysis process. The chapter examines application, reflection and understanding of the whole research process, which I regard as extremely relevant. I describe how CGT was used by detailing the coding procedure, cultivated categories, core-category and theory.

Due to CGT method, this research was delimited to discovering participants perceptions in developing new theory. I took the approach of delimiting findings to perspectives that were explanatory of the WSDB influence.

The chapter concludes by stating emergent theory which is the major knowledge contribution of this research. I organised the chapter into sections that aid continuous reflection of how data was collected, analysed and theorised upon. The first sections explain extricating my preconceptions and data collection processes, while the last sections explain CGTM use.

4.2 Preconceived Notions

Avoiding preconceptions and remaining open to gradual emergence of the theoretical concepts is among the most challenging issue in CGT. Holton

(2007) proclaims that CGT researchers are required to undertake their study with no preconceived research problems, interview procedures and extensive literature review. Researchers should be open to allowing interview data to guide emergence of core issues or concepts.

Regarding my literature review undertakings, I admit that I had an extensive literature review before data collection and analysis because: 1) First and foremost, the Information Systems Department at the University of Cape Town requires all doctoral proposals to thoroughly undertake literature review on any proposed research topic. It is impractical not conduct any literature review because it is core to proposal defence; 2) Secondly, I needed to determine whether the research area or topic that I wanted to undertake had been adequately researched or not; and 3) Thirdly, choice of CGT and being a novice CGT researcher meant that I had to study extensively about the method, especially during initial research phases before I adopted the methodology. This allowed me to plan my work and then have a structured theoretical basis.

I was able to confirm that analysis of ICTs, and specifically WSDB influence on water sector development is under-researched. Although Glaser (1998, 2002) recommends that CGT researchers should not conduct literature reviews not bias the study, other GT scholars such as Holton (2007) and Urquhart (2007) explain that literature reviews do not prevent researchers from being theoretically sensitive and knowing relevance of data to theory construction. Urquhart & Fernandez (2006) declare that preliminary literature reviews examine theories that exist in any research area, and how researchers may have confronted facets of the research problem but does not impose a framework on future data collection. In addition, literature reviews are undertaken with an understanding that new cultivated theory will determine the relevance of literature.

Indeed, the literature review greatly informed my knowledge of CGT and its concepts, but did not prejudice how I perceived and conducted the research.

4.3 Research Participants

Data was collected from persons working in Uganda's water sector. *Tables 4 and 8* present interview participants and their roles. Using CGT, the study scope, data collection and analysis processes were determined in a process based on emergent data as shown in *appendices A.4* and *A.5*. As a researcher, it was important that I collect data patiently while following whatever the participants conveyed to me. I was conscious of the fact that I had to start data analysis simultaneously. It was crucial that I do not collect all data, and then attempt to analyse it all at once because CGT does not recommend that. Analysis after each interview sequence is crucial for delimiting data collection and coding to the core concepts.

CGT contributed to multiple data collection phases, and a philosophical conceptualisation of the data and theory concerning WSDB influence.

4.4 Data Collection

The data collection process aimed at shedding light on an under-researched problem by determining perspectives that participants reveal. Over thirty encounters of interview sessions were partaken with participants. Some participants were interviewed twice (multiple encounters or iterations) at different phases. This meant that I had over thirty hours of interviews. Glaser (1978, 1998) recommends multiple participant encounters from the researchers; first to establish rapport so that participants freely open-up or feel comfortable with my presence, and later iterate encounters in case more explanations of identified concepts are required. I wrote notes during sessions that were not recorded. See *Appendix A.7*.

Ideally, I would have liked to conduct much more interviews but a lack of response from some invited participants and the complex political situation at the time due to upcoming local elections was challenging. I spent some hours or days observing interview locations with participants based in rural and urban districts. An interview guide which included thematic concepts with semi-structured questions about WSDB and the role of WSDB in

service delivery helped my focus. Having interview guides or topic questions is a condition required by the University of Cape Town before ethic clearance is provided for any data collection process.

Qualitative data was collected through face to face interviews, written notes, observations, photographs and secondary data. In CGT, the type of data does not matter because all data has the potential to provide a meaningful contribution depending on context and what the researcher is looking for. Interviews lasted between thirty minutes to one hour for oral conversations. In the first field study, some interviews were conducted without tape recording, and these involved relatively shorter sessions and written notes.

The field study phases entailed exploratory face-to-face interviews. Initial interviews were conducted between December 2015 and February 2016; while the second iteration was between October 2016 and January 2017. All interviews involved similar participants and some new ones. All interviews were conducted to identify the underlying perspectives and imperceptible notions. Interview guides were developed from literature, pre-study knowledge about ICT or WSDB and stakeholder information about the water sector. Subsequent interviews in second phase were guided by data analysis and iterations from the initial research data.

Secondary data was obtained from literature clarifying the current status of ICTs and the water sector. Literature was obtained from stakeholder websites, reports, conference or journals and snowball references using keyword searches. Some literature was from ICT4D studies and forums in WASH such as Rural Water and Sanitation Network (RWSN).

I undertook analysis of collected data to discover concepts and nascent views. Initially, concept discovery felt like I would not 'see light at the end of the tunnel' due to repetitions in viewing data, and meticulous identification of concepts or themes that the data was indicating. I would like to thank iCOMMS lab colleagues for various discussions and thoughtful viewpoints.

4.4.1 Field Study Engagements

Before data collection, I contacted several potential participants via email and telephone call to seek their permission for participating in the study. After obtaining ethics approval from the Department of Information System (*appendices A.10 and A.11*) and authorisation from participants, I began the first field work between December 2015 and February 2016. These months entailed encounters with participants at the MWE, UWASNET and NGOs in rural and urban districts. Because the WSDB is accessible countrywide, perspectives from different settings was relevant towards holistic learning.

I communicated with eligible participants to setup appointments and interview locations. Choice of participants was guided by: 1) participants had to be working in the water sector; 2) participants needed to be familiar with ICTs or WSDB and probability sampling. As for interview locations, this depended on participant suggestions, familiarity with some districts and references from some participants who had engaged in prior ICT studies.

The schedule for the first field study started in more urban districts of Kampala and Mbale, before moving to rural districts of Kween and Kapchorwa. On 3rd of December 2015, I had my first session at MWE headquarters in Kampala with an engineer and manager in the Rural Water Supply Department (RWSD). He briefed me about RWSD, how water supply projects are implemented and relevance of WSDB and other ICT's in supporting project implementations. After the meeting, I was introduced to new participants with whom I scheduled interviews. Over the next few days, I met and interviewed participants at MWE and UWASNET. At UWASNET, I interviewed the administrator at the head office to understand NGO and private stakeholder access to WSDB for information. Some participants encouraged me to visit certain districts which I scheduled.

However, like all field studies there were challenges. I experienced some cancellations and reschedules. But adaptability to unplanned circumstances such as cancellations and changes to interview dates or locations by

participants was something I had expected. I gave myself the flexibility of time which meant that I could reschedule within the planed timeline.

After over two weeks in Kampala, I travelled over 400km to the eastern region of Uganda to Mbale and to two rural districts of Kween and Kapchorwa. I scheduled interview sessions with DWOs and NGO staff in each district. I made observations and took some pictures of rural water points. Although Kween and Kapchorwa are next to each other, and it took about 30 minutes to move from one interview location to another. Lack of formal public transport and dusty murrum roads which became muddy with rain was challenging. Flexibility allowed me to interview an additional participant recommended by DWO in Kween, and this made me very excited. During interviews, we discussed perspectives about WSDB influence, submission of water source information and management of water sources.

Related conversations were held in Mbale with DWO and other participants. I found some rural participant insights a little different compared to those from urban locations. However perspectives about WSDB were analogous. See *Table 8* for interview encounters, participant organisations and districts.

No	Location	Interview Encounters
1	MWE Kampala	9
2	UWASNET Kampala	2
3	NGO Kampala	2
4	MWE-Kabarole	1
5	NGO-Kabarole	1
6	MWE-Mbale	2
7	NGO-Mbale	6
8	DWO-Kween	2
9	Admin-Kween	2
10	DWO-Kapchorwa	1
11	NGO-Kapchorwa	2

Table 8: Showing field study encounters and locations

I was able to have direct observations of office activities and take pictures of rural water points. Some offices of lacked computers and internet, which respective participants stated as a major hindrance to WSDB and information access. I wrote notes or memos from interviews encounters, and I started my data analysis immediately. Glaser (1978) enunciates that it is important to start data analysis immediately because this analysis guides subsequent interviews and observations.

During stopovers at each interview locations, I often experienced delays waiting for participants. Some delays lasted for over an hour and this tested my patience. Transport in rural districts was a challenge. I rode at the back of a motorcycle twice between Kween and Kapchorwa for over 20km because it is the fastest and most readily available form of transport. These public motorcycles are called *boda boda*. Murrum roads ensured that I had dust on my clothes. I was fortunate to clean up before interview sessions at the district headquarters because they are aware of dust or mud issues, and a water source is available for staff and visitors. Despite the challenges, I was fortunate to conduct the interviews. *Figure 21* depicts *boda boda* ride.

Figure 21: BodaBoda ride going through a muddy road in Kween

From Mbale to Kapchorwa, I used a taxi which normally takes about one and a half hours. I had to wait over 1 hour for the DWO because he had

gone for a field tour of water sources in other areas. This interview was much needed because the DWO explained why he feels that ICTs and WSDB are significant for monitoring and managing rural water points.

Field study experiences fuelled my disposition that a researcher must be flexible and adaptable to collect all required data. Themes and sample questions developed where valuable because they helped plan or refine initial interviews. The valuable experiences prepared me for next interviews.

The second data collection phase was between October 2016 and January 2017, and included participants chosen using guidance from initial research design and first field study. This comprised of previous participants and a few new ones. Interviews ranged between 30 minutes to one hour. Interview guides included focused codes and categories which were developed from derived concepts from previous interviews. Follow-up questions included generated concepts. I made brief handwritten notes during recorded and non-recorded interviews. The notes captured instances, discussions contexts, nuances of interviews and observations.

In the end, I successfully completed two data collection field studies despite several challenges along the way. *Table 9* presents my itinerary.

Interview Locations	**Timeline (2015-2017)**						
	Dec-15	**Jan-16**	**Feb-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**
MWE – HQ Kampala							
UWASNET Kampala							
Districts Staff							
NGO Staff							

Table 9: Showing field study Itinerary

During and after each interview, data analysis to determine emergent concepts and categories was done using processes of theoretical sampling and selective coding. *Section 4.5* explains CGTM use.

4.4.2 Data Sources

Since I had decided to pursue research focused only on qualitative data, I had to be cognisant of what types of data sources I could use. Creswell (2012) and Guba & Lincoln (1994) readings supported me to carefully navigate literature explaining strategies for collecting qualitative data from different sources. Because I adopted CGTM, theoretical sampling which is a process of analysing collected data, and guides data source selection is one process I was sensitive to. Glaser (1978) explains theoretical sampling as where CGT researchers use categories and concepts generated to direct additional data collection processes.

I used six different sources of data which were divided into primary and secondary. Primary data was collected from interviews, field notes, observations and photographs while secondary data included WSDB content and published reports. All data obtained was carefully stored for analysis. See *Table 10*.

No	Data Source	Data Source Type
1	**Primary Data**	Interviews
		Jotted Field Notes
		Observations
		Photographs
2	**Secondary Data**	Downloaded Content from WSDB
		Published Reports

Table 10: Showing multiple data sources and types

Several stakeholders were considered for data collection based on their access and use of the WSDB. *Figure 22* shows water sector stakeholders.

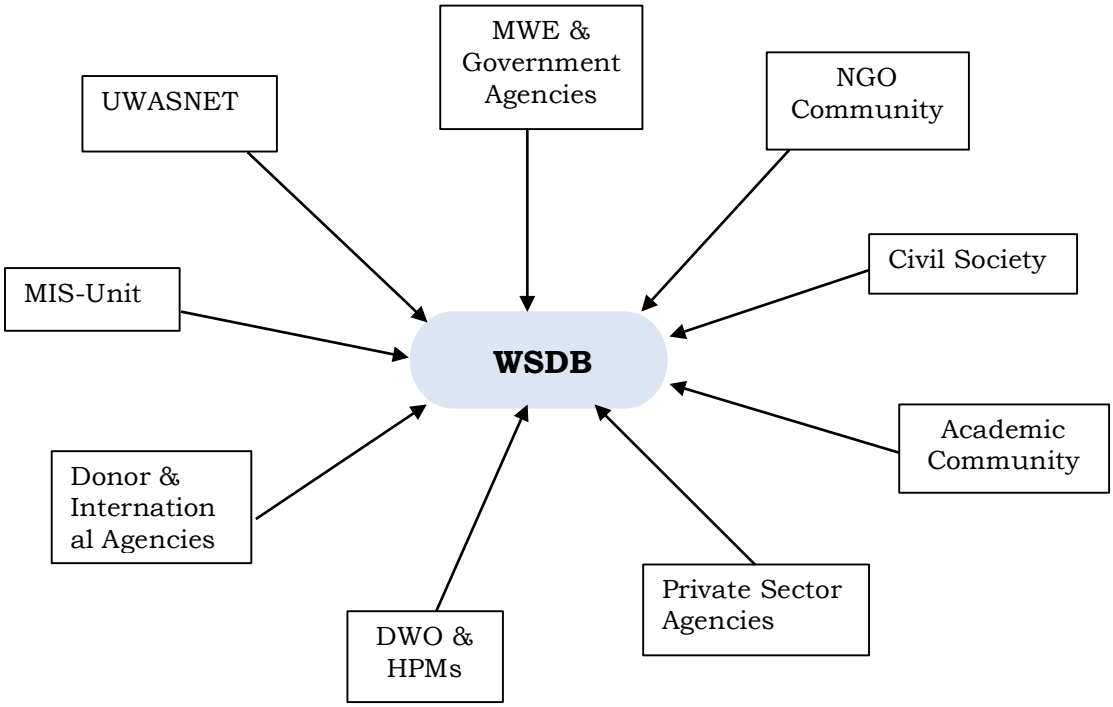


Figure 22: Showing all stakeholder in Uganda's water sector

In the end, the multiple stakeholder and data sources complimented the study process and supported analysis for research findings.

4.4.2.1 Interview Sessions

Face-to-face interviews were my main data source and were fundamental data contribution. Participants were drawn from three stakeholders as shown in *Figure 20*. Different stakeholder groups were chosen with the intention of providing different perspectives about the WSDB. I prepared specific guides or themes in advance to assist me in conducting the interviews. Interviews were refined and adapted to specific circumstances whenever I needed to obtain specific data.

All interviews were conducted in English but some participants gave limited explanations in local Ugandan languages of *Kupsabiny* and *Luganda* because they knew I could understand, and they wanted to succinctly explain a particular concept.

Consent was obtained before each interview. *Appendix A.12* depicts a consent form. I often engaged in relevant and casual conversations with participants to continue building rapport. Participants were all key players working in Uganda's water sector. At the MWE, I had several encounters which included recorded and non-recorded interviews. On average, I spent approximately 30 minutes to one hour interviewing participants. Some interviews were done without recording with an undertaking of casual conversations and memo writing during non-lengthy interview sessions. See *Table 8* above for interview encounters with different participant groups and districts. The aim was to obtain different views from participants groups to justify theory building process.

The biggest challenges experienced during data collection were scheduling cancellations experienced, and the distance travelled to different interview locations. I travelled over 1500Km to different regions in Uganda as shown by the map labelled *Figure 3*. I rescheduled the interviews and thankfully many participants were forbearing.

Interviews were conducted in offices, workspaces, and cafes. Some participants took the lead during interview sessions because I had notified them what the research was investigating. Subsequent interview questions were guided by participant answers to some questions. Before and after each interview, I had between 5 to 10 minutes of casual conversations with participants which I felt contributed to building rapport, knowing each other and understanding the research area. I had follow up interviews with five participants to elucidate cultivated concepts from previous interviews. *Appendix A.13* depicts interview topic guides, themes and some questions. This guide was only used for planning purposes but many of questions were asked *on the fly*.

I often asked participants to discuss their experiences, perceptions, expectations and influence of WSDB. Attitudes towards WSDB were obtained, in addition to their views about ICTs. Some interviews proceeded from specific questions about the WSDB; to more general topics about

community water access and WSDB's support for service delivery and data sharing. Observations of WSDB use at the MWE generated more questions.

All digitally recorded interviews were transcribed, while notes and memos were written down. Some interview encounters had only notes jotted instead of recordings because I was following CGT approach termed '*delayed action phenomenon*'. Glaser (1978, 1998) asserts that generating theory grounded in data takes time and is a 'delayed action phenomenon'; thus, I had to pace myself. Being a novice grounded theorist, I was trying not to be hard pressed to meet short time deadlines, but I was rather accommodating every process until something interesting manifested.

I was often excited to interview participants about WSDB use and its impact. It was significant for me that at no point did any participant state that they were opposed to the WSDB positioning. One participant did express WSDB integrity issues (accuracy and timeliness of data) and individual challenges (irregular WSDB access, poor internet access and regular electricity blackouts). I was able to determine that other than the WSDB, all participants had experiences with ICT use. Simultaneously with data collection, I started analysis and note writing immediately because it could guide succeeding interviews and observations.

All participants affirmed to technology optimism; where ICTs are perceived as having progressive or development role no matter the circumstances. This confirms nomothetic and analytical view of technology artefacts as explained by Kling (2000). Optimism is presents the view that people make use of ICT to achieve their developmental goals just like several ICT researchers enumerate development benefits of ICTs. My understanding is that ICTs like other technologies can support developmental efforts. However, development influence depends on several factors such as how we use the technology, stakeholder adoption, its perceived benefits etc. Thus, as Andrade (2007, p. 4) asserts, "*we must avoid taking a universalistic and technological deterministic stance*" that all technologies have developmental effects or "*implicit assumption that technology is advantageous per se*".

4.4.2.2 Field Notes

Field notes were additional primary data sources. I wrote interview notes on a notebook and typed some into the computer; while some notes acted as memos during analysis. I wrote memos and notes because they are core to CGT. However, there is a difference between notes and memos.

a) Notes comprised all information written during each interview encounter whether recorded or not (*See Appendix A.7*). For example, some interviews were conducted without tape recording, and these involved relatively shorter sessions and written notes. The notes captured participant responses, instances, discussions contexts, nuances of interviews and observations.
b) Glaser (1978, p. 180) describes memos as records documenting a researcher's developing ideas and thoughts "*that come to mind during coding, data collection, analysis, and theoretically sampling*". Memos are typically written by researchers because they core key to ideation, and transform field descriptions and codes into theoretical accounts.

Field notes helped record and make for better understanding of interview data. Memos kept a record of thoughts, analysis of codes, cultivated or emerging concepts during coding and built theoretical ideas around codes.

To my knowledge, there is no standard structure or template for which all written notes or memos are standardized to. I wrote notes in ways I could understand and monitor information; and it aided analysis to move from contextual descriptions to theoretical understandings. Interviews without recordings and planned or unplanned encounters consisted of written notes.

Appendix A.8 depicts a sample of written notes. As a standard, I included some the following details in notes.

- Title
- Date
- Participant details and meeting place where necessary

- Summaries about the interview and meanings understood
- Any views or what is suggested
- Derived concepts, categories, summaries and emergent codes where necessary
- A Statement or word detailing what data obtained from the participant
- Any patterns observed in the data

The notes contained summarised information, descriptions, explanations and outcomes from interviews or observations. Notes were of great assistance during attempts to understand abstract data concepts and core category emergence. They aided focus on next participant interviews on the core issue. Notes written iterated following emerging ideas.

At the end, I had over 50 pages of notes in my notebooks and those typed into the computer. Data Summaries, understandings, comments, experiences, observations and explanations had been written. Notes were useful when certain interviews were not communicative or meaningful.

In a way, notes provided a reflection of analysis because I jotted down observations, experiences, meanings, concepts, ideas and interpretations. This allowed me to integrate preliminary data analysis with data collection.

4.4.2.3 Observations

Observations were simply obtained from noting different situations that I felt were worthy writing. For instance, while discussing the WSDB at MWE headquarters, participants allowed me to see staff doing data entry using water form submitted. I was showed how data is validated and output is generated from WSDB. This kind of observation was insightful. In another instance, while waiting to interview an MIS-Unit participant at MWE, I observed staff interacting, planning and using the WSDB. I interacted and had causal conversations with them. Once the interviewee arrived, my interactions led to a breakfast invitation; which I was very grateful for.

Observations were valuable because I watched what participants do in their locales. At the MWE, I was shown a copy of the latest Water Supply Atlas which is a WSDB generated report mapping Uganda's rural water sector. In the districts, I observed and took pictures of water points such as boreholes or piped gravity flow schemes (*See pictures under sub-section 2.4*). Written observations aided theoretical coding. Glaser (1978) describes theoretical coding as an indistinct process which examines interaction of memos and substantive codes; and then moves substantive codes to theoretical codes

Generally, observations allowed me to note situations observed which interviews might not explicitly state such as staff using WSDB, discussions about data validation and observing the MIS-Unit team cordially interact. *Appendix A.7 and A.8* show a copies observation notes which are written similarly like memos.

4.4.2.4 Photographs

The few pictures I took represented another data source. Some of the pictures are depicted in *chapters 2* and *3*. Visual data from pictures are reported to present narratives and context to research (Banks, 2001; Willoughby & Liu, 2018). I took pictures of interview locations, water sources and relevant situations that I felt would give context. I obtained specific images from some participants in Kabarole, Kween and Kapchorwa. In incidences where were participants were present, I sought ethical permission before taking scenic pictures because I did not want to be intrusive. Pictures included in this thesis support my contextual explanations and interpretations of experiences.

Some participants did not allow to me take pictures of them and their offices. They stated that their contact details where sufficient and pictures would be invasive of their privacy. I realised that the prevailing political climate in Uganda is one of the many reasons that made participants wary. Many pictures taken depict the spatial environment of interview locations

and water points. These photos 'paint a picture' of interesting perspectives on the water sector and deterministic WSDB role that this research conveys.

4.4.2.5 WSDB Content

I obtained some data from the WSDB such as maps and data about the status of the water sector. The same maps and content are used to produce WATSUP. The portal WSDB is accessed through: *http://wsdb.mwe.go.ug Figure 2* and sector specific statistical information used in this thesis shown in *Table 1* were acquired from WSDB. Any user can download published information such as district reports and national statistics. WSDB content provided verification and background for the research.

Public access to WSDB is only possible through the internet. With country-wide computing and internet challenges such as low computer literacy, very low internet penetration, technical issues, geographical challenges and telecom network problems in rural areas; overcoming these challenges is strenuous for participants especially in rural districts. I was fortunate to encounter sporadic access which helped me understand some of the challenges. Finally, it has to be noted that non-timely or quarterly data submissions lead to queries about its reliability and integrity.

4.4.2.6 Published Documents

Printed material provided another source of secondary data. Published information existing in annual reports were obtained from MWE, UBOS, NGOs, UWASNET and other forums such as RWSN provided literature that assisted focus and study preparations. Some participants at the MWE provided relevant documents about the water sector.

I reviewed specific information relating to WSDB, water sector performance, trends and existing golden indicators of performance. Information contributed to an analysis of deterministic perspectives about WSDB.

4.5 Grounded Theory as Method

GT being a generalised methodology provided an approach to think, analyse and conceptualise the data collected. My aim was to generate theory through examination of data in a subject area which I felt would have been difficult to analyse with a quantitative approach. Choice of GT is rooted in the fact that recent ICT studies have successfully used it to develop theory (Adolph, 2013; Andrade, 2007; Bailey, 2009; Tossy, 2012). Andrade (2009) and Matavire & Brown (2013) assert that GT is reported to be appropriate when research is exploratory, explanatory, contextual and process oriented in nature.

My readings of these studies provided an understanding of how different studies have adopted or adapted GT methodology to cultivate substantive theory. (Glaser & Strauss, 1967, p. 32) describe substantive theory as a theory that emerges from rigorous analysis of relevant first-hand data to generate original theory; and is "*developed for a substantive, or empirical, area of social inquiry*".

The inductive nature of GT meant that I did not need a specific theoretical framework before conducting this research. GT provides for inductive exploration; which is generating new theory or understandings that require researchers to identify research problems and build theory from data. This is illustrated by researchers adopting GT and its rigorous set of procedures to cultivate theory in scientific research (Andrade, 2007; Tossy, 2012).

A variety of GT approaches have been applied in IS, and there is a big scholarly debate in the research community about which approach is true GT. In this study, I considered all approaches; but chose Glaserian CGT. Andrade (2007) elucidates that CGT differs from other approaches because it suggests selective coding after open coding as a way to focus analysis around one core category. Glaser & Holton (2004) describes selective coding as a process that begins as soon as the core category (core variable) is discovered; and it delineates analysis around the core category which is

ideal for theory. As Glaser (1978, p. 93) explains, "*only variables related to the core are included in the theory*". Open Coding (OC) is the initial line-by-line coding of data to identify substantive codes that conceptualize empirical substance of research area (Holton, 2007). Researchers pursue data, consider strategies, tactics and consequences while focusing analysis around the core category.

Because I was interested in determining perspectives from participants, attractiveness to CGT was because I could produce a generalizable substantive theory. In the end, the theory explains how users perceive WSDB, and gives an understanding of its progressive influence.

4.5.1 Theory Cultivation Using CGTM

CGT method was suitable for theory development; which is the main contribution of this research. With the view that study output is to provide an explanation about WSDB's influence, an important notion was to find a proper methodology to develop contextual theory. I could not find any previous theory explaining WSDB effect on water sector growth. Cho & Lee (2014) asserts that CGT is appropriate when no theory exists or when a specific theory is too abstract to be tested.

In recent years, CGT has been effectively used in IS; and the theory building aspect articulates how to collect data, code, iterate and apply control of the emerging theory from data (Adolph et al., 2012; Rowlands, 2005; Urquhart, 2007). Tossy (2012) adopted CGTM to examine and identify the main concerns of e-learning providers in East Africa; and *Cultivating Recognition* emerged as core variable and the theory. Adolph (2013) adopted CGT to understand how people manage the process of software development; and *Reconciling Perspectives* emerged as core theme and substantive theory processes moderated by social dynamics. Andrade (2007) used CGT with a holistic a multiple case study design to investigate consequences of ICT on social relations of rural communities; and two core themes are used to make theoretical propositions. Due to limited research related to Social Media

Influencers (SMIs) impact on shaping attitudes and perceptions of people about environmental awareness, Okuah et al. (2019) adopt GT to explored literature related to characteristics and techniques used by SMIs that can be used to influence the public on pro-environmental awareness and behaviour. This novel approach of adopting GT was very exciting, enlightening and augments GT adoption in understanding ICT influences. Additional studies from Bailey (2009); Fraser-arnott (2016); Piko (2014) were of great reading significance to me.

Readings of these CGT studies provided an understanding of how CGTM in different studies had been adopted or adapted to develop a core category (variable) and substantive theory. The core category best explained the research problem and addresses views of participants; while the substantive theory emerging from rigorous analysis of data generated for a specific empirical area of social inquiry (Glaser & Strauss, 1967, p. 32).

The studies showed and gave me an understanding of how different studies had adopted or undertaken CGT use; and imparted valuable knowledge about CGT in IS research. This being my first in-depth CGT study, the readings were a great source of knowledge which I could use to query how I would approach my research. Indeed, some of studies differed in their methodological application of CGT and presentation of results.

Despite my conceptual knowledge understandings about CGT principles from aforementioned studies, I found the method and its processes tiresome, tasking and complex because developing theory required creativity and theoretical sensitivity. Theory development is not a straightforward process despite the well-defined methodological steps laid out. My analytical processes progressed in rugged manner with plenty of up and down frustrations. Nevertheless, using CGTM was an enlightening experience.

In the end, I strove to attain Walsham (1995a) four theoretical generalisations for interpretive case studies which are: concept development, generating theory, drawing implications and contributing rich insights. I adopt and relate the generalisations, and I would like to categorically state

that I achieved the four generalisations because this research has transferable interpretations onto comparable research settings.

4.5.2 Process of Theory Building

For this study's theoretical contribution, I cite Glaser (1992, p. 87) assertion below to summarise rationale for selecting CGT.

> "*In grounded theory the analyst humbly allows the data to control him as much as humanly possible, by writing a theory for only what emerges through his skilled induction. The integration of his substantive theory as it emerges through coding and sorting is his verification that the hypotheses and concepts fit and work and are relevant enough to suggest. They are not proven; they are theory*"

In addition, Glaser (1992) asserts that CGT does not explicitly require researchers to state their philosophical position during study inception. However, from a graduate students point of view, we are required to explicitly state our positions before conducting ethically essential research.

My interpretivist stance entails data interpretation, hence integrating human relevance to the research. And with the view that the study output is to provide a theoretical explanation based on qualitative data, CGT was suitable. CGT's data gathering and analysis processes provided a means for generating new perspectives and concepts relevant to participants. Glaser & Holton (2004) proclaim that researchers execute an intensive open-ended process initiated by collecting data about a phenomena of interest, and then simultaneously analysing data by coding, memos, and comparing with new data to find core category. The cycle continues until saturation; which is when new data does not add anything new to existing categories.

The core category best explains the research problem and addresses views of participants; while the theory emerges from core category (Holton, 2007). Categories are abridged theoretical explanations of participants concerns (Grounded Theory Institute, 2016). Theory developed is then compared to

existing theories in literature, and this is done late to avoid forcing pre-conceived notions onto new theory being developed (Glaser, 1998).

Having clarified my CGT approach, the next sections explain techniques followed.

4.6 CGT Analysis Techniques

CGT provides for specific stages through which a researcher must follow, although one can change the procedural order depending on the data collection stage and what data is emerging. My objective was to follow a coding procedure that produces theoretical generalisations using core concepts obtained from participant views on study focus and context.

Analysis processes described in the next subsections illuminate my discovery journey, and explain methodological principles followed. Flexibility of CGT processes and sequences allow for disclosure of study investigation.

4.6.1 Coding Process

Coding is the foundation of CGT and facilitates emergence of concepts and categories (Chametzky, 2016; Holton, 2007). The purpose of coding is to sensitise researchers to processes and patterns that emerge or are revealed during later stages of generating substantive or theoretical categories (Glaser, 2002; Urquhart, 2007). According to Glaser & Holton (2004, p. 13), coding provides "*a condensed, abstract view with the scope of the data that includes otherwise seemingly disparate phenomena*". Coding aids to fracture data and then group it into conceptual categories that become theory. GT acquiesces that coding is an essential stage, as succinctly stated:

> "*the excellence of the research rests in large part on the excellence of the coding*" Strauss (1987, p. 27)

According to Holton (2008), coding gets analysis off the empirical level by fracturing data, and then conceptually groups data into codes which later become theory that explain what is happening in the data. Codes give a

condensed abstract view of data. Dey (1999) affirms that coding creates and assigns categories from data, and explores links among categories, then concludes by focusing on a core integrating variable.

I cite Böhm (2004, p. 271) statement below to describe my understanding of coding.

> "*In coding researchers use their background knowledge about the context of the textual passage being investigated and, in general terms, their knowledge about the area of investigation. The result of the work is an interpretative text which adheres to analytical thinking about the phenomenon*"

According to Montgomery & Bailey (2007), GT has three levels of coding: (1) first-level coding, which involves use of participants' words resulting from line-by-line analysis; (2) second-level coding, which involves categorizing first-level codes; and (3) third-level coding, which involves selection of theoretical labels to represent links between categories. Articles by Chametzky (2016); Glaser & Holton (2004); Holton (2007); Montgomery & Bailey (2007) were very enlightening. Three coding phases followed were Open coding, Selective Coding and Theoretical coding. Constant comparison allowed developed codes to be collapsed to categories.

During coding, I assigned codes to interview statements to understand meanings. I went from specific codes with descriptive interpretations, to generalised codes categorising or combining data into deeper theoretical underpinnings. My coding process was dynamic, and not fixed. I could change, move, remove or transfer codes in order to unearth or refine. *Figure 23* below presents the inductive coding phases.

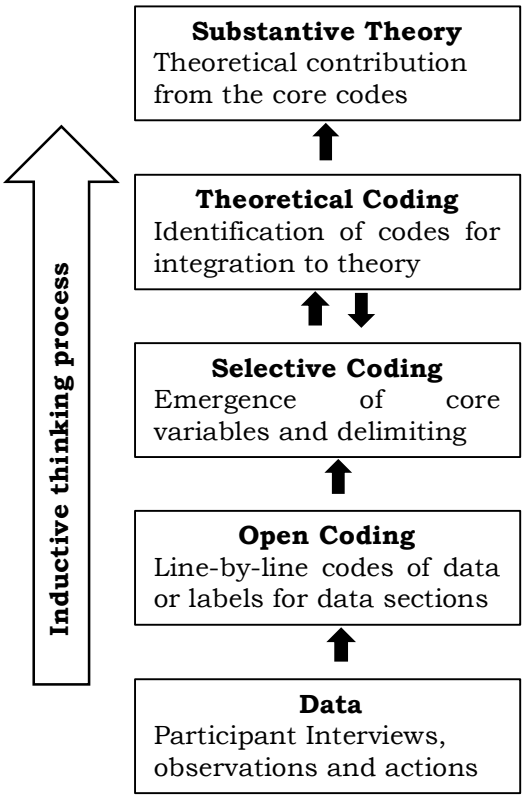


Figure 23: My coding process adapted from Holton (2007)

During coding, I wrote memos and notes because they are core to generating theory. Memos cultivate theoretical concepts during coding, and they record thoughts, analyses of codes, emerging concepts and build theoretical ideas around codes (Adolph et al., 2012; Dey, 1999). Memos and notes helped gather my thoughts to make better data understanding, and I typed into the computer those that I had manually written.

My coding process was done using Microsoft Word and Nvivo software. Nvivo helped link codes and categories generated from interviews. I was fortunate that both software have a commercial licence that is freely supported for students by the University. Although both software were helpful, I would like to categorically state that I did data interpretations and analysis using my cognisance mind. Software were mostly helpful as data stores and for providing visualised interconnections between codes and summaries. Although I was comfortable coding on paper, storing and relating the codes made me appreciate significance of using the software.

4.6.1.1 Open Coding

Known as substantive coding, Open Coding (OC) is line-by-line coding of the data to identify substantive codes emerging (Holton, 2007). Both Glasarian and Straussian approaches begin with OC as the initial coding process, although Charmaz (2006) defines the start of coding as Initial coding. I found initial coding to be abstractly similar in all GT approaches. Strauss (1987, p. 29) states that OC leads researchers to "*fracture, break the data apart analytically, and leads directly to excitement and the inevitable payoff of grounded conceptualization*".

During OC, codes are generated from data by asking generative questions; and the data concepts become building blocks for theory. Codes are often labelled with verbs ending with "*ing*" (Glaser, 2002; Holton, 2007). Chametzky (2016) describes the codes as "*gerunds*"; which are verbs that end with *–ing* to indicate the operative or active nature of the verb or processes coded. *Gerunding* sensitises researchers to patterns that might be revealed in subsequent stages; and assists in describing data segments so that researchers capture "the data in a mature way" (Glaser, 1978, p. 61).

Researchers constantly reflect on the data and concepts or categories generated; and because researchers code everything, Glaser (1978, p. 57) explains OC process as when researchers reflect upon generative questions such as: "*What is this data a study off*?"; "*What is actually happening in the data*?"; *What is the main concern of the participants*?; *What is the data about*?; *What are my looking for in this data or study*?; "*What category or property of a category does this incident indicate*?"; *What concept does this specific transcript indicate*?; and, *Under what category can I group these concepts*?. According to Chametzky (2016), researchers will potentially misinterpret the data if they do not ask themselves these questions.

The questions allowed me to be constantly aware of study subject, and to generate and integrate related codes to discover the core category. My approach to OC was to read transcripts line-by-line or word-by-word as

recommended by Glaser (1992, 1998). I wanted to understand context and meaning of participant statements; which allowed me to generate codes after reading interview transcripts. The criteria involved producing codes after getting the complete notion of transcript; and codes yielded preliminary concepts. Not all statements or lines would yield a code, but sometimes a word alone was enough for a new code. I meticulously scrutinised every line for incidents that would yield codes. I repeatedly read transcripts line-by-line, frequently listened to recordings, concurrently reviewed notes and wrote memos to identify implicit or explicit intimations. I have to admit that my understanding of OC seemed simple. However, it was challenging, demanding and tedious because it required an extensive amount of time. *Table 11* is a sample interview transcript that underwent OC. This single paragraph alone produced several codes.

Interview Transcript	**Initial Sentence Summary**	**Open Codes**	**Conceptual Categories**
"We want to have some level of control. But they are able to see what we have entered on their behalf and they are able to tell that I think this is not proper and this is not as reported in the system or we gave you data and you have not updated because even that they are able to see. We submitted data but you guys have not updated in the system and then we tell them that we have a backlog, we are trying to you know update and ensure that whichever data come in first is what is entered then when we get to yours then we will be able to enter it at all. But we have full time data entrants, there are rare cases when their data takes long. Actually, the biggest problem we have is some of them submit late"	- MIS controlling entry of information to WSDB - Viewing of district information done by DWO - DWO can query missing and un-updated data - Experiencing backlogs by data entry staff which often affects data timeliness - Late submitting of data leads to longer inputs to the system - Reflecting on problems and solutions	- Controlling Processes - Viewing - Querying - Delaying - Updating - Submitting - Inputting - Reflecting - Backlogging - Non-real-timing - Delaying - Experiencing	- Controlling Processes - Validating and Verifying - Reconciling Data - Reflecting Delays

(Site 1, November 2016)			

Table 11: Sample of my coding process

Over 322 codes were initially generated from OC between December 2015 and January 2017. Generating codes felt overwhelming because of the numerous number produced. It is not unusual to generate several codes in CGT, and several of these initial codes tend to be expressive and repetitive. As my aptitude enhanced, the codes reduced significantly to a list of 56 open codes. The codes were further collapsed into primary and secondary sub-core categories. CGT endorsement of openness to what might emerge during coding allowed illumination of relevant concepts to construct theory.

I analysed interview transcripts on a case by case basis. Initial interviews where challenging because I would transcribe each interview, make a written summary about the interview and then code. OC was hectic because I was still learning coding nuances. Sometimes, it took weeks to appropriately code one transcript due to the iterative nature of coding. I would work several hours a day coding, thinking and making repeated reading cycles of transcripts. I was not very prepared for the time consuming effort of CGT approach to data analysis and theory generation despite reading several articles. Creswell (2012, 9. 49) assertion that qualitative researchers must be prepared to "*engage in the complex, time-consuming process of data analysis through the ambitious task of sorting through large amounts of data and reducing them to a few themes or categories*"; succinctly spoke volumes about my experience.

In addition, I applied the concept of constant comparison using CGT concept-indicator model. Holton (2007, p. 272) explains it as raising the "*conceptual level early on in the analysis process through the constant comparison of conceptual indicators in the data under study*". Constantly relating several generated codes and categories relieved me from getting lost due to their massive number. Constant comparison reduced code numbers

because I would revisit data, and then integrate or relate categories before they "*earn their way into theory*" as stated by Glaser & Holton (2004, p. 16).

The core category manifested from processes such as constant comparison, and its major functions were to explain and integrate theory, after becoming the focus for further selective data collection and coding processes (Glaser, 1998; Holton, 2007).

OC guided development of initial codes, concepts and scheduling of additional interviews. Although it was very exciting to generate codes, it was equally challenging to integrate them into a core category that best explains data variation. Many initial categories developed during OC were integrated or simply discarded during emergence of the core category.

During coding, I did my best to avoid preconceptions from my experiences in ICT4D and literature about the water sector. I acknowledge that I might not have been able to completely set aside my presumptive world views.

4.6.1.2 Selective Coding

Selective coding (SC) begins as soon as the core category is discovered. SC is a higher level of abstraction where coding is delimited to only variables that relate to the core variable to produce a parsimonious theory. The core category becomes focus for selective data collection and coding to explain participants main concern (Glaser & Holton, 2004; Holton, 2007). Glaser (1992, p. 75) emboldens discovery of core category from a catalogue of categories that '*accounts for most of the variation*' in data, because it is centrally relevant to theory contribution. This involves comparing, excluding, integrating, re-categorisation and elimination of other categories.

Glaserian and Straussian approaches agree that consequent to OC, any researcher delineates the next focus for data collection and analysis phases around core category. Strauss (1987) describes this phase as Axial Coding. I subscribe to CGT approach of SC. Glaser & Holton (2004) states that during SC, the core category delimits analysis on main participant concerns, and

there is no GT without core category. Coded data is integrated around core category which represents conceptual elements of theory. As Glaser (1978, p. 93) explains, "*only variables related to the core are included in the theory*".

After core category manifestation, SC allowed me to make comparisons, cultivate theoretical ideas and look for fresh tinges to improve categories. During comparisons, I followed Holton (2008, p. 83) assertion that the core category is central to "*relating to as many other categories and their properties as possible*", "*reoccurs frequently in the data*" and is "*increasingly related to other variables*". I considered the core category as a uniting concept that best explains data perspectives, and encompasses all related concepts.

I persistently applied constant comparison to emerging codes and categories by iteratively comparing them while looking for matches and disparities. I compared new codes and categories from the latest interview with those existing. These undertakings aided theoretical sampling and ensuing data collection or analysis processes. I was riveted by Holton (2007, p. 19) quotation below of SC activities which was similarly experiential to me.

> "*By focusing on the core and other related categories, subsequent data collection can go very quickly; merely minutes, with a few field notes to be captured and analysed. In this way, the researcher can saturate the selected categories that form the basis of the emerging theory without collecting a lot of additional material that has no relevance to the developing grounded theory. This selective data collection and analysis continues until the researcher has sufficiently elaborated and integrated the core variable, its properties, and its theoretical connections to other relevant categories*"

The description relates to my experiences because I saturated after conducting few more interviews. In addition, I listed my categories to properly envision those that could relate to the core category by indicating categories next to each interview transcript. I would then relate the categories through an indexing process that allowed me to view codes in a tree-branch or pyramid format. This approach was vigorous in picturing the entire coding and categorising process in a sort of vantage viewpoint.

I performed SC to examine which categories revolve around the contending core category. The pyramid view allowed me to visualise all categories, and to consider that which accounts for the best description. Nonetheless, there were many false starts during SC. False starts were due to consideration of other conceptual categories other than the final core category.

As I constructed the pyramid, I classified categories from initial concepts to primary and secondary sub-core categories cultivating core category. *Figures 29* and *30* present the categories. Secondary sub-core categories like *Policying Assessments*, *Prospective Positioning*, *Reconciling Undertakings*, *Decisioning* and *Balancing Partnerships* were considered but could not provide a proper explanation of all perceptions. Similarly, primary sub-core categories *Validating Developments, Sanguine Orientating* and *Negotiating Compromises* did not explain most of the perspectives. They lacked what CGT describes as parsimony and adequate conceptualisation for the data; and I felt the resultant theory would not be precise.

From the reasoning above, and after considering all categories, the concept '*Optimizing*' emerged as a candidate core category. I posited *Optimizing* as a process that best explains the data and perspectives about WSDB influence. I spent a substantial amount of time developing and examining *Optimizing* to ensure that it explains the data, and would satisfy parsimony criteria or lead to a parsimonious model. Rationale for adopting *Optimizing* as a core category is based on generative questions: "*What is happening in the data*?" and "*What is the main perspective from participants*?" *Optimizing* accounted for "*most of the variation*" in the data as stated by Glaser (1978, p. 94).

In the end, I conceptualised *Optimizing Perspectives* as a core category accounting for the most data variation about WSDB. *Optimizing Perspectives* was apt to what I was determining, and I swiftly reconciled the theory around it. *Optimizing Perspectives* formed the main conceptual elements of a theory. I was able to substantiate Glaser (1992) claim that the theory conceptualised will integrate, and one does not need to force pre-conceived notions on it.

4.6.1.3 Theoretical Coding

During theoretical coding (TC), researchers maintain conceptual levels by scripting concepts and their interrelations, thus giving integrative scope and emic perspectives. TC conceptualises how substantive codes may relate to each other as assumptions to be integrated into the theory (Glaser & Holton, 2004; Holton, 2008). Glaser (1978) explains that what starts as substantive code can manifest as theoretical code; and moving substantive codes to theoretical codes is an obscure process which entails examining interaction of memos and substantive codes.

Constant comparison helps generate substantive codes, that later synthesize into theoretical codes. Glaser (1978, p. 71) states that one "*should simply constantly code and analyse the categories and properties with theoretical codes which will emerge and generate their complex theory of a complex world! And in turn they will produce simple or complex explanations along the way of the processing of the concerns of a substantive area*".

Glaser (1978, p. 74) suggests "Six C's" that are "*bread and butter*" to keep in mind while doing TC. The Six C's are Causes, Contexts, Contingencies, Consequences, Covariances, and Conditions. Because OC and SC lead to generating core conceptual categories and emergent theory, researchers should swathe emerging theory over theoretical codes basing on the Six C's.

At this point, I was engaging with my intuitive intellect to find core category. TC helped shift focus by explaining the relationship between codes and emergent theory. I moved from low level contexts that describe study focus to higher level conceptual abstracts for theorisation. Emergent high level concepts allowed me to reflect on the study, and explain research findings.

I related conceptualised categories to the Six C's to find core category. I enfolded the primary sub-core categories *Prospective Positioning*, *Validating Developments, Sanguine Orientating* and *Negotiating Compromises* to the Six C's; but they did not relate very well with some (e.g. Consequences, Covariances, Contingencies and Conditions). Enfolding the categories over

the Six C's resulted in a deficient theory that only explained WSDB influence on '*information access and submission process*', '*service delivery*' and '*making decisions*'. It did not relate well to innate perspectives of how participants view the WSDB, how individual capabilities were obtained from WSDB use and how sector performance or growth is be related to WSDB. According to Glaser (1978), these categories lacked parsimony because they cannot entirely explain what is going on and are not significant enough. These sub-core categories were singular aspects explaining WSDB influence. I needed a core category that would explain a much larger aspect; which is to explain the data, and was parsimonious enough to constitute all "*conceptual elements of a theory*". *Optimizing Perspectives* emerged as that core category. See *Figures 29* or *30*.

I was able to relate *Optimizing Perspectives* to the Basic Social Process (BSP) which Glaser (1978) contends as one type of theoretical code that may be applied towards generating theory. *Optimizing Perspectives* gave an intrinsic explanatory perception of WSDB influence and innate perspectives of how participants view the WSDB. *Appendices A.7 - A.8* illustrate abstract notes, diagrams and procedures for *Optimizing Perspectives* emergence.

4.6.2 Theoretical Memos

Glaser (1978, p. 180) describes theoretical memos (TM) as records documenting researchers developing ideas and thought nuances about codes and their interconnections. They are an "*ideational and conceptual production that come to mind during coding, collection, analysing, and theoretically sampling*". Montgomery & Bailey (2007) contend that memos state a researchers ideas rather than descriptions of social contexts, and the final theory proposed is typically an integration of several TM. TM are classified as field notes, and are typically written by researchers because they are considered key documents for ideation, and transform field descriptions and codes into theoretical accounts.

Researchers write memos to record thoughts and analytical ideas to support emerging concepts and their correlations (Adolph et al., 2012). New insights are recorded as memos during data collection, analysis, interpretation and iterative process of constant comparisons (Chametzky, 2016).

I assent Glaser (1978, p. 83) claim that emphasises the importance of TM.

> "*Writing of theoretical memos is the core stage in the process of generating grounded theory. If the researcher skips this stage by going directly to sorting or writing up, after coding, she is not doing grounded theory*".

To reiterate their significance, Glaser (1978) contends that research that does not make use of memos fails to substantially reveal the main perspectives or concerns of those being researched. TM focus on ideas that by fit, relevance and workability find their way into emerging theoretical explanation.

I wrote notes or memos that comprised of date, time, and location of my interview; summary of interview; observations and coded concepts. I wrote notes on notebooks, and I realised that most thoughtful ideas did not emerge immediately, but often after several thought processes and several days. Notebooks were often besides me to reflect and guide analysis. I termed some notes or memos *exciting thought*, which is what I felt about a specific analysis. These ideas and categorisations would then constantly be compared to others as a way of integrating and building the theory.

4.6.3 Theoretical Sensitivity

Strauss, 1987 (p. 21) simply describes Theoretical Sensitivity (TS) as "*thinking about data in theoretical terms*". Glaser (1978); Holton (2007) assert that TS entails researchers generating concepts from data and relating concepts according to models of theory. TS reflects "*on the attribute of having insight, the ability to give meaning to data, the capacity to understand, and capability to separate the pertinent from that which isn't*", and "allows one to develop a theory that is grounded" (Strauss & Corbin, 1990, p. 42).

Glaser (1978) contends that it is crucial to acquire TS prior to commencing research. Glaser & Holton (2004) reiterate that the first step to gaining TS is to enter the research settings with few predetermined ideas as possible to allow concerns and their delimitation to be discovered. Generating concepts and linking them to theory development is core to TS. Holton (2007) states that TS obliges researchers to have analytic temperament and competence. Temperament demands maintenance of analytical distance, openness, tolerating confusion and regressions; while analytical competence entails developing theoretical insights and abstract concepts from data.

Equipped with TS awareness, I collected data with knowledge that I had to be open minded, and not prejudice participants. I agreed with Strauss & Corbin (1990, p. 41) assertion that "*one can come to the research situation with varying degrees of sensitivity depending upon previous reading and experience with or relevant to an area*". Knowledge of CGT, and experiences of Ugandan history, society, culture, interview locales and IS understanding supported me to be theoretically sensitive.

4.6.4 Theoretical Sampling

Glaser (1978, p. 36) describes Theoretical Sampling (TSP) as occurring when the researcher '*collects, codes, and analyses data and decides what data to collect next and where to find them, in order to develop theory as it emerges*'. TSP is best used when the goal is to develop theory following emerging research concepts. Glaser (1998) recommendation not to record some initial interviews was based on TSP. Significance of TSP is in establishing rapport between researcher and participants, and allows for multiple encounters because researchers may not get required data from a single interview encounter (Glaser, 1978; Tossy, 2012). All TSP encounters with participants are be documented using memos.

Critics of TSP point to the fact that little guidance is available on how to implement the sampling process (Butler et al., 2018; Draucker et al., 2007). I adopted an approach similar to that used by Butler et al. (2018); Draucker

et al. (2007); Tossy (2012) which appropriately relates to CGT. Using purposive sampling, I interviewed some participants at least twice to gain more perspectives. *Figure 24* presents the sampling process.

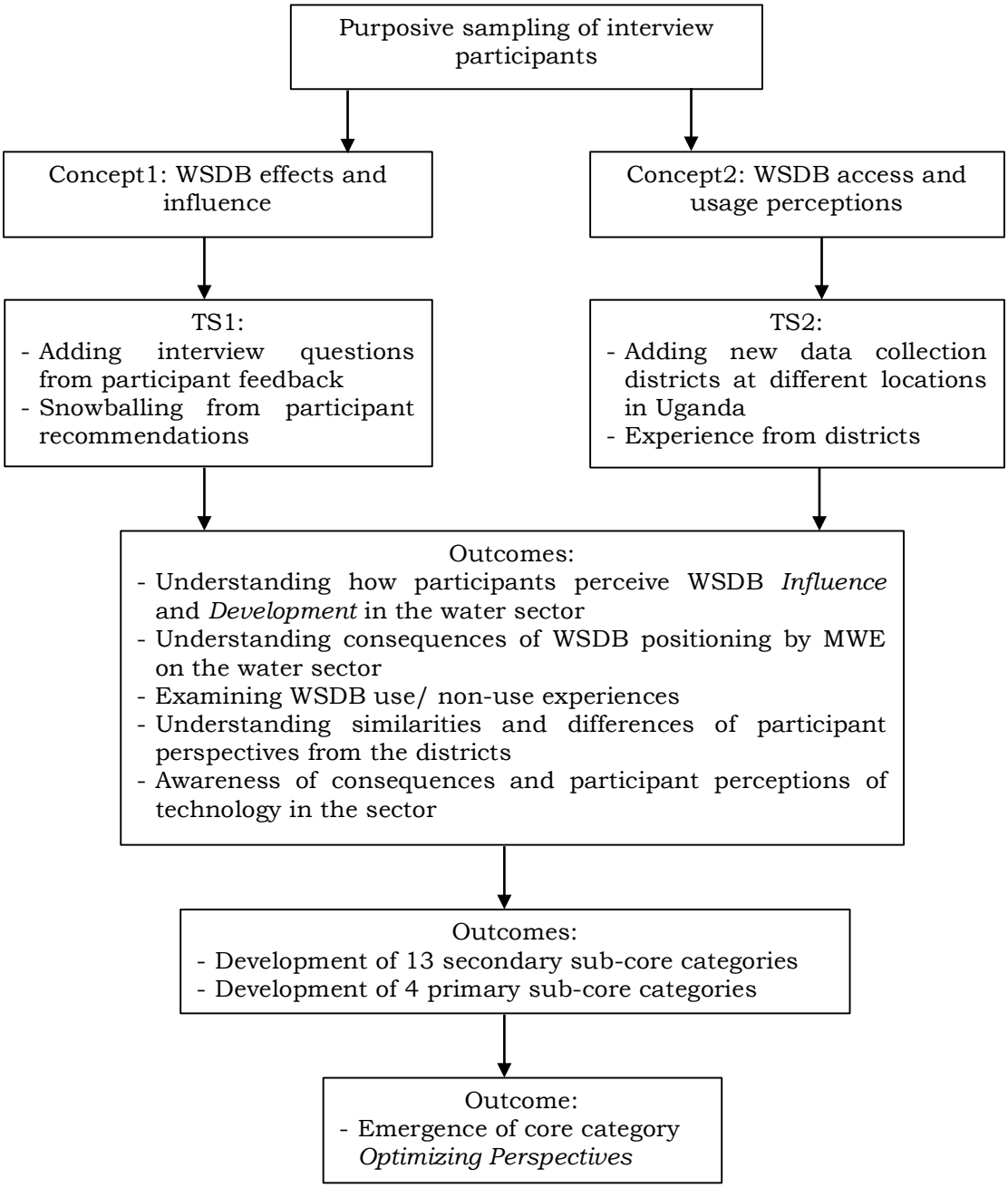


Figure 24: Adapted Theoretical sampling process

4.6.5 Constant Comparison Approach

GT is based on a concept-indicator model of Constant Comparison (CC) for incidents and indicators (Glaser, 1978; Holton, 2007). CC contrasts all the

data as theoretical codes emerge, and occurs throughout coding and categorisation during theory development. CC allows analysts to understand their data to give an authentic explanation of participant perspectives and concerns (Glaser, 1992). Strauss (1987, p. 25) denotes that CC "*sharpens and clarifies the concept to achieve the best fit to the data*"; leading to more properties of the category being "*generated until the codes are verified and saturated yielding nothing much new*", and then allows concepts to earn their "*way into the theory by systematic generation from data*". Glaser (2002) argues that CC is an iterative process cultivating the core category.

I followed CC when generating new codes, and relating old concepts. This often required me to go back to the data when looking for related concepts. Lessons learned from initial coding and analysis processes helped in proceeding interviews. CC led me to review and re-evaluate transcripts to ensure that codes were accurately captured and compared or related.

I manually conducted CC because software was not rational. It was sequential to constantly compare codes and categories. For instance, the theoretical code *Validating Developments* was connected to properties like *Reflecting Decisions*, *Focusing on Goals*, *Recognising Policy Impacts* and *Validating and Verifying Submissions*. *Infrastructuring* was linked to codes such as *Designing and Evaluating Modules*, *Administering WSDB operations*, *Conjoining Efforts*, *Reconciling Undertakings*, *Coordinating Stakeholders*, *Promoting Data Sharing* and *Centralising Interactions*. *Sanguine Orientating* was connected to *Administering WSDB operations*, *Designing and Evaluating Modules*, *Collaborating on Sector Goals* and *Validating and Verifying Submissions*, *Expressing Dissatisfaction* and *Mediating Interactions*. These codes were constantly compared to find similarities and differences. All categories and their properties generated during analysis underwent CC.

4.6.6 Sorting

Once theoretical saturation has been accomplished, analysts sort and integrate all memos related to core category, other categories and individual

properties (Glaser & Holton, 2004). Sorting is an iterative process that occurs in later states but is significant in ensuring that theoretical codes are included in theory generation (Glaser, 1978). Sorting puts fractured data back together, and generates emergent theoretical outline or conceptual framework for enunciating theory formulation (Holton, 2007). I assent to Glaser (1998, p. 187) description that:

> "*Sorting is the last stage of the grounded theory process that challenges the researcher's creativity. In fact it is the epitome of the theory generation process. Writing is merely a write up of the sorting piles. Sorting a rich volume of memos into an integrated theory is the culmination of months of conceptual buildup*"

I sorted memos, codes and categories. Sorting ensured that the core category was fully saturated. Glaser (1998) claims that if sorting is omitted, then theory generated will be less linear and less integrated. The theory generated without sorting lacks integrated connections with categories.

Sorting and re-sorting was challenging, and it required reasoning and consolidating codes and categories to make meaningful ideas with a clear rationale. In the end, writing this thesis certainly became my final sorting process that led to a consolidation of all write ups, memos, codes and categories. Sorting enabled me to grasp the creative process and was significant towards cultivating *Optimizing Perspectives* which is the main theoretical contribution for this research.

4.6.7 Core Category Emergence

As explained in sub-section *4.6.1*, coding is a continuous process that is coupled with CGT techniques that systematically lead to a high level of data conception, core category emergence and theoretical integration (Glaser & Holton, 2004; Glaser, 2002). Holton (2007, p. 18) describes the core category as "*any kind of theoretical code: a process, a typology, a continuum, a range, dimensions, conditions, consequences and so forth*", who's main "*function is to integrate the theory and render it dense and saturated*". In appearing to

explain perceptions or how the main concern is resolved, the core category becomes focus for further selective data collection and coding efforts.

Holton (2007) explains that the core category begins to emerge as a researcher codes; and processes like selective coding begin when the core category is identified. The core category accounts for most of the variation in data. It is suffice to say that researchers wishing to undertake CGT must incorporate emergence of core category as an indisputable requirement.

Only categories associated with the core are included in the theory. Researchers must demonstrate how raw data was coded up to the point where the core category emerged; and any reader of the research should understand how the core category emerged (Glaser, 1992; Holton, 2008).

Discovery of core category, sub-core categories and attaining theoretical saturation allowed me to focus on theorisation using the core category. Theoretical saturation implied that no new interesting data was being found. The core category *Optimizing Perspectives* emerged as a key consequence from participant perspectives and explanatory aspects of WSDB significance towards the water sector.

4.6.8 Theoretical Saturation

As challenging as CGTM is, conducting interviews and doing initial line-by-line coding is straightforward. However, the challenge is to know when to stop coding and categorising. This stage is referred to as Theoretical Saturation (TSR). Glaser (1978, p. 53) explains TSR as occurring when "*no new properties emerge and the same properties continually emerge*". Saturation is achieved when a researcher gathers data, and exhaustively generates new categories until no new aspects can be incorporated into the theory, or no new additional data is relevant (Böhm, 2004; Holton, 2007).

Ascertaining when TSR has been attained is a common challenge; and inability to correctly identify saturation is a drawback that can lead to early termination of data collection (Glaser, 1998; Suddaby, 2006). It is important

to identify and delimit categories to focus further data collection on a core category that will lead to TSR. Analysts who achieve TSR, and discover core category proceed to review, sort, write and integrate related categories; and then examine theory from a high level (Glaser & Holton, 2004).

To know when saturating had been attained, all CGT techniques such as coding, memo writing and constant comparison were supportive. Although Glaser (1978, p. 53) asserts that "*same properties continually emerge*" for all data, I affirm to achieving TSR. The core category *Optimizing Perspectives* succeeded in explaining participant perspectives and epitomises underlying meanings determined from data. It answered research questions and reflected upon the study's significance and limitations.

4.7 Theoretical Contribution

The final contribution of any CGT study is a theory grounded in data Glaser (1978); and "*accounts for behaviour in any substantive area*" (Lowe, 1996, p. 1). Theories produced can be described as either substantive or formal. Glaser & Strauss (1967) distinguish '*Substantive Theory*' from '*Formal Theory*' by relating substantive theory to empirical research while formal theory is related to theoretical or conceptual studies.

Substantive theory emerges from a rigorous analysis of relevant first-hand data to generate original theory. In addition, substantive theories are "*developed for a substantive, or empirical, area of social inquiry*" Glaser & Strauss (1967, p. 32); and emerge from examining similarities or differences between categories, subcategories and related properties (Gasson, 2004).

Glaser & Strauss (1967, p. 32) define formal theories as those "*developed for a formal, or conceptual, area of sociological inquiry*". Formal theories can be developed from data although it is essential to first develop substantive theory. Formal theories emerge over time because they are derived from conceptual abstractions of substantive theories across several studies. Gasson (2004) states that formal theories emerge from extensive data analysis instances that describe multiple situations; and a single study is

not expected to generate formal theory although the ultimate end of GT is to generate formal theory because they maybe generalisable at abstract level.

In cultivating the substantive theory '*Optimizing Perspectives*', I heeded to Glaser (1978) caution of delimiting substantive theories within an area of human concern or scope. I did not focus this research on developing formal theory which covers several situations or substantive areas. *Optimizing Perspectives* is a result of adhering to techniques annotated in CGT; and it is a substantive theory that is grounded in data about participant perspectives regarding WSDB influence on development in Uganda's water sector.

4.8 Validating the Theory

While using CGT, I reflected upon primary features that allow for credibility, validity and verifiability of theory contribution. Elliott & Lazenbatt (2005. p. 51) state that there seems to be international or nationally accepted definition of best GT research practice. However, quality of GT research is evaluated by rigor and fundamental techniques followed. Processes such as constant comparison and theoretical sampling "*provide an integrated research approach to data collection, analysis and checking the quality of research findings*".

Particulars critical for validating the quality of my research and theory included: firstly, philosophical assumptions; that is keeping in mind my ontological, epistemological, and interpretive postulation. Secondly, going through coding phases to determine the core category, and then delineating the study to it. Thirdly, continually incorporating constant comparison for new data against previously coded data. Fourthly, memo writing and sorting which integrates data to the core category and leads to theory formulation.

In addition, it was important that I address issues related to assessing validity, quality, verifiability, limitations and credibility of CGT research. I adapted two validation criteria, which are meaningful for interpretive studies that allow manifestation and determining theory. First, I followed the four criteria, adopted by Elliott & Lazenbatt (2005, p. 49) to assess quality with

qualitative interpretive approaches. Subsection *3.8.2* explains the criteria which are *Fit*, *Workability*, *Relevance* and *Modifiability*. See *Table 12*.

Qualitative Criteria	**Universal Criteria**	**Grounded theory criteria**	**Strauss & Corbin's grounded theory criteria**
- Credibility - Transferability - Dependability - Confirmability	- Validity - Relevance	- Fit - Work - Relevance - Modifiability	- Research Process - Empirical grounding of findings

Table 12: Elliott & Lazenbatt (2005) criteria for assessing GT research quality

Secondly, Gasson (2004, p. 90) presents rigorous principles for using qualitative and interpretive techniques to generate and validate theory. See *Table 13*.

No	**Interpretive Perspective**	**Research Concern**	**Description**
1	**Confirmability**	Represent findings to situation under research	Researchers should be wary about their implicit influence, bias and prejudices. Conclusion must be based on subjects and theory generated has to be consistent with the data
2	**Dependability/ Auditability**	Findings are clear and procedures are repeatable	Authentic findings are consistent and proper techniques have been followed. Define and record procedures used to collect, analyse, interpret and ensure understanding of the data
3	**Internal Consistency**	Ensuring rigor in the research process	Credibility of findings is consistent with research context, rigorous process followed, study participants and theory whose perspective the data reflects
4	**Transferability**	Generalisability of theory proposed	State extent to which research claims can be generalised to similar or dissimilar contexts. This is useful for deriving ways in which the theory can be extended to contextual factors

Table 13: Criteria adapted from Gasson (2004) for assessing theory validity

Although there are other quality features, the paragraphs above describe qualities that were significant for this research. The discreet CGT techniques discussed in previous subsections were important for generating and validating the theoretical contribution. Credibility of theory is established from appropriately defining CGT methods, engaging with participants doing interviews and transcripts, triangulation of data from multiple sources, deriving meanings or interpretation of results, conceptualisation and categorisation and finally the substantial description of entire process leading to theory building. My theory *Optimizing Perspectives* is a result of processes that explain participant perspectives about WSDB influence.

4.9 Addressing Credibility Concerns

Glaser & Strauss (1967, p. 224-225) stress that incessant intermeshing of data collection and analysis has an effect on how the research ends; and the emerged theory is equivalent to what the researcher knows systematically about their data. Additionally, the researcher's own conviction about the core category and theory is hard to argue against because theoretical analysis develops from a researchers own analysis processes, observations, experiences and perceptions. Researchers will always have confidence in the credibility of their theory and conceptual analysis as long as the GT research process was fundamentally sound.

However, credibility and trustworthiness is always an issue. Credibility questions can still be asked about a specific GT study; including how theoretical analysis evolved. Questions like: *Why the researcher trusts what he knows*?, *How the research was undertaken*?, and *Did the researcher correctly understand and interpret meanings of the participants*? are some questions that can impact credibility. Glaser & Strauss (1967, p. 225) denote that GT researchers:

> "*readily agree that their own theoretical formulations represent credible interpretations of their data, which could, however, be interpreted differently by others*".

According to Glaser (1998), researchers' self-assurance in credibility of their CGT work is based on confidence in the rigorous structured processes undertaken, coding processes, theoretical analysis and proposition of an integrated substantive theory that is grounded in data. Thus, researchers should have confidence in conveying credibility of their work by giving plausible explanations and presentation of theory *developed through analysis of qualitative data* to satisfy readers.

I employed specific practices to demonstrate transparency and auditability of the research. See *Table 14*.

No	Approach	Approach Description
1	CGTM Fundamentals	I was cognizant of practices; starting with data collection, coding, determining categories and core category, more interviews, memo or notes, constant comparison and sorting, until theory is generated
2	Work Narratives	I maintained research activity logs about interview participants, notes, time, location, summary briefs, analysis write-ups, observations and photographs
3	Interview logs	I created a word document showing all interview transcripts and hierarchical structure of the coding and categorising process
4	Participant Validation	I emailed participants who requested transcribed of interview logs to get feedback about their the transcript and my analysis of it
5	Referencing Data	During analysis, I cited interview transcripts to state concepts or Categories and how they were generated or interpreted.
6	Triangulation	I collected data using multiple sources (especially interviews) which allowed some validation

Table 14: Approaches to manage study transparency

Because this study is qualitative and interpretive, credibility cannot be enumerated. Nonetheless, I adapted CGT practices and made findings (interviews, codes, memos, notes etc.) available to allow for repeatability. *Tables 12* and *13* present distinct practices that support credibility and validate findings.

Risks such as researcher bias can have an effect on research credibility, but being cognizant of this fact made me not to state my views to participants; especially preconceptions about consequences of ICT deployments in SSA. Additionally, bi-weekly discussions held under iCOMMS's research team meetings allowed me to reflect on how I could interpret or analyse data without influencing it with my views.

Finally, Glaser (1978) asserts that trustworthiness or credibility of a CGT study and emerged theory can be obtained by testing, applying or adjusting it to situations with sufficient exactitudes to guide thinking and understanding. Future studies can comparatively test and apply *Optimizing Perspectives* in related or non-related substantive areas.

4.10 Validating Engagements

Participant feedback was essential towards validating transcripts and analysis findings. I engaged with participants to confirm whether the theoretical findings were valid interpretations of their statements. In the beginning, some participants requested transcripts of their interviews because they wanted to verify the statements. One participant justified the request by stating that a previous interview with a journalist had been misrepresented on an article published in the media. I emailed the participant copies of their interview transcripts and my interpretations. I made a concerted effort to contact other participants to check if they would like copies of their interview transcripts and coded interpretations. I requested for their availability in case they were keen to engage with results from data analysis and theoretical interpretations.

Despite early enthusiasm to engage in interviews, I was surprised that most participants were generally indifferent towards extra engagements after analysis. Some participants said they did not have the time to get involved in analytical issues of their own words; and they rather trust me to correctly interpret and analyse what they had been stated. I felt like because of my ICT experience and the fact that I was doing a PhD research led some to

think I was more knowledgeable. This was far from what I felt as a researcher, and I told them.

Only five participants were willing to engage in validating my thoughtful categorisations. I created a summarised document for each participants because I wanted to make it less tasking for them to review. The document contained a summary of each interview transcript, codes and categories established from that individual interview.

The level of engagement with the five participants was at best minimum. I expected more deliberations to validate my conceptual categories but I was surprised that all participants did not disagree with my analysis or data interpretations. Other than a few elucidatory questions, specific clarifications on verbatim and a suggestion from one participant to remove certain texts from the transcript, I did not get any major criticisms or objections. The participant who requested removal of specific text, felt that it was not necessary because it revealed private information that was not contributing to the study. I agreed and I removed the text, and removal did not affect my overall interpretation.

I did not realise that being a PhD researcher would be a drawback to participant engagement about analysed data. Participants were unwilling to challenge my theoretical interpretations, perhaps because of my level of education. Being a PhD candidate is seen as one of the highest levels of education in Uganda. One participant specifically stated that he could not query the analysis because of their inexperience in data analysis and their perception of my high experience. The participants liked the way I had summarised their transcripts to convey meaning using one word (codes) or a specific category.

I presented my coding process, conceptual analysis, theoretical findings and substantive theory to iCOMMS team meetings. I received several questions and opinions which made me re-check or re-organise some conceptual processes to enhance validation. From the feedback, I reflected more on conceptual deliberations and theoretical contribution of the study

4.11 Limitations

In this sub-section, I describe limitations faced throughout the CGT study. First and foremost, while I declare that my theoretical findings provide a suitable explanation for participant perspectives, I cannot claim my interpretations to be absolute rationalisation. Glaser & Strauss (1967, p. 225) explains that theoretical formulations from data can be interpreted differently by researchers, and explanatory interpretations are backed by confidence in the CGT processes followed.

Secondly, the scope of this research was exclusively bound to understanding influence of WSDB initiative in Uganda's water sector. I did not find existing or similarly related studies in the substantive area; hence making this study among the first to use CGT to examine IT artefact interventions. This is the reason why I referred to this research as exploratory, because the study problem has not evidently been well studied and this is general for all exploratory studies.

Thirdly, I cannot claim generalisability because participant views were used to develop an integrated substantive theory in a specific empirical scope. The goal of CGT is to generate theory, but the substantive theory developed may or may not be transferable to other contexts, which future studies involving other participants or case studies should substantiate.

Fourth, the most significant challenge was being a novice CGT researcher initially. I made a conscious effort to read several articles about GT, as well as variant GT approaches before selecting Glaserian CGT. Glaser (1978, 1998) affirms that novice CGT researchers face research impactful challenges, especially proper identification of core variable and theory. With guidance from my supervisor and an experienced Professor in the department who has supervised several GT researches, I trusted my analysis processes. CGTM supported theorisation without prejudicing the research, and participants could express views without my interference.

Fifth, the study was limited to participants working in different roles in Uganda's water sector. I did not make any preference for participant types, but most of those interviewed were MWE staff. The private firm responsible for WSDB design and other funders were not engaged in this study. Some participants refused to take part, and stated private commitments or schedule issues. I felt like they were not comfortable taking part. Thus, this study may not be completely representative of all stakeholders views.

Additionally, snowball sampling was limitedly used. Snowballing is where a "*researcher accesses informants through contact information that is provided by other informants*" (Noy, 2008, p. 330). Some participants were interviewed due to recommendations from others. I was concerned that some participants would suggest others with similar thoughts, I decided to continue with recommendations if participants had different work roles. One participant working at MWE in Kampala suggested participants in rural districts of Mbale and Kabarole. For future studies, I would like to evaluate the effects of snowballing on the research.

Finally, despite limitations, this research was very exciting and it has opened new avenues or opportunities. Future research avenues whose scope is not examined in this thesis such as extension of the exploratory study, effect of snowballing and the potential for new substantive or formal theory can be looked upon. In particular, research that gives an understanding of contextual effects of government backed ICT interventions, and information exchange processes on development in SSA countries like Uganda.

4.12 Chapter Conclusion

As Chapter 3 provides my philosophical assumptions and justification for using GT; this chapter sets CGT's methodological course of action i.e. research design approach, data collection process, coding, ensuing data analysis, generating core category and finally theory generation. The chapter described CGT practice guidelines and reflections that enlightened my research journey leading to development of theory from substantive area.

The next chapter explains theoretical findings and interpretation of results from data analysis. I discuss the theory *Optimizing Perspectives* which is this research's major theoretical contribution.

Chapter Five

5.0 The Theory of Optimizing Perspectives

"Knowledge is the conformity of the object and the intellect"

Ibn Rushd, Averroes (1126 - 1198)
Philosopher

5.1 Chapter Summary

The primary goal of any CGT study is to produce theory that is grounded in data from a specific substantive area. This chapter describes emergence of an exploratory substantive theory *Optimizing Perspectives* that explains how participants perceive WSDB influence on improving sector performance and development. The chapter illuminates processes of discovering the core category and theory, and then concludes by explaining *Optimizing Perspectives* which is the theoretical contribution of this research.

Explanatory narratives throughout this chapter follow a structured series of processes and procedures that have been selectively organised to give distinct meaning to theory construction. The chapter explains how *Optimizing Perspectives* emerged, and the process of generating it. The chapter comprises several sections and sub-sections that can be related to CGT processes of theory development, and elaborates all conceptual categories that contributed to the cultivation of theory. *Appendix A.5* presents all concepts and categories.

5.2 Overview of Theory Realisation

Due to an inductive mode of inference and interpretive philosophical stance, emergence of the core category and theory *Optimizing Perspectives* is based on interpretation of participant perspectives. In addition, I subtly exploited

observations and secondary data sources to further illuminate the research. Qualitative data from participants was the primary data source. Examining influence of the WSDB on sector development was the main research objective because the MWE has positioned it as an ICT artefact to manage performance.

Optimizing Perspectives manifests from subsequent analysis of data. The theory emerged from data analysed, and is presented transparently to demonstrate discovered categories that were constructed around core category. *Figure 25* depicts my analytical pathway and inductive approach to examine data. The interpretive thought process facilitated an analytical approach towards understanding and discovering meanings from participant responses collected about the WSDB.

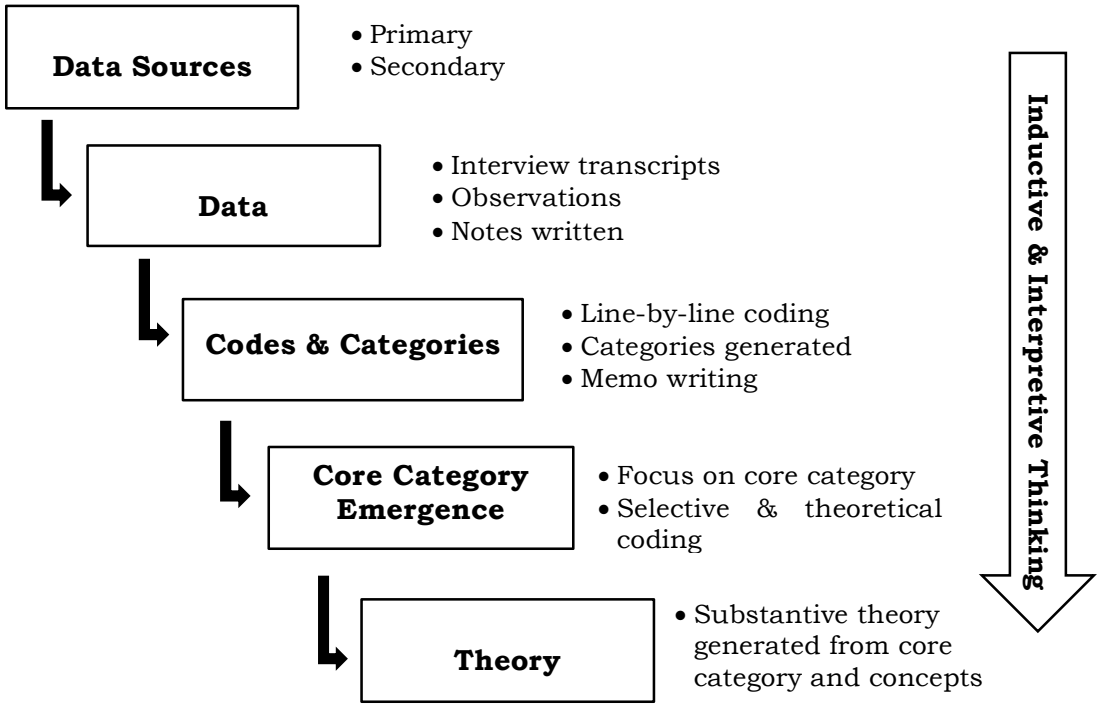


Figure 25: Analytical phases constructing the theory

The WSDB usage takes place in the context of MWE workflow ecosystems that allows water supply data to be submitted from all over Uganda to the MWE, where it is analysed, validated and entered into the WSDB. The MWE makes sure that data submission is undertaken by DWO, and that correct data is entered into the WSDB because it is used for decision making and

impacts water project implementations. Participants have individual experiences about the WSDB and its current significance; as stated below:

> "*there was a budget conference in Bunyangabo and they needed information on their coverage…I went to internet café and I went on database because I was in Kampala. Yeah, and I could see Kabarole; data on Kabarole. There is a report, a summarised report showing coverage per sub-county. And I picked information from there and mailed to the people here who are planning for this meeting and they used that data in the meeting.*" (Site 11, January)

During analysis of participants viewpoints, the initial open coding process, core category cultivation and theory generation were all reciprocally interconnected to explanatory interpretation of data. Interpretive approach allowed me to make a conscious effort in relating data findings. Descriptions discerned explanations, and I frequently quote participant accounts when presenting. These quotes chronicle interpretive aspects of the entire study into a structure of codes and categories representing research findings. I constantly reflected upon these quotes not only to obtain interpretations of experiential explanations, but to present evidences were needed.

The next section describes contextual roles of individual participants.

5.3 Participant Contextual Roles

Before describing theory generation, it is important to portray contexts of the participants in this research. In chapter 2 (*section 2.4*), I describe locations and roles of participants. I sought participants by corresponding via email and phone. Most participants were enthusiastic to participate, although some declined. Some participants recommended others in a snowball approach.

All participants reflect an ecosystem of multiple stakeholders working and contributing to water sector growth; and play different roles which allowed me to consider their holistic views. All participants claimed to have used the WSDB. See *Table 15* about participant roles.

No	Organisation	Unit	Significance
1	MWE	DWOs/ TSUs	Collect and submit water supply information using manual forms. Contributed to understanding WSDB use, and perceptions about performance measurement and growth
		MIS/ ICT	Contribute to understanding WSDB implementation, design, usage, challenges, perceptions, benefits, data management, report generation and technical support.
		Admin	Contribute to understanding WSDB influence on projects, decision making and policy.
2	UWASNET	Staff	Contribute to understanding use, significance and perception of the WSDB at UWASNET by NGOs, CBOs and private utilities
3	NGO	Staff	Contributed to understanding WSDB use, significance and perceptions amongst NGOs

Table 15: Presents contexts about participants

5.4 Concepts Learned About Participants

Generally, I learned from interviews, and interacting with participants. The findings contributed specific perspectives which cultivated theory. I provide summary data about participants showing findings of their WSDB experiences and related views. See *Table 16*.

Organisation/ Participants	Responsibilities	ICT/ Computer & WSDB Skills	WSDB Access, Use & Perception
MWE (MIS-Unit/ ICT)	- Data entry - Data analysis - Validation & verification of data - Reporting - WSDB operations and Management - Involved in co-design of WSDB modules	- Graduates with high computer skills - Very positive about ICT influence - Trained to use and manage WSDB	- Access and use WSDB - Very positive about WSDB contributions - Appreciative about WSDB effect on data submission processes - Elaborated about WSDB and ICT potential in the water sector - Very optimistic perceptions about WSDB ability to change the MWE and water sector at large

			- Felt WSDB has influenced several positive changes especially data submission and management
MWE (DWO)	- Submit water source information from their districts - Engage with NGOs and private utilities on water access	- Most had limited computer skills - Received training on how to use WSDB - Cannot do Data entry with WSDB	- Access WSDB although some do not have office computers - Some are indifferent about WSDB because of IT infrastructure problems especially in rural districts - Submit timely water supply data because it is required by MWE
MWE (Admin)	- Manage project implementations and budgeting in the water sector - Manage Policy, planning and decision making	- Good computer skills - Use WSDB and other ICTs at the MWE for sector management	- Commended WSDB and ICT influence on data flow and decision making - Very supportive of improved access to timely information - Very enthusiastic about WSDB and consider it significant
UWASNET (Admins)	- Coordinate NGOs in Uganda's WASH sector - Support water source project implementations by NGOS - Link MWE to NGOs in WASH	- Had good computer skills - Trained how to use WSDB	- Access and use the WSDB - Somewhat critical of WSDB data integrity issues - Optimistic about WSDB influence - ICT enthusiasts particularly with regards to growth in WASH
NGO	- Provide WASH services - Can submit water source information to the MWE through DWOs	- Good computer skills - Access WSDB using authorised login accounts	- Access the WSDB - Somewhat critical of WSDB data integrity - Pessimistic although use data sourced from WSDB - Optimistic about WSDB influence

Table 16: Summary of WSDB experiences from participants

5.4.1 Participant's Central Concern

A central concern for participants was how to make effective WSDB use in augmenting information processing and decision making to bring changes to water sector management. This entailed resolving sector-wide data submission processes by DWO and impediments faced. I derived the core category from a central theme of how the MWE is making effective WSDB use. Participants intimated effective use as working towards:

1. Enhancing data submission and processing to improve their work
2. Improving decision making which is viewed as impactful or influential
3. Engaging with stakeholders to create a feeling of togetherness to accomplish challenges
4. Minimising errors and duplications for financing water source projects

Many of the experiential perceptions expressed by participants were because they felt that effective WSDB use was not only about improving data collection and integrity aspects, but about enhancing decision making and coordination among stakeholders; thus influencing sector growth.

5.5 Core Category Emergence

CGT advocates focusing on a core category to provide a theoretical explanation. The core category best explains the research problem and addresses views of participants; and then explains the general underlying meaning or implications. Glaser & Holton (2004) define the core category as any kind of theoretical code discovered which can be a process, a condition or a consequence.

Generating the core category and theory entailed an iterative interpretive investigative process of data collection and analysis. After two data collection phases, I achieved theoretical saturation for the study. *Figure 26* shows the processes of data collection, analysis, core category emergence and theory discovery.

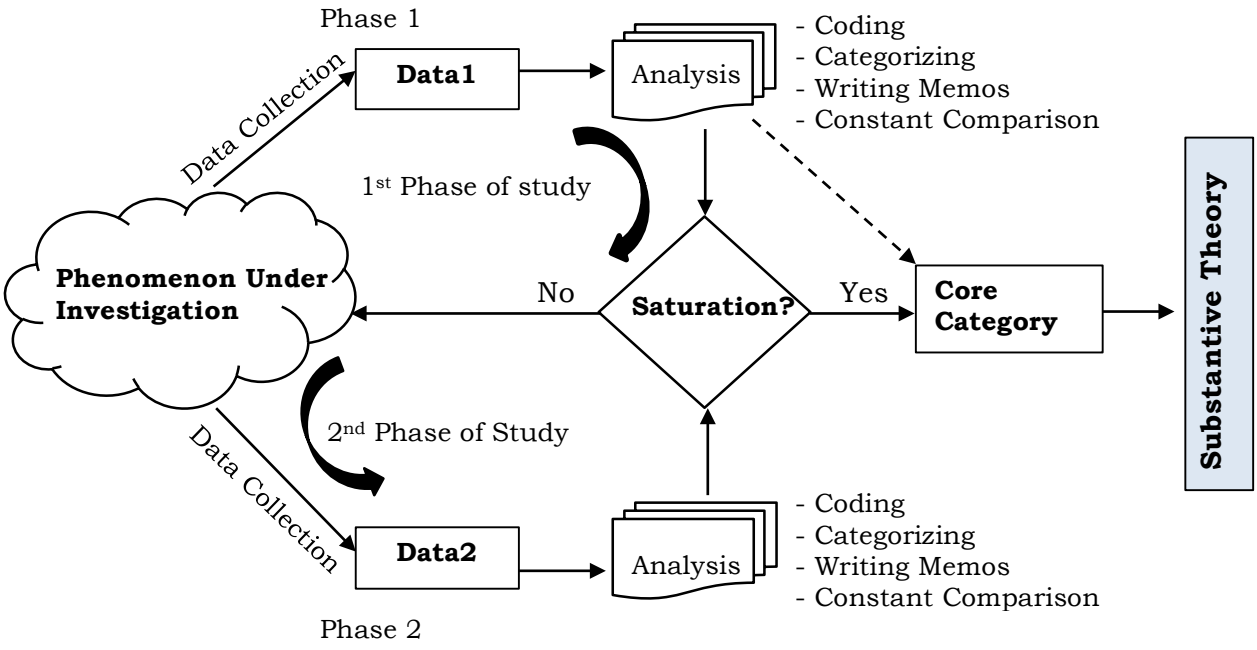


Figure 26: The data collection, analysis and theory generation process

The core category which is *Optimizing Perspectives* emerged from data conceptualisation, and reflects a theme that emphasises how effective WSDB is influencing sector growth and ways in which the water sector operates.

Figure 27 depicts a flow chart showing processual stages of how the core category and theory emerged.

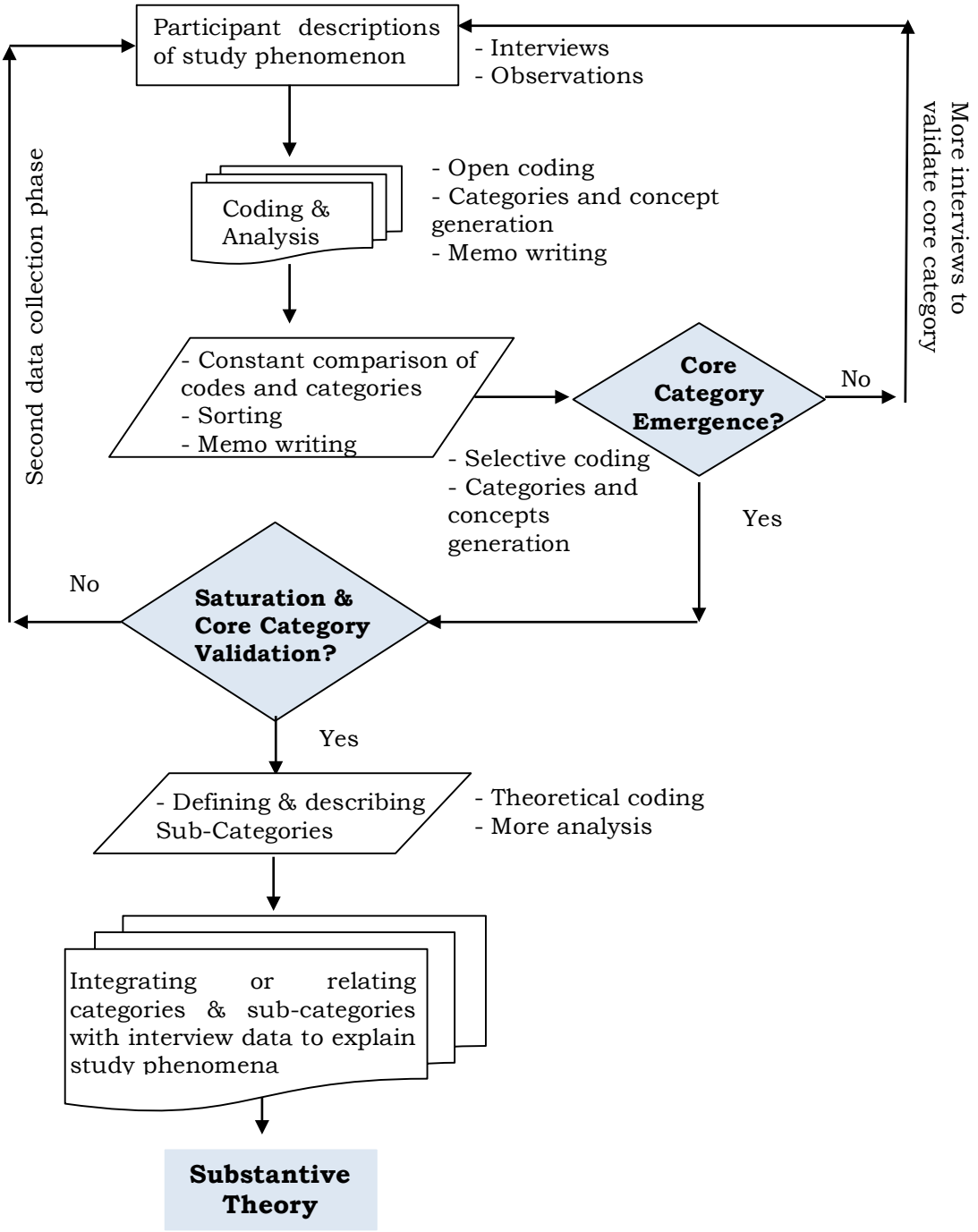


Figure 27: Processes of how the core category and theory emerged

The first step entailed interviewing participants to gain insightful descriptions. Some participants presented their perspectives about experiential WSDB use. As one participant stated:

> "*Every end of financial year, around September/ October…we hold a forum with all our sector stakeholders and in this forum, we discuss the performance of the sector. Now, the performance of the sector is only gauged using data from the Water Supply Database*" (Site 2, November)

This account reveals WSDB significance as expressed by the participant. The description was one of several that cultivated *Optimizing Perspectives* as a way of explaining WSDB influence.

The second step entailed coding and analysis of interview data. This step revealed several conceptual codes and categories. While undertaking fundamental processes such as constant comparison and sorting, I had to be cognizant of a stretch when no significant codes or categories are generated; hence preparing me to realise attainment of saturation. Before saturation, additional interviews were coded, analyzed, categorised and constantly compared to unveil similar latent patterns. Saturation meant that there was no further requirement to collect data because latent patterns had been determined.

The third stage defines relevant categories or sub-categories; and then integrate or relates categories and sub-categories with data to explain evidenced based findings. I determined the core category from other categories which best explain data about WSDB influence.

Finally, I determined *Optimizing Perspectives* as core category and substantive theory cultivated from how participants perceive the WSDB influence. *Figures 26 and 27* illustrate steps undertaken to cultivate *Optimizing Perspectives* as a theory that accounts for an interpretive understanding of participant perspectives. The steps depict how the theory emerged and best explains data about participant explanations. *Optimizing Perspectives* manifests from four primary sub-core categories *Negotiating Compromises*, *Validating Developments*, *Infrastructuring* and *Sanguine Orientating* which portray perceptions. The four categories explicate a lower level explanation of *Optimizing Perspectives*.

5.5.1 Constructing the Core Category

The core category was generated from processes that created and grouped concepts or codes. *Optimizing Perspectives* BSP was determined to be an emergent core category that accounted for the most variation in data.

Participants views were integrated into a core concept explaining WSDB influence and how it is effectively used to manage water source data. Based on my data interpretations, I delineated *Optimizing Perspectives* as: -

> *Persistent MWE activities that make effective WSDB use to successfully manage operation of water sources, and enhance development in Uganda's water sector.*

The description above provides an explanatory understanding of the WSDB, and how the MWE has effectively adopted it to improve water sector management. *Optimizing Perspectives* emergence is construed from descriptions of WSDB use and contextual narratives about influence, data management and positioning as central ICT artefact.

Eventually, CGTM cultivated *Optimizing Perspectives* from codes, primary sub-core categories and secondary sub-core categories. Each primary category was constructed from several secondary categories. To make a comprehensive step-by-step elaboration, *Table 17* presents a top-to-bottom approach explaining how the core category emerged.

No	Stages of Core Category Emergence
1	Qualitative interviews were conducted from two field studies; and were transcribed in preparation for coding and interpretation.
2	Data was coded, analysed and categorised to construct the core category through a high level of abstraction for grouped codes or categories. Several categories like *Optimizing Perspectives, Balancing Partnerships, Decisioning* and *Validating Developments* emerged as concepts considered.
3	*Optimizing Perspectives* emerged as a core category that accounts for the most variation in data. Other concepts considered for core category like *Balancing Partnerships, Decisioning* and *Validating Developments* revealed themselves to be less definitive. These categories were considered to be lesser sub-core categories constructing the core category
4	Primary and secondary sub-core categories were discovered to be concepts that constructed *Optimizing Perspectives*. In other words, these sub-core categories were sub-sets of the core category. *Figures 29 and 30* depict visual descriptive links between sub-core categories and core category

5	Several codes were used to construct the primary and secondary sub-core categories. *Table* in *Appendix A.5* lists all codes and categories.

Table 17: Description of core category emergence

Throughout the study, I recognised the major purpose for WSDB implementation is to ensure up-to-date information availability so that decisions that influence water sector are concurred upon. As one participant stated:

> "*the ministry found it fit that in order for you to track your progress towards achievement of your objectives…you need a database where your store all information.*" (Site 2, November)

> "*Now, the performance of the sector is only gauged using data from the Water Supply Database.*" (Site 2, November).

These participant explanations clearly show WSDB significance. It is fairly simple to interpret and categorise these quotes in terms WSDB significance towards *Tracking Performance, Progress* and *Validating Developments* in the water sector.

There are three distinct data-centric stages that account for WSDB data use as inferred from participants. These phases include *Submitting Information*, *Validating Inputs* and *Making Policy Decisions*. I referred to these phases as the WSDB *Information Cycle*. The *Information Cycle* refers to process of data submission, data entry and data use for decision making processes which influence the water sector. *Figure 28* presents a schematic diagram showing *Information Cycle* concepts and processes; their interdependence and optimization for sector development.

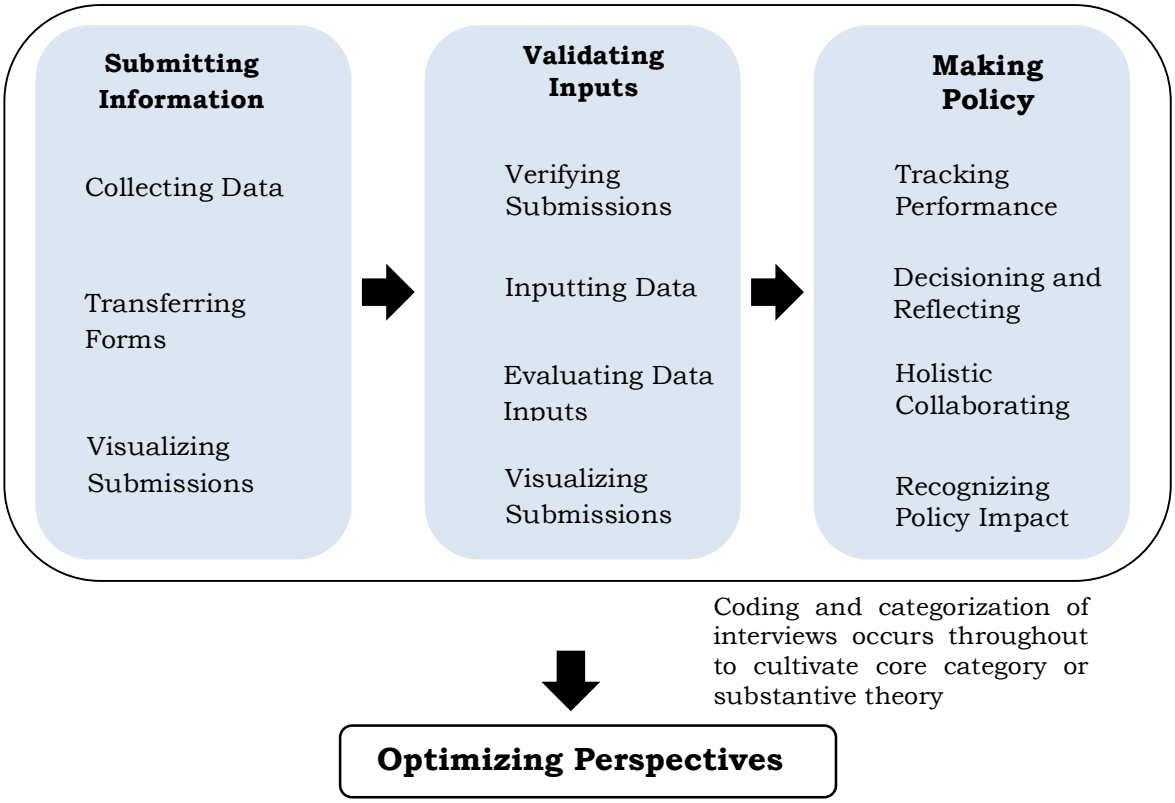


Figure 28: Schematic WSDB information cycle processes

The data-distinct stages are related to *Optimizing Perspectives* through primary and secondary sub-core categories emerging from multiple contextual instances.

The next sub-section diagrammatically examines all categories cultivating *Optimizing Perspectives*.

5.6 Constructing *Optimizing Perspectives*

Constructing *Optimizing Perspectives* are four primary sub-core categories that emerged from thirteen secondary sub-core categories and several conceptual codes. *Figure 29* presents a pyramidal structure of the bottom-up process showing *Optimizing Perspectives* emergence.

It shows a diagrammatic illustration of the theory construction process. *Figure 30* depicts a less detailed illustration of *Optimizing Perspectives* showing only primary and secondary sub-core categories.

Figure 29: Pyramidal structure of the bottom-up process showing *Optimizing Perspectives* emergence

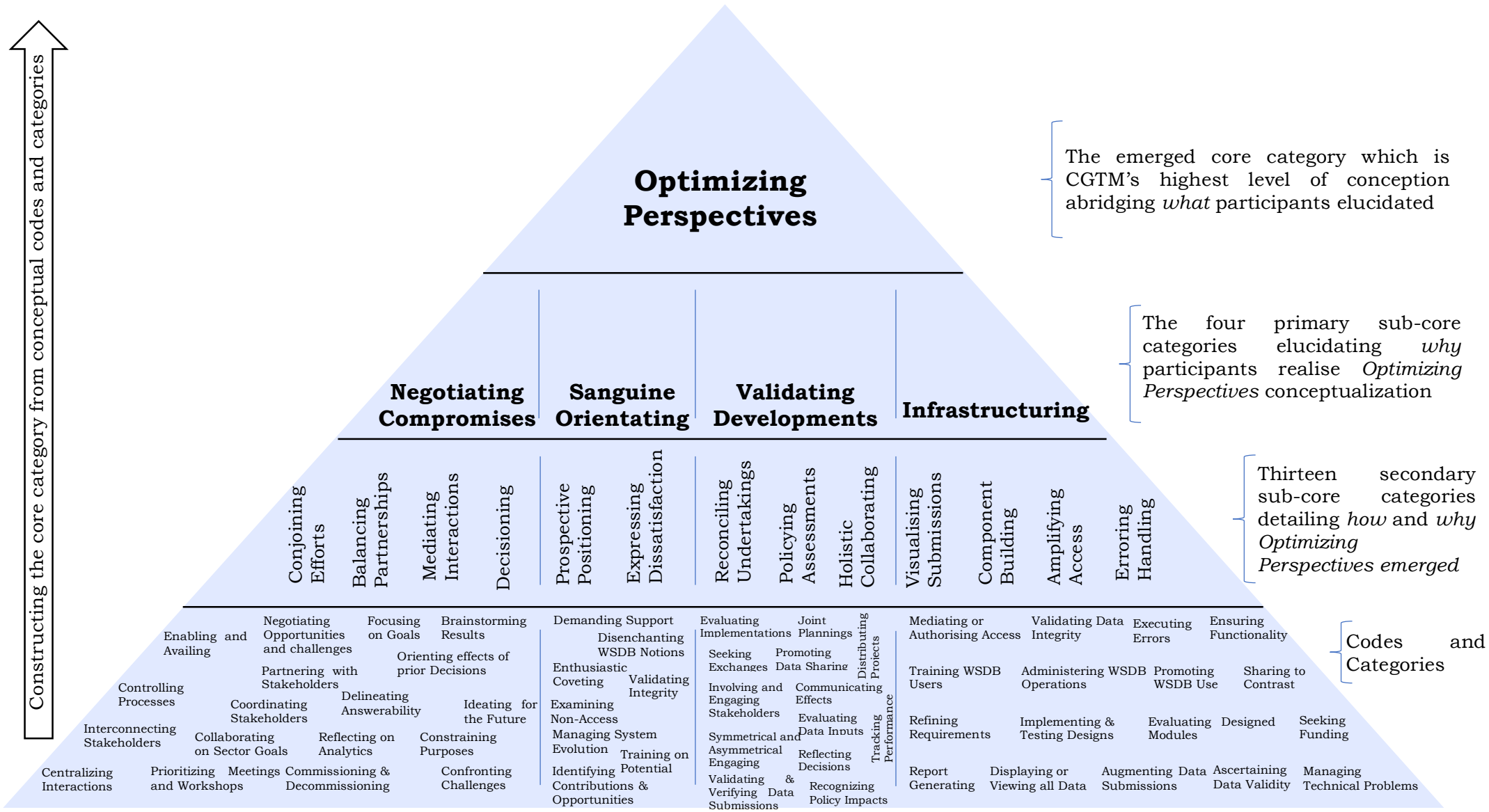
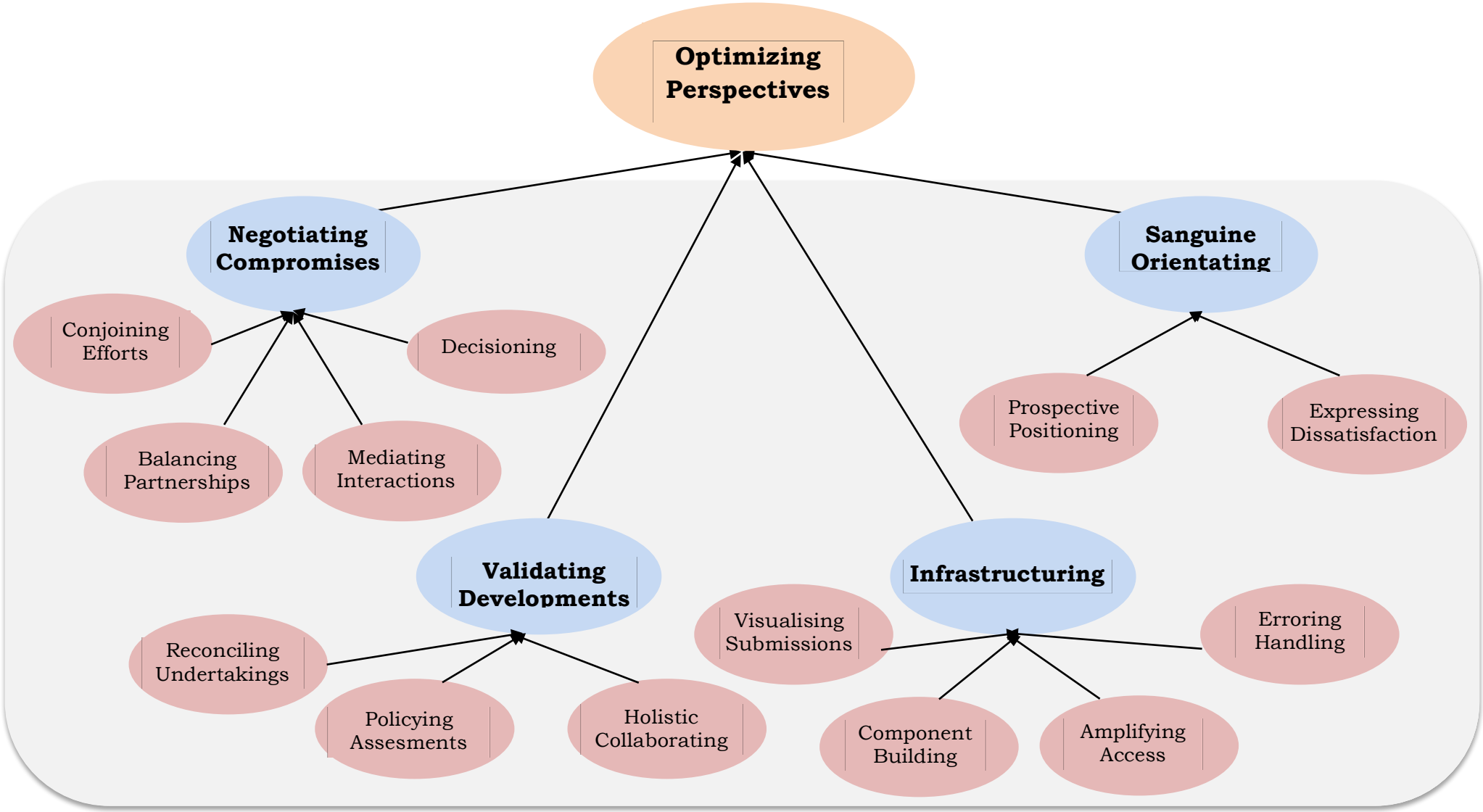


Figure 30: A less detailed illustration of *Optimizing Perspectives* showing sub-core categories only



From *Figure 29,* the pyramid's bottom section depicts several distinct conceptual codes that led to the core category emergence. The core category arose from primary sub-core categories, while primary sub-core categories arose from secondary sub-core categories. Secondary sub-core categories developed from line-by-line data codes. *Figures 29 and 30* diagrammatically depict *Optimizing Perspectives* emergence as core category and substantive theory.

Optimizing Perspectives emergence conveys a relationship between data, codes or categories; and depicts what Glaser (1978) refers to as temporal properties. Temporal properties require the researcher to take quality time with data for the discovery process; and the time is taken in a manner consistent with their temporal nature or calm pace. Temporal properties include spasmodic, cyclic (recursive) and perpetual. *Appendix A.5* shows my temporal characteristics. Codes and categories nurtured development of core category; and are vital elements that give an understanding of participant perceptions explaining *Optimizing Perspectives* processual dynamics.

The fourth tier codes shown in *Figure 29* are a hierarchy of lower level concepts crucial to *Optimizing Perspectives* manifestation. Codes shown at the bottom of *Figure 29,* and in the first two table columns of *Appendix A.5* are all presented individually under *sub-sections 5.7*.

5.7 Sub-Core Categories Constructing *Optimizing Perspectives*

In this section, I explain how *Optimizing Perspectives* emerged from constitutive primary and secondary sub-core categories. *Optimizing Perspectives* is derived from my analytical thought process following CGT tenets; and transcribed data that I coded to infer meanings of participant perceptions. The sub-sections diagrammatically elucidate ways in which participants clarify MWE's *Optimization* of the WSDB to influence performance and growth.

Participants gave *optimised* perspectives about their understanding. I delineated the perspectives as *Optimizing Perspectives* because it succinctly accounts for the best concept rationalization. Four primary sub-core categories illustrated in *Figure 31* interpretively depicts the cultivation.

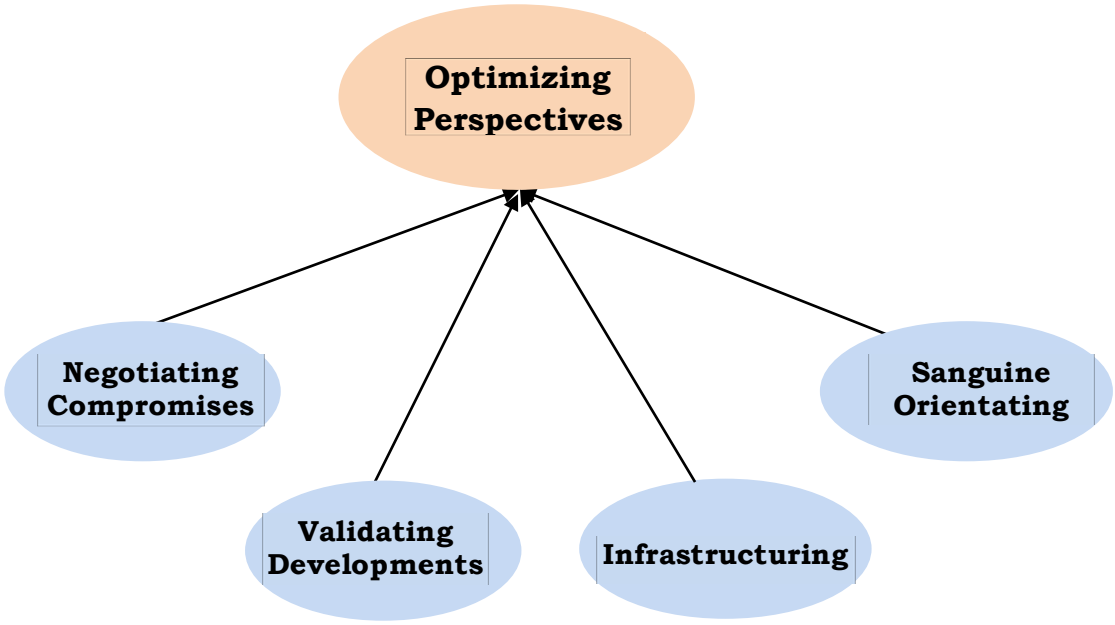


Figure 31: Primary Sub-Core Categories of *Optimizing Perspectives*

The categories *Negotiating Compromises, Validating Developments, Infrastructuring* and *Sanguine Orientating* are generated from lesser level codes and categories, and contribute to *optimization* of *perspectives* as elucidated by participants. The categories comprise a theoretical code relating them, which is essential for *Optimizing Perspectives* emergence.

In the proceeding sub-sections, I describe and diagrammatically present primary sub-core categories and related secondary sub-core categories.

5.7.1 Negotiating Compromises

This primary sub-core category embodies the way WSDB facilitates how information is used to set targets, goals, Performance Indicators (PI) or measures and make agreements. *Negotiating Compromises* process is undertaken by stakeholders as they make decisions on goals that are developmental. I defined *Negotiating Compromises* as:

A process that manifests from use of WSDB to develop, plan, coordinate, commission, manage, sustain and finally decommission water source projects by MWE with relevant stakeholders under its leadership.

Negotiating Compromises entails four *constructed* activities conceptualised as secondary sub-core categories. *Figure 32* depicts the categories.

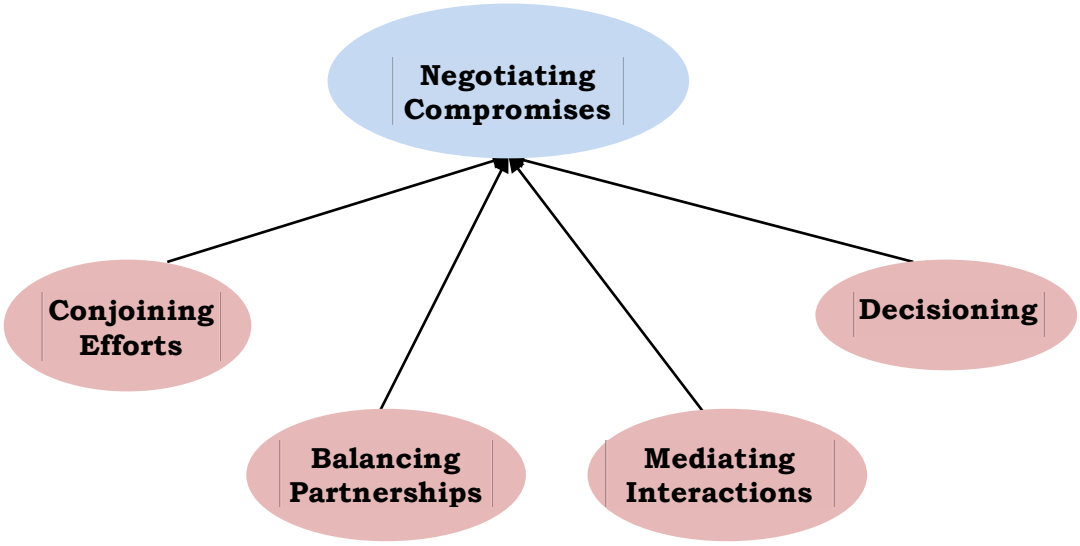


Figure 32: Secondary sub-categories constructing *Negotiating Compromises*

Participants denoted that the MWE conducts meetings and workshops several times a year with stakeholders to *negotiate* WASH matters and reach *compromises* as part of augmenting sector development. Stakeholders engage, negotiate and compromise with one another to reach consensus on several specific subjects that impact developmental goals using WSDB facilitated information. One participant denoted:

"*We hold a forum with all our sector stakeholders and in this forum, we discuss the performance of the sector. Now, the performance of the sector is only gauged using data from the Water Supply Database*" (Site 2, November)

I discovered from participants' experiential elaborations that one of the most important stakeholder engagements that facilitates *Negotiating Compromises* occurs during the annual Joint Sector Reviews (JSR). JSR is held annually, and meetings encompass several *undertakings* for the ensuing year which are devised and agreed upon. Joint stakeholder groups or sub-groups are selected to implement reviewed undertakings. An annually published Sector

Performance Report (SPR) is a major basis for discussions during JSR (MWE, 2014). As stated by study a participant:

> "*The information that you see in the Sector Performance Report is generated from the data in the Water Supply Database. And therefore, since this is a published report, it is used widely. It is shared, there is nothing to hide. Everything is shared publicly*" (Site 2, November).

Secondary sub-core categories that cultivated *Negotiating Compromises* include: *Conjoining Efforts*, *Balancing Partnerships*, *Decisioning* and *Mediating Interactions*. The sub-core categories provide conceptualised insights of how MWE and stakeholders *collaborate* to make decisions that impact *developing* water source projects. These negotiations majorly influence collaborations, planned sector specific goals or targets and measures set to ensure sustainability and growth.

Table 18 presents coalesced concepts constructing *Negotiating Compromises* along with constituent conceptual codes, categories and a summary memo supporting its emergence.

Theoretical Memo Summary	**Conceptual Codes**	**Secondary Sub-Core Categories**	**Primary Sub-Core Category**
Participants reflect upon the way MWE and stakeholders coalesce to make informed decisions that are facilitated by WSDB information	Centralizing Interactions, Interconnecting Stakeholders, Controlling Processes, Enabling or Availing Access, Conjoin tasks with stakeholders	Conjoining Efforts	**Negotiating Compromises**
Participants highlight how MWE and UWASNET manage and coordinate stakeholders to undertake specific tasks using WSDB data	Organising meetings and workshops, Collaborating on sector goals, Coordinating amongst stakeholders, Partnering with stakeholders, Negotiating opportunities and challenges	Balancing Partnerships	

Participant highlight the decision making processes and policy that utilise WSDB based information	Commissioning and Decommissioning projects, Reflecting on WSDB analytics Defining Accountability, and Transparency, Constructing Sources, Planning Submissions	Decisioning	
In situations where there are integrity issues or conflicting data accounts, participants highlight WSDB significance in resolving data based issues	Confronting Challenges, Constraining Purposes, Ideating for the Future and Brainstorming Results	Mediating Interactions	

Table 18: Emergence of *Negotiating Compromises*

The next sub-sections explain discovery of categories cultivating *Negotiating Compromises*.

5.7.1.1 Conjoining Efforts

To discover WSDB influence, I isolate perceptions and expectations that relate to information *access* and stakeholder *coordination*. Because the WSDB is centralised, accessible and provides information for everyone, I recognised this as my starting point towards understanding how multiple stakeholders *coordinate*, *partner*, *negotiate*, *compromise* and make *decisions*. All these concepts enabled me to generate *Conjoining Efforts*.

At the start of *Negotiating Compromises*, stakeholders who include critical partners like NGOs, donors, UWASNET and Civil Society observers collaborate; and this *collaboration* is spearheaded by the MWE. This initial *collaboration* is what I conceptualised as a secondary sub-process *Conjoining Efforts*. I defined it as:

> *The process of coalescing stakeholders to identify opportunities, build collaboration and make development based decisions.*

To put it simply, *Conjoining Efforts* means *coming together* or *engagement* by stakeholders in order to agree and make *decisions*. *Conjoining Efforts* is a medium to long term process of *partnering* that includes harmonising strategic objectives. Participants explained that JSR and workshops or meetings organised throughout the year to provide opportunities for stakeholders to interact and develop joint plans. A participant quote in sub-section *5.7.1* clearly explain it. *Figure 33* presents constructing codes.

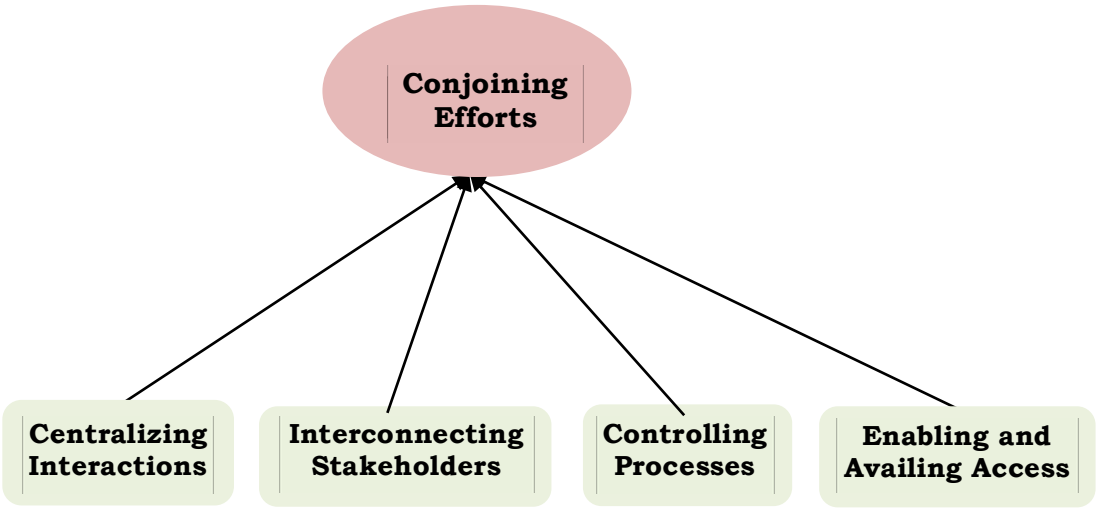


Figure 33: Coded concepts constructing *Conjoining Efforts*

Conjoining Efforts is constructed from processes related to stakeholders *collaborating* to fund and build water source projects using integrated WSDB data. Process include *partnering* in *managing* or *administering* projects, identification of mutual benefits by i*ntegrating* goals and *realising* advantages that the WSDB brings. Development in the water sector is mutually beneficial to everyone, and all stakeholders tend to collaborate due to these symbiotic benefits.

5.7.1.2 Balancing Partnerships

Soon after *conjoining efforts*, *Balancing Partnerships* emerges as a way to manage egoistical or individualistic tendencies from different stakeholders. I determined that MWE *balances* stakeholder *partnerships* or *participation* in water project *planning* and *implementations* through *collaboration* and

coordination. Conceptualising these processes led to the emergence of secondary sub-core category *Balancing Partnerships*.

I defined *Balancing Partnerships* as: *a process of managing and building cooperation amongst stakeholders despite individual agendas, interests and disputes*. This is useful for *supporting* and *validating* project processes. *Balancing Partnerships* helps to coordinate, increase *collaboration*, create funding opportunities, reduce duplications and streamline water supply projects. *Figure 34* shows codes constructing *Balancing Partnerships*.

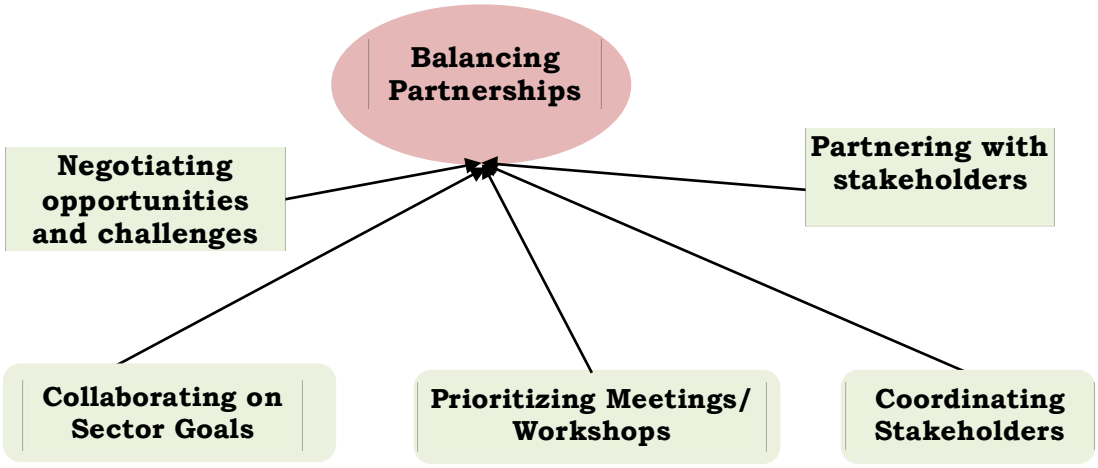


Figure 34: Categories cultivating *Balancing Partnerships*

Participant views of *partnerships* related to how the WSDB information is shared for strategic decision making. As denoted in the quote.

> "*we realized that our biggest stakeholders, our biggest users are actually the districts….other users; the NGO's are using it allot, the donors are using this Water Supply Database allot, the general public is also interested*" (Site 2, November)

I verified from participants that they regularly participated in activities organised by MWE to streamline *coordination* amongst stakeholders in several districts. One participant explained that UWASNET often assists the MWE to build partnerships with NGOs; and UWASNET sometimes uses the WSDB to access information about the status of water sources across all districts. That information is then used for *planning* and *budgetary* allocations. In addition, the MWE resolves any stakeholder concerns or

disputes related to all water supply projects. In many situations, the MWE, donor agencies or NGOs' operate in the same districts, and the is always need to *coordinate* and *partner* when implementing projects. WSDB data which forms part of the SPR is now used during joint meetings organised by the MWE to plan, prioritize and collaborate during water supply project implementations.

Being the leader casts the MWE with an enviable task of keeping *partners* together, and to satisfy all their individualistic interests. Coordination efforts from MWE like Sector Wide Approaches (SWAp) and monitoring trips as part of Joint Technical Review (JTR) teams play a role in *balancing partnerships*.

I constructed *Balancing Partnerships* from conceptual categories *Collaborating on Sector Goals, Prioritizing Meetings/ Workshops* and *Coordinating Stakeholders*. Concepts were generated from perspectives that relate to *managing* and *building* stakeholder cooperation amongst; and how these partnerships influence development.

5.7.1.3 Mediating Interactions

When stakeholders meet, there can be agreements, differences and *conflicts* that arise due to varying views, strategies and interests. Using WSDB and SPR, the MWE attempts to match stakeholder strategies and objectives during JSR. I conceptualised this process as *Mediating Interactions*; defined as: *The process of aligning goals, strategies and resolving differences for mutually beneficial purpose of improving the water sector*. As denoted below:

> "*To avoid double accounting,…we then send this information to a central database and that place, that village is ticked; and they know that Musa put up a borehole in Fort Portal. That helps clean up the accountability to avoid different agencies claiming the same work and duplicating the work, putting in the same location*" (Site 11, January)

Figure 35 illustrates construction of *Mediating Interactions*.

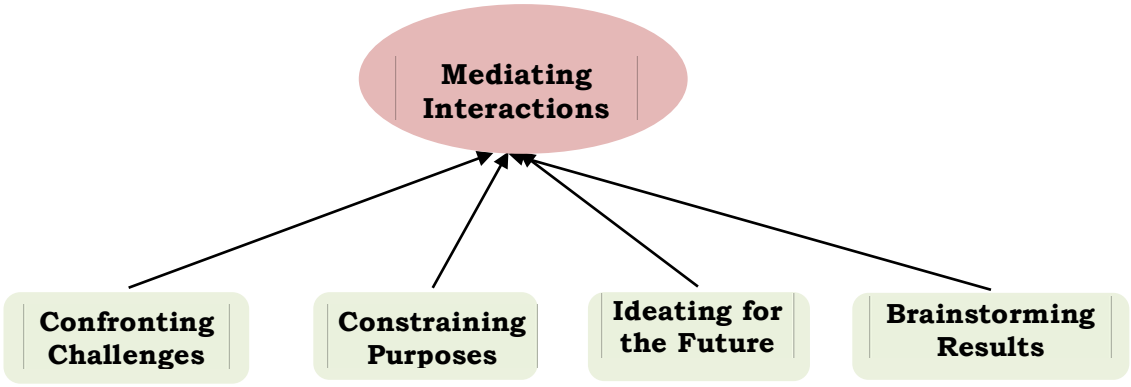


Figure 35: Coded Categories constructing *Mediating Interactions*

I constructed *Mediating Interactions* from four concepts presented in *Figure 35*. The concepts were built from an analysis of perspectives, notes and memos that relate to WSDB significance. MWE now mediates interactions by *centralising* data into WSDB; and *coordinates* interactions at JTR and JSR with support from UWASNET and partners.

5.7.1.4 Decisioning

After examining participants views cultivating *Conjoining Efforts*, *Balancing Partnerships* and *Mediating Interactions*, I introduce *Decisioning* as the final sub-core category. *Decisioning* is linked to the process of understanding how WSDB reflects upon resolutions or decisions made.

I define *Decisioning* as: *a process of making sense of collectively deliberated judgements made using information generated from the WSDB*. As stated previously, the WSDB provides information used by the MWE and stakeholders for SPR and decision making. One participant explained that the WSDB is used at district or regional levels of governance:

> "*to make informed decisions while they are allocating their resources within their districts*" (Site 1, November)

Figure 36 presents generated concepts constructing *Decisioning*.

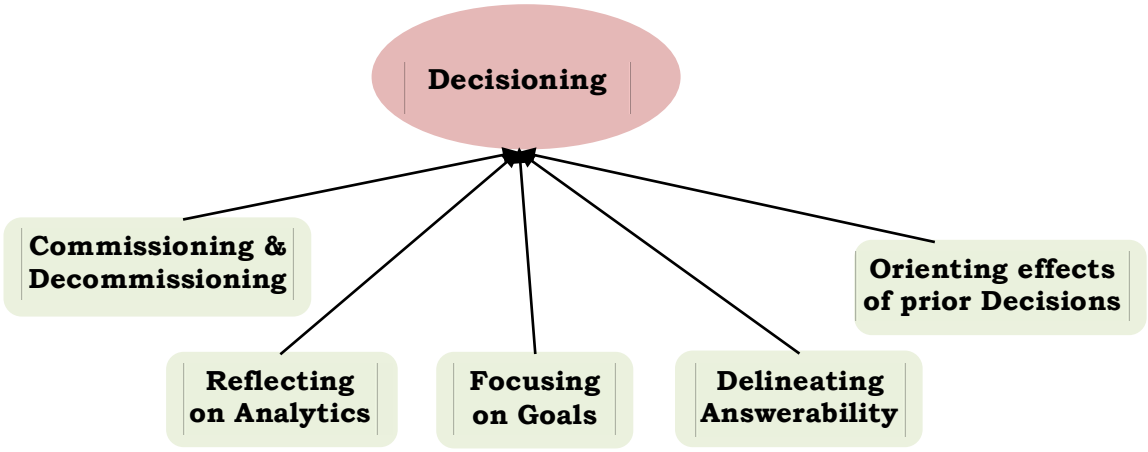


Figure 36: Coded Categories for generating *Decisioning*

The five concepts constructing *Decisioning* were generated from an understanding of *decision* making processes supported by the WSDB.

5.7.1.5 Summary of Negotiating Comprises

Interpreted revelations suggest that stakeholders have adopted the WSDB to undertake collaborative processes among themselves when making decisions impactful about development. WSDB data is used to set PI or goals because it is currently a central repository of country-wide water related information. Under MWE leadership, decisions are *negotiated* upon with stakeholders, and *compromises* struck in encompassing negotiations during JSR, JTR and other joint meetings. Participants postulated the significance of the WSDB whose data comprises all district water sources implemented by public or private utilities.

With regards to *Negotiating Compromises*, my interpretations stem from description of how influential the WSDB has become. I defined *Negotiating Compromises* as a process manifesting from WSDB usage to set performance goals and make developmental decisions. The process entails *collaboration*, *coordination*, *engagement*, *leadership* and *compromising* by MWE and stakeholders.

Negotiating Compromises is generated from a theoretical coding process that epitomises processes undertaken by MWE and stakeholders. I encountered

some participants who did not to trust WSDB entirely because its data is not updated daily. This led me to believe that WSDB uptake is still ongoing, despite being central to MWE operations.

5.7.2 Validating Developments

I found this primary sub-core category to be shaped by the way MWE and partners define PI using the WSDB to *validate*, *endorse*, *verify* and *exchange* information about project implementations. I *discerned* a well organised process within which information is sent and received. Originally, manual forms were used to exchange data, but the WSDB now supports this process. The WSDB was determined as initiative that would support achieving sector development goals, in addition to *validating* developmental projects undertaken. As, stated by participant at site 2.

> "*In 2004, the ministry undertook what we call the performance measurement framework. It undertook to document how the sector should be to measure progress in achieving its objectives. And it was a study that was done comprehensively with high involvement of all stakeholders….the ministry found it fit that in order for you to track your progress towards achievement of your objectives, you need like a store; you need a database where your store all information in your systems*" (Site 2, November)

I define *Validating Developments* as: *a process that adopts WSDB information to set PI or measures in order to examine, validate or verify sector development*. *Validating Developments* occurs during assessment of performance set to understand development through functioning water themes namely: - *access*; *functionality*, e*quity* of improved water sources, per capita *investment costs*, water quality, water storage, and community or gender management. As one participant stated:

> "*So, we sort of carry out a validation; the information that we have in the database and what facilities, what water sources are actually on the ground and we produce what we call a Water Supply Atlas from the validation….then we are sure that what we have in the database is almost 100% representative of what is on the ground*" (Site 2, November)

Individual water source project validation mechanisms like GPS coordinates are often recorded to validate presence and functionality. MWE jointly *negotiates* PI with stakeholders, and WSDB is used to calculate PI based on WATSUP and subsequent updates. MWE reports targets and achievements for the PI. Participants explained that the annual SPR report epitomises WSDB data analysis with respect to agreed PI.

Figure 37 depicts three secondary sub-core categories related to *Validating Developments*; and were necessary for the discovery process.

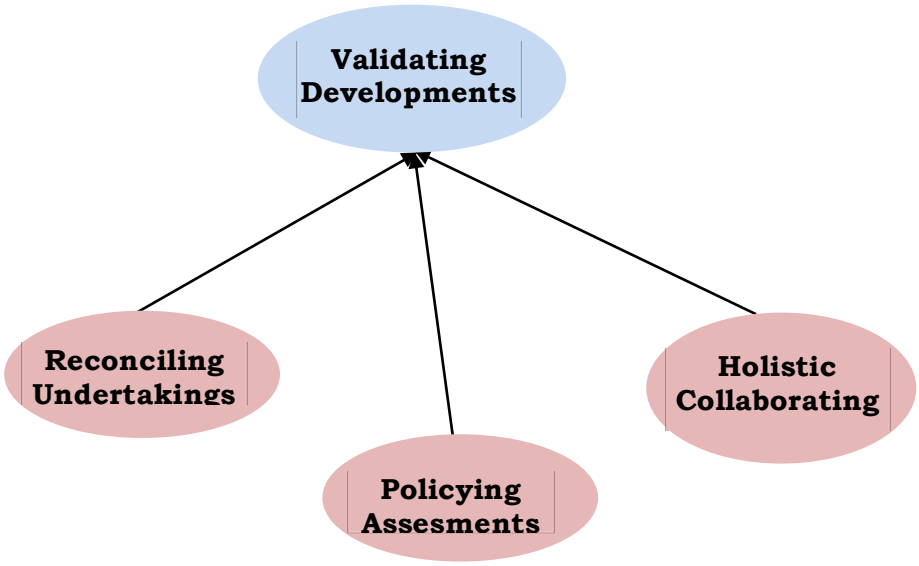


Figure 37: Secondary Sub-Categories of Validating Developments

Multiple engagement and joint monitoring mechanisms such as JSR and SWAp not only epitomised process for *exchanging* information, but were evidence based approaches for *Validating Developments* based on set PI. *Validating Developments* surmises from *categorising* and *analysing* participant perspectives about WSDB. *Table 19* presents conceptual codes, categories and theoretical memos constructing *Validating Developments*.

Summary of Theoretical Memos	**Conceptual Codes**	**Secondary Sub-Core Categories**	**Primary Sub-Core Category**
Data submitted is verified, input to WSDB and then analysed by different stakeholders for validity, correctness or accuracy before its	Validating and Verifying Submissions, Joint Plannings, Seeking Exchanges, Analysing data,	Reconciling Undertakings	**Validating Developments**

adopted for use	Correcting submitted data, Evaluating implementations		
Decisions and policies are made based on WSDB facilitated information submitted by DWO and TCUs	Reflecting Decisions, Evaluating Data Inputs, Communicating Features, Recognising policy Impacts, Assessing project implementations, Planning around projects	Policying Assessments	
Stakeholders collaborate and coordinate using data from WSDB as a benchmark to reflect upon the entire water sector, its growth and future plans	Symmetrical or Asymmetrical Engaging, sharing data, Promoting System use, Involving and Engaging Stakeholders, Distributing Projects	Holistic Collaborating	

Table 19: Constructing the primary sub-core category *Validating Developments*

As shown in *Table 19*, *Reconciling Undertakings, Policying Assessments* and *Holistic Collaborating* provide an understanding of how stakeholders collaborate to set PI that verify development or sustainability. Collaborative mechanisms such as JSR, SWAp and JTR support information sharing for symbiotic benefits which the WSDB facilitates.

The next sub-sections explain discovery process of *Validating Developments*.

5.7.2.1 Reconciling Undertakings

One of the most obvious perspectives was description of stakeholder engagements. The MWE is Uganda's most important WASH institution, while NGOs and private utilities engaged in WASH programmes often *reconcile* their projects and *plans* across the districts. In this way, stakeholders *coordinate* to avoid *imposing* realistic or unrealistic burdens on

each other. The WSDB now plays the role of data repository for water source projects implemented. As stated by Site 2 participant:

> *"The water supply database is a database where all information about water sources in the sector, in the ministry, in the rural areas and the urban areas as well as some little bit of water for production facilities and irrigation system"* (Site 2, November)

I defined *Reconciling Undertakings* as: *a process of stakeholder interaction that involves unison in integrating and undertaking information integrity, accuracy and decisions*. It derived from processes that ensure that information and decisions agreed upon are consistent. I constructed *Reconciling Undertakings* from the fact that stakeholders coordinate and collaborate using WSDB to minimise duplications and *streamline* project implementations. In this way, the WSDB facilitates access to information that is used for *decision* making and new water project *initiating*.

Some stakeholders run their own database systems, and use the WSDB to *reconcile* or *verify* data accuracy. As stated:

> "*you have glaring gaps in the Water Supply Database of the Ministry….most of us we go to it much as we know it is not effective, but we start from there, we use it and then we update in our own ways….Some of the water points when you get them from their and you pick the coordinates that are there, and you plot them like on google maps, you find a water point of Kabarole in Karamoja or in the Indian Ocean*" (Site 12, January)

Figure 38 shows sub-core categories constructing *Reconciling Undertakings*.

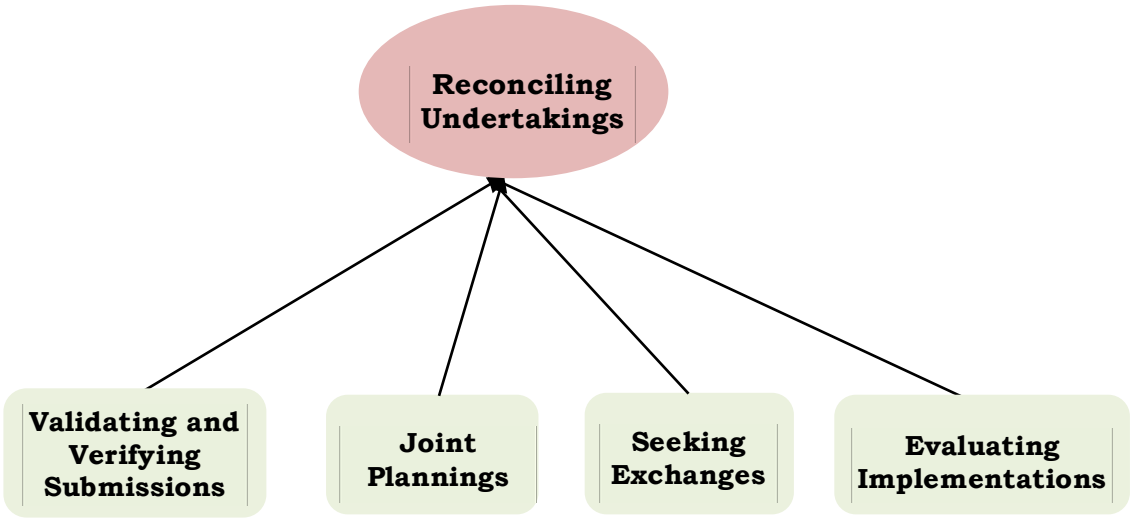


Figure 38: Coded Categories for *Reconciling Undertakings*

The categories depicted in *Figure 38* were built from coding and analytical memos that relate *information-centric* interaction amongst stakeholders to *improving* water sources. The MWE mediates and coordinates *reconciliation* processes using consultative processes like JSR. WSDB provides data, and the fact is stakeholders download and reconcile information for *decisioning*.

5.7.2.2 Policying Assessments

During data collection and analysis, one matter I needed to understand was the effect of WSDB on policy *decisions*. The WSDB is an artefact that has not been fully studied, and my goal was to discover its influence on decision making and policy. So, construction of this category evolved from seeking to understand influence on policy *decisions*.

I defined *Policying Assessments* as: *a process whereby the MWE and stakeholders use WSDB information to make influential decisions that are perceived to have an impact on policies and community water access*. *Policying Assessments* process describes perceptions based on *interactions*, decision making and policy making tailored to meet water source requirements. *Figure 39* illustrates four constructing categories.

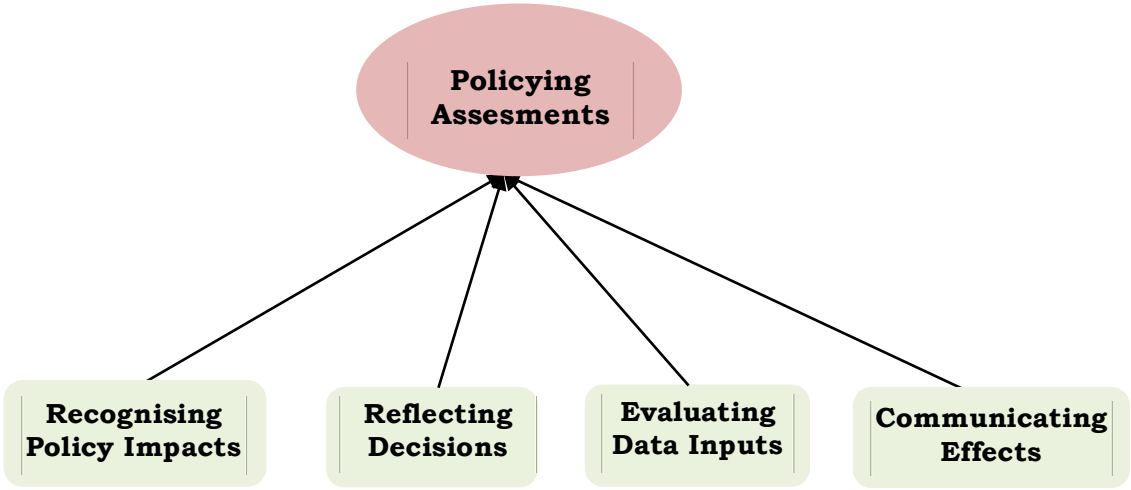


Figure 39: Coded Categories for *Policying Assessments*

Policying Assessments reflects the fact the MWE is *seeking opportunities* to improve decisions made that impact water access and sector development using WSDB. Participants stated that the WSDB is significant towards decision making processes which are developmental.

> "*there was a budget conference in Bunyangabo and they needed information on their coverage…I went to internet café and I went on database because I was in Kampala. Yeah, and I could see Kabarole; data on Kabarole. There is a report, a summarised report showing coverage per sub-county. And I picked information from there and mailed to the people here who are planning for this meeting and they used that data in the meeting*" (Site 11, January)

Forums and workshops meetings are often held, and the WSDB is a significant data source for those forums.

> "*we hold a forum with all our sector stakeholders and in this forum, we discuss the performance of the sector. Now, the performance of the sector is only gauged using data from the Water Supply Database*" (Site 1, November)

Policy-centric categories depicted in *Figure 39* show processes undertaken to develop a *results-oriented* outlook *manifesting* from perspectives about data based decisions. The generated categories depict the notion that the WSDB facilitates data based decisions made that are negotiated and endorsed by stakeholders. Secondly, the categories illustrate the notion that the WSDB

facilitates *prioritisation* of water source projects implemented due to a needs based assessment of specific districts or regions in Uganda.

5.7.2.3 Holistic Collaborating

Since this study focused on providing an understanding of how the WSDB use has influenced sector growth, the concept of *collaborating* among stakeholders is noted. Stakeholders known to the MWE are given access to WSDB's functional components. All interview participants had access to the WSDB, and although their access levels differed, they were all in a position to provide good insights about WSDB. From analysis, I conceptualised *Holistic Collaborating* from stakeholder interactions.

I define *Holistic Collaborating* as: *a process that entails all stakeholders engagements using WSDB data to plan, develop and initiate water supply projects*. Private utilities, donor agencies and NGOs are allowed to construct water sources; and the MWE harmonises or communicates projects using DWOs to submit functionality data. Joint workshops and meetings are used to discuss collaborative engagements, as stated by a participant at Site 2:

> "*Every end of financial year, around September/ October coming to the end of the year; We hold a forum with all our sector stakeholders and in this forum, we discuss the performance of the sector. Now, the performance of the sector is only gauged using data from the Water Supply Database. Of course, as well as other smaller databases of the NGOs data and whatever. But the main is the Water Supply Database*" (Site 2, November)

The MWE is very much focused on ensuring the *holistic* execution of water supply projects in order to increase access to water supply and grow the water sector. The WSDB is central to all the *holistic collaborations*.

Holistic Collaborating is cultivated from coding perspectives that describe *data sharing* and *symmetrical* or *asymmetrical* form of *coordination* and *collaborative* mechanisms by all stakeholders. *Symmetrical Engaging* is a regular processes of engagement which occurs between vital stakeholders.

While *Asymmetrical Engaging* is an irregular process that occurs with stakeholders whose engagement is lax or negligent. *See Figure 40* below.

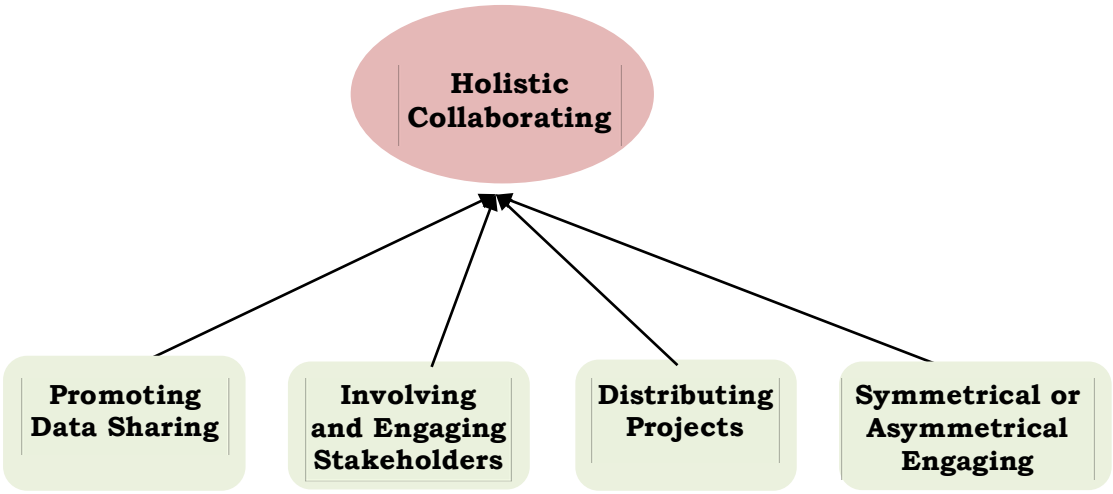


Figure 40: Categories constructing *Holistic Collaborating*

Figure 40 depicts concepts cultivating *Holistic Collaborating* grounded from descriptive participant perspectives. I constructed *Holistic Collaborating* from four categories and analytical codes that explain MWE seeking *Symmetrical Engaging* with all stakeholders to accomplish mutually beneficial development goals in the water sector.

5.7.2.4 Summary of Validating Developments

Preceding sub-sections under *Validating Developments* give an explanatory understanding of verifications. PI outlined jointly during stakeholder interactions represent scope within which development is defined. Using WSDB, the MWE and stakeholders make collective decisions about the future of the water sector; and these decisions are based on PI and projects implemented. WSDB influence represents the scope which is most relevant, and augments understanding of validated developments.

Validating Developments emerges from numerous categories and concepts that provide basis for understanding WSDB influence. Sub-core categories *Reconciling Undertakings*, *Policying Assessments* and *Holistic Collaborating* allowed discovery of *Validating Developments* as primary sub-core category.

As stated earlier, I relied on data interpretations to construct *Validating Developments*. Interpretations gave meaning towards substantiating sector development. *Validating Developments* occurs when WSDB is used to set PI; which then asses development using themes such as improved water access, functionality, equity of water supplies, per capita investment cost, water quality, water storage, gender and management.

However, not achieving all PI does not mean that the growth has not been experienced (MWE, 2016, 2018). Indicators are different but they are all contributory. The fact that some stakeholders do not use WSDB does not mean that they do not consent to PI. PI's are negotiated upon using data from WSDB and other databases.

On reflection, I constructed *Validating Developments* as a primary sub-core category from analytical memos and coding processes that represent use of the WSDB information to set PI and authenticate developments.

5.7.3 Infrastructuring

Because WSDB influence is the subject under exploration, I interpreted participant descriptions about WSDB *design*, *implementation*, *usage*, *evolution* and *sustainability*; and how they relate to *planning* and *decision making*. The sub-core category *Infrastructuring* was constructed as a process that examines WSDB design significance. I define *Infrastructuring* as: *a WSDB component design processes of creating support infrastructure which is significant towards data management and data provision*.

The MWE envisioned WSDB as a technological *amplifier* for sector development. Toyama (2011, p. 75-77) asserts that "*technology projects in global development are most successful when they amplify already successful development efforts*" and that "*technology is merely a magnifier of underlying human and institutional intent and capacity*". The MWE envisioned WSDB as an IS that tracks data from all districts in order to make accurate data based decisions that impact water sector development.

Infrastructuring represents an assessment of design and theorisation features of WSDB. To evaluate WSDB influence, an understanding design, implementation, usage and evolution was required because the MWE is still improving it for *data access* and *decision making* process. I discovered that:

1. The WSDB was designed by a private IT firm, which is majorly responsible for modular changes and technical problems that are often required from time-to-time. As cited in transcript below:

   "*We engaged a private firm; a company to do the design…we drafted terms of references, sent them out, the companies had to bid for the work and evaluation was done. And then the best evaluated bidder got the assignment to design…but it is also a company that has been in the water sector for a while*" (Site 1, November)

   "*The ministry engaged consultants; gave them whatever is required and they did the design of the water supply database. So, it was designed by the private sector*" (Site 2, November)

   "*Stakeholders and users where involved in its design because it went through the classical stages of a consultancy where you present your conceptual whatever design and then they are vetted and then your given feedback; what/ how the system should be; what the users expect in terms of requirements, in terms of what data, what reports the system should generate. So, the users and the rest of the stakeholders where involved in its design*" (Site 2, November)

2. After WSDB implementation, staff at the MWE were trained to use it and the MIS-Unit plus ICT were given higher priority for technical training.

   "*So, we've tried as much as possible to train the districts especially our district staff to know how to use the database. But certainly, I would imagine that the public might not be able to use all the features of the system unless they are trained*" (Site 2, November)

3. WSDB access was made free to the public and all stakeholders, but data entry functions were set for MIS-Unit or ICT staff.

   "*The users, I would say everybody has access. Specifically, the users that were targeted are the districts because we realized that the districts actually need to access*" (Site 2, November)

"*Other users; the NGO's are using it allot, the donors are using this water supply database allot, the general public is also interested in knowing what facilities are in our area; they also can access it*" (Site 2, November)

Figure 41 shows emergence of *Infrastructuring* from secondary categories.

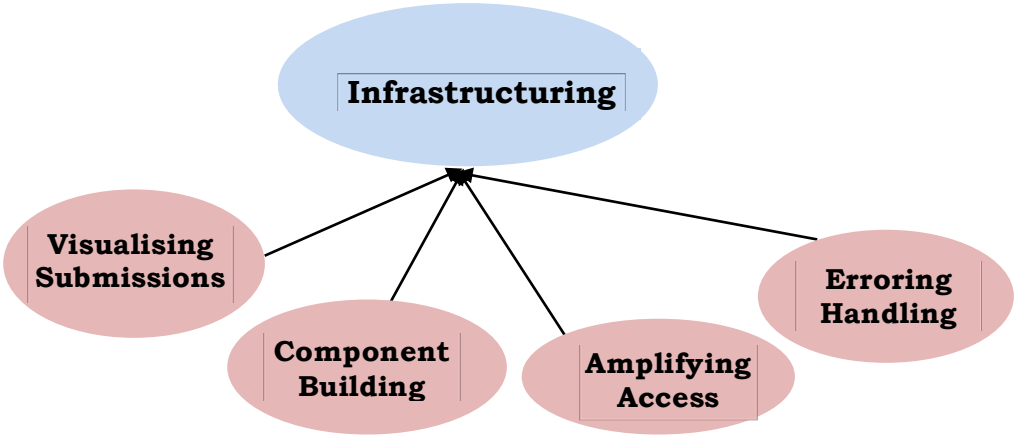


Figure 41: Secondary sub-categories under *Infrastructuring*

Table 20 presents construction of *Infrastructuring*.

No	Summary of Theoretical Memos	Conceptual Codes	Secondary Sub-Core Categories	Primary Sub-Core Category
1	Stakeholders access and view WSDB to verify data validity. This process aids in developing new functional requirements if data is not generated as needed	Reports Generating, Displaying or Viewing all data, Augmenting data submissions, Ascertaining data validity	Visualising Submissions	**Infrastructuring**
2	New modular components for the WSDB are developed based on suggestions from stakeholders, partners and MWE staff.	Refining system Requirements, Implementing and Testing designs, Evaluating designed Modules, Training users, Seeking Funding	Component Building	
3	The MIS-Unit at MWE gives WSDB access to	Administering WSDB operations, Mediating or	Amplifying Access	

	all stakeholders. The public have limited access to data such as statistics about the water sector	Authorising use, Sharing to Contrast, Promoting WSDB Use		
4	WSDB technical challenges are often managed or corrected through MIS-Unit by the developers	Managing Technical Problems, Ensuring System functionality, Executing Errors, Validating data Integrity	Erroring Handling	

Table 20: Codes and categories constructing *Infrastructuring*

Categories cultivating *Infrastructuring* highlight WSDB *implementation*, *design* and *usage* with respective elements that these processes detail. *Infrastructuring* constitutes a representation of how MWE is continually *evolving* new functional *requirements*. Designed *components* are planned based on new data requirement and how they should be analysed. Stakeholders can contribute new *conceptual* requirements.

The next sub-sections explain categories constructing *Infrastructuring*.

5.7.3.1 Visualising Submissions

A core significances of the WSDB is capability to *retrieve*, *visualise* and *prepare* documents easier and faster compared to manual processes. *Visualising* data from all over Uganda in one central location presents an enormous potential for good *decision making*. I confirmed that participants often or *sporadically* used the WSDB to access data about their individual districts and the entire country.

Since the WSDB provides a central information source, *centralisation* was a starting point towards understanding its influence perceptions. Participant description of usage activities guided me towards discovering *Visualising Submissions* as a sub-core category describing processes of intelligent data

access. Data is visualised to validate accuracy using functions like GPS coordinates.

I defined *Visualising Submissions* as: *a process of creating increased credence towards WSDB use through increased engagement towards improved data validity*. Increased endorsement by stakeholders is enhancing use and acceptance. As stated:

> *"Our biggest users are actually the districts….other users; the NGO's are using it allot, the donors are using…the general public is also interested in knowing… they also can access it and it is very easy when you click on it"* (Site 2, November)

The MWE involves stakeholders to use and validate its data.

> *"they engage even Non-Government People. Recently they came in; it could have been October there. They came and they wanted an update. They wanted people to correct the wrong information and also to update"* (Site 12, January)

In brief, increasing WSDB credence, access, *validation* and data viewing processes is what I categorised as *Visualising Submissions*. *Figure 42* presents constructing *Visualising Submissions*.

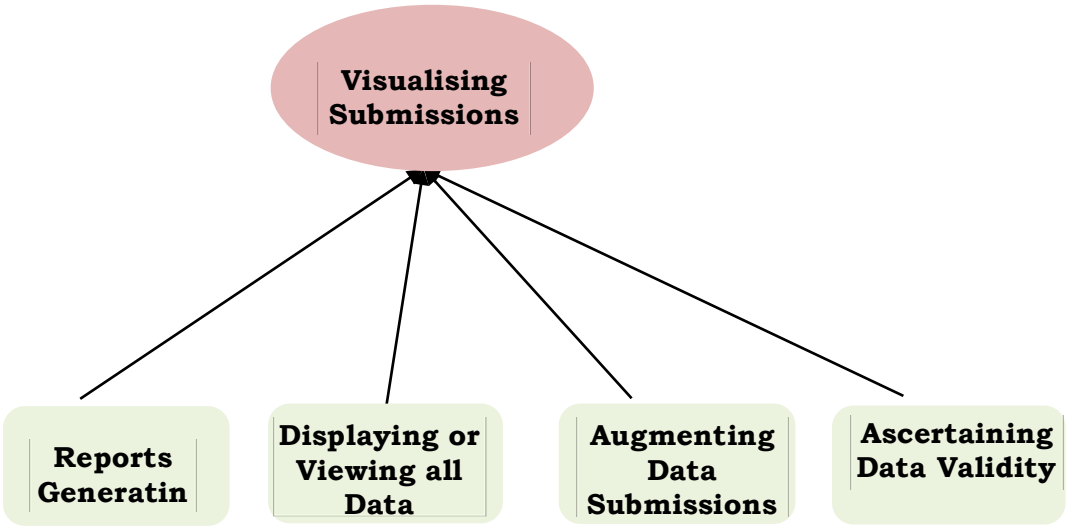


Figure 42: Codes and categories generating *Visualising Submissions*

Visualising Submissions is constructed using concepts related to WSDB credence and increased use despite some concerns.

5.7.3.2 Component Building

Besides use, continued WSDB *evolution* has facilitated improved procurement of information. I discovered that WSDB has been undergoing new modules or *component* design. These include planned and unplanned modules based on new data requirements or priorities suggested to improve WSDB *functionality* and capabilities for *decision making*. The modules support data analysis concepts such business intelligence, graphs and charts that enhance use.

I conceptualised these modular changes under sub-core category *Component Building* which is *a process ensuring WSDB designs are planned and executed so that information-centric decision making is realised*. As stated:

> "*We developed something then we started using and then where they were gaps, we have continued to; even now it is still a product in development*" (Site 1, November)

> "*It's more like an in-house thing that is continuously growing and transformed with more modules and even more components, more features*" (Site 1, November)

> "*more components, more features, more reports, customizing depending on the changes and the requirement of the users*" (Site 1, November)

Figure 43 illustrates five categories constructing *Component Building*.

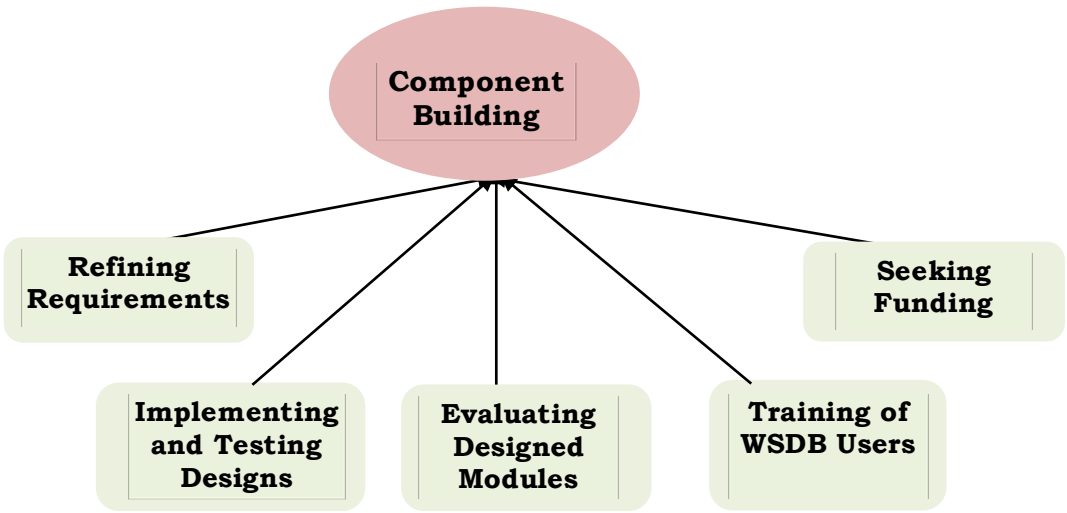


Figure 43: Categories constructing *Component Building*

Component Building was generated from interpreted understandings of module descriptions; and how WSDB *evolutions* is influencing adoption. The resulting notion is that of subsequent growth of WSDB acceptance and continued significance.

5.7.3.3 Amplifying Access

Because this study's focus is provide an understanding of WSDB influence, the simple thought of exploring how it has *enhanced* information access required strong consideration. To promote WSDB use, the MWE provides limited free access to the public; while stakeholders get privileges to access more functions. The MWE has been encouraging WSDB access and usage so stakeholders can contrast data with their own databases.

Using increased WSDB access as my vantage point, *Amplifying Access* emerged as a secondary sub-core category. *Amplifying Access* is *a process that entails availing WSDB access to stakeholders ensuring accurate data provision to amplify uptake*. This in turn would increase stakeholder *engagement* and *coordination* through *data sharing* so that any crises are well managed.

Participants provided excellent insights of how the WSDB has *amplified* data sharing and integrity despite different access levels. As stated.

> "*We have given access to the districts, we have given access to the NGOs in the water sector, we have given access to the public…just that the level of access defers for security reasons…So those are the users. Even you if know the URL you can go there as guest and you will be able to see some information. The districts also have their own credentials that they use to access the system*" (Site 1, November)

Figure 44 shows four conceptual categories constructing *Amplifying Access*.

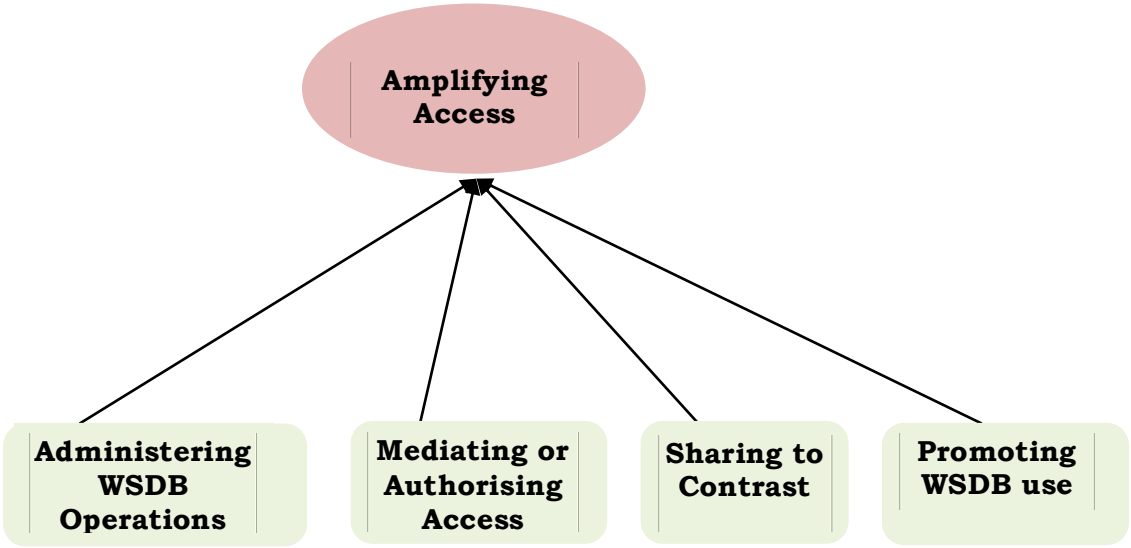


Figure 44: Concepts for *Amplifying Access*

The four conceptual elements manifested from interpreted understandings about *enhancing* access. The resultant concept is that increased information access and *sharing* enhances *decision making*. The WSDB is now used by MWE to plan future projects and set policy; as stated below.

> "*every time the rural department even Water For Production, if they are going will first come and say we want to see which areas are not well served, or which areas are do not have water sources at all, and then your able to see. Even decommissioning some of the sources, the system is able to produce and say this water source last produced water maybe six or seven years ago. But of course, like any other system it also has its own limitations*" (Site 1, November)

5.7.3.4 Erroring Handling

To understand the WSDB significance, I had to understand issues to do with *performance*, *reliability*, *robustness* and technical functionality because they ensure consistent information access. I asked participants about *operational* challenges. This enquiry cultivated the secondary sub-core category *Erroring Handling,* under *Infrastructuring*. Challenges to functionality are related internal system errors due software failures and human mistakes.

I defined *Erroring Handling* as *the daily process of ensuring WSDB operation which entails managing system errors or challenges such that stakeholders get the information needs*. *Figure 45* shows four conceptual categories constructing *Erroring Handling*.

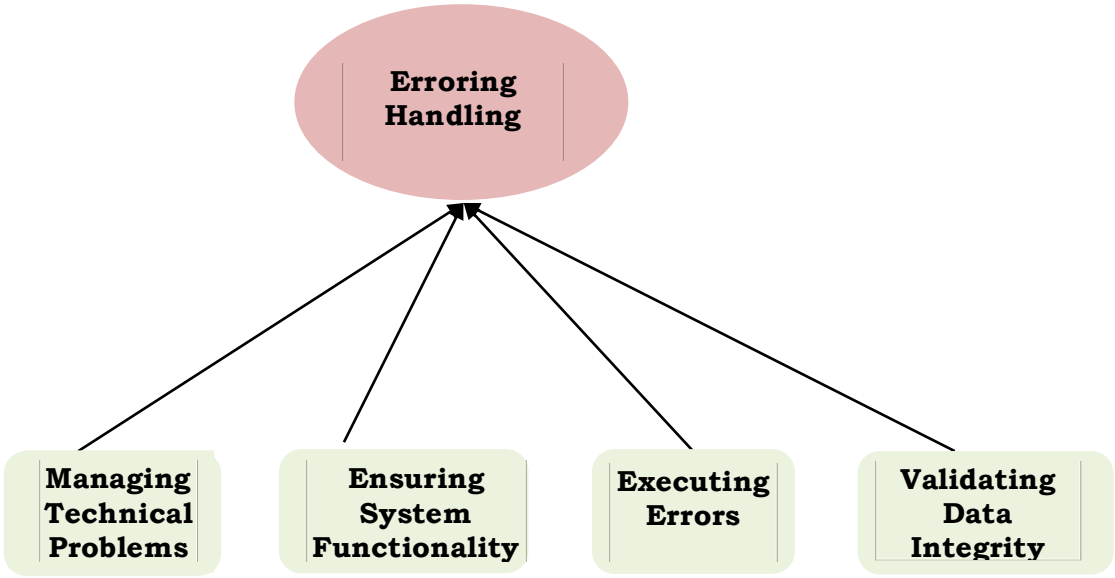


Figure 45: Categories for *Erroring Handling*

Participants explained challenges of *managing* WSDB under *infrastructure* issues which I related to *evolution*, *use*, *sustainability*, *hosting*, *internet* and *electricity* access issues. As stated:

> "*we've not been able to host it internally. We are currently paying a service provider to host the application. Reason being, we want the system to be as available as much as possible. So, whenever we have a problem with our internet at least the application will always be available, whenever we have a problem with power (electricity) the application will be available*" (Site 1, November)

> *"The other one is when our internet is slow, then data entry also becomes a problem. When we do not have internet then data entry cannot be done if we don't have internet here. We still rely on internet to do data entry*" (Site 1, November)

As for internal system errors, these occur but managing WSDB downtime is an ultimate prerequisite. Hunt & Thomas (1999) make the following software engineering quote "*You can't write perfect software... because perfect software doesn't exist*". As Site 2 participant with technical role explained.

> *"the requirements keep changing. That is a problem for the developer",..."but also the gaps have been many and some features you find they are not working as expected. So, we keep having you know back and forth. This is not working right, the computation here is not okay. So, that also proves to be a challenge"* (Site 2, November)

Erroring Handling postulates how daily WSDB functionality and management ensures system and data are always available for decision making. This allows for theorisation on concepts that make WSDB exhibit its significance to sector development.

5.7.3.5 Summary of *Infrastructuring*

During the investigations, I realised that few people are involved in WSDB management and component design decisions. Participants involved in functionality issues incorporate managing data *submissions*, system *access*, component *implementation* and technical challenges. Summarily, I conceptualised functionality and management procedures under sub-core category *infrastructuring*.

Infrastructuring provides an understanding of WSDB functionality and evolution so that the MWE achieves information its requirements. Using participant perspectives, the secondary sub-core categories *Visualising Submissions*, *Component Building*, *Amplifying Access* and *Erroring Handling* allowed for the discovery of *infrastructuring* as a primary category. Interpretations of participants views guided category manifestation.

One positive is the WSDB is accessed by many stakeholders for information. Secondly, the WSDB is continually *evolving* with new requirements added, and continued management is ensuring circadian access to required data.

Finally, all WSDB properties constructing primary sub-core categories *infrastructuring* represent its theorisation.

5.7.4 Sanguine Orientating

Thus far, it was clear that most participants have positive views about the WSDB. The few mixed views were optimistic that their *discontents* were being resolved slowly. As stated by a Site 12 participant in sub-section *5.7.2.1*, data integrity issues were the major reason for mixed views. They were often *validating* data before use. I discerned some positive views about MWE positioning the WSDB as a *central* IS for the water sector.

I constructed the primary sub-core category *Sanguine Orientating* as a process perceived by participants from WSDB *positioning* and mixed views. I defined *Sanguine Orientating* as: *a process of increasing belief among stakeholders in WSDB's ability to provide accurate data and its positioning*. *Figure 46* illustrates sub-core categories constructing *Sanguine Orientating*.

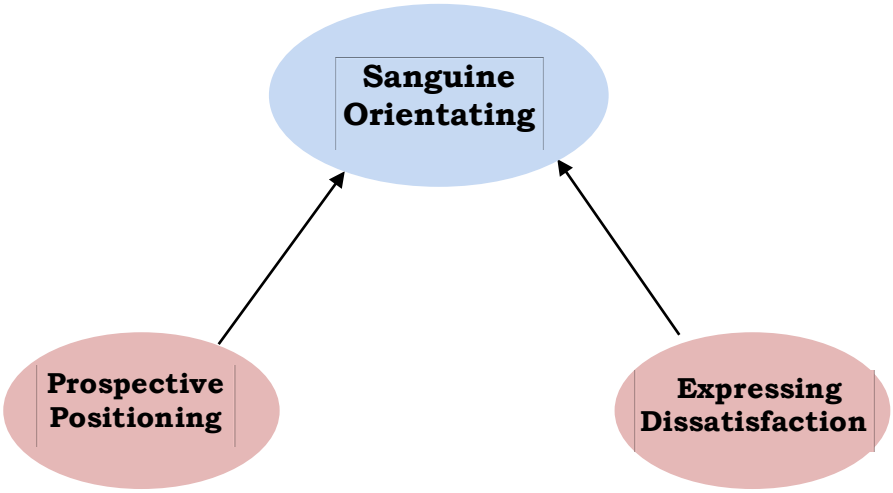


Figure 46: Sub-categories cultivating *Sanguine Orientating*

Table 21 presents categories and processes constructing *Sanguine Orientating*.

No	Summary of Theoretical Memos	Conceptual Codes	Secondary Sub-Core Categories	Primary Sub-Core Category
1	Participants stated how the felt about MWE positioning WSDB and why they agreed that its centralisation is important towards	Identifying Contributions and Opportunities, Managing System Evolution, Training Users on Potential, Enthusiastic	Prospective Positioning	**Sanguine Orientating**

	ensuring data integrity and accuracy	Coveting by Participants		
2	Discontentment and mixed views were expressed by some participants, especially issues such as data integrity and lack of computers or internet to access WSDB daily	Disenchanting WSDB descriptions, Describing Non-Access Reasons, Venting Data Integrity Issues, Demanding for more support	Expressing Dissatisfaction	

Table 21: Conceptual categories of *Sanguine Orientating*

5.7.4.1 Prospective Positioning

Although all participants claimed to use the WSDB, I witnessed usage only at the MWE headquarters. I observed data entry using manual data forms submitted by DWOs and TCUs. I witnessed discussions or deliberations among data entrants. This observational experience and subsequent interviews allowed me to discover centralising views. Perspectives were surmised from concepts that included WSDB's centralised *positioning*, *enthusiasm* about its *significance* on data *submission*, its discreetly managed growth over the last five years and *optimism* about its influence towards development based on good decision making.

I defined *Prospective Positioning* as *a process of increased acceptance in WSDB potential to influence development based on benefits and adoption*. I constructed *Prospective Positioning* as a secondary sub-core category that describes *enthusiasm*, *positioning* and *potential* of WSDB to influence development. *Figure 47* presents categories under *Prospective Positioning*.

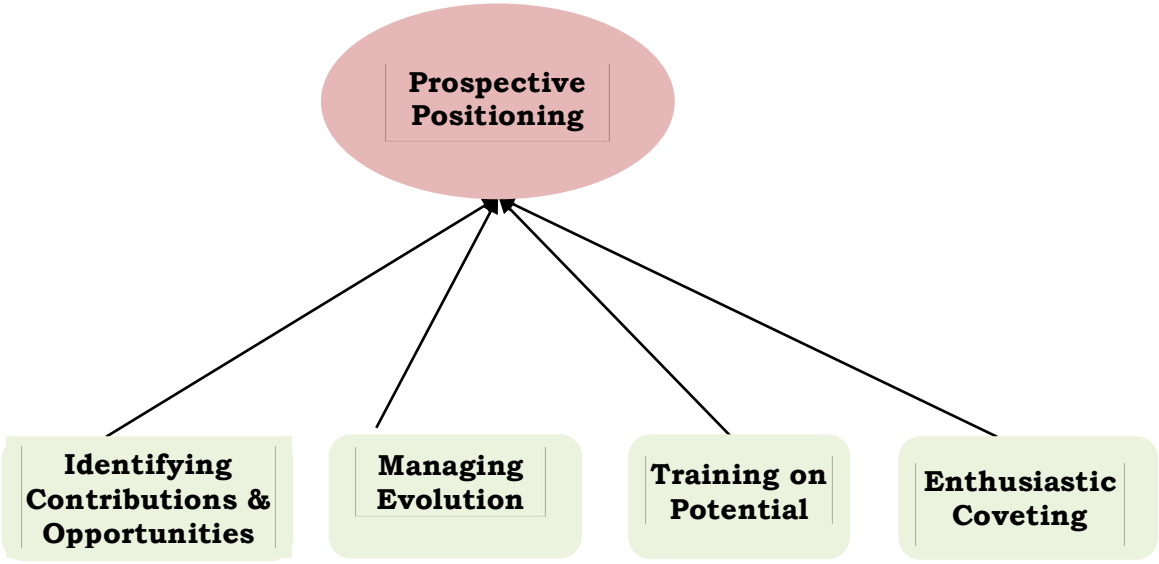


Figure 47: Sub-core categories constructing *Prospective Positioning*

One goal of the MWE positioning the WSDB is to have a centralised data source that provides accountability and transparency. As stated by participants being *able to*:

> "*filter through and see the various reports that are on that system. For example, how many water sources are in the particular sub-county, how many of them are functional as per the system*" (Site 1, November)

Participants were enthusiastic about the WSDB, and have good perceptions.

> "*Yes, they are happy about it, they believe the statistics and those who have participated they know that they are not statistics that you know somebody sat under the tree and produced or cooked, no. The perception I would say, generally it is good. Because it helps them look up those statistics, allocation of resources and yes even access to information. Because it is them it guides them when it comes to planning*" (Site 1, November)

> "*I don't know about out there but in the building, it is good. I would say, not good but very good*" (Site 1, November)

Personal access to the WSDB showed me the kind of information I could download. Although some participants were disappointed with intermittent access, especially those without computers in their offices; participants still appreciated its significance to data provision and planning.

5.7.4.2 Expressing Dissatisfaction

Although there is much enthusiasm about WSDB potential, *dissatisfaction* was expressed by participants who stated that they seldom use the WSDB. I identified data integrity issues which do not reflect real time functionality of water points, computer access, poor internet access, poor electricity coverage and average computer literacy skills as reasons for *disenchantment*. Site 12 participant stated:

> "*Because all of us we try to align by the Ministry but the Ministry is not giving us what we expect. Periodically they used to update. The Ministry has largely a manual system and they are just beginning to embrace ICTs*" (Site 12, January)

> "*When you use…then you have such terrible errors it's so annoying….you have glaring gaps in the Water Supply Database of the Ministry….most of us we go to it much as we know it is not effective, but we start from there, we use it and then we update in our own ways*" (Site 12, January)

While looking for reasons to illuminate *disenchantment*, I conceptualised the category *Expressing Dissatisfaction*, and defined it as: *a process whereby participants convey discontent so that improvements are effectively made*. Such disgruntlements make for enhancement of WSDB integrity and functionality for *decisioning* process. See *Figure 48* below.

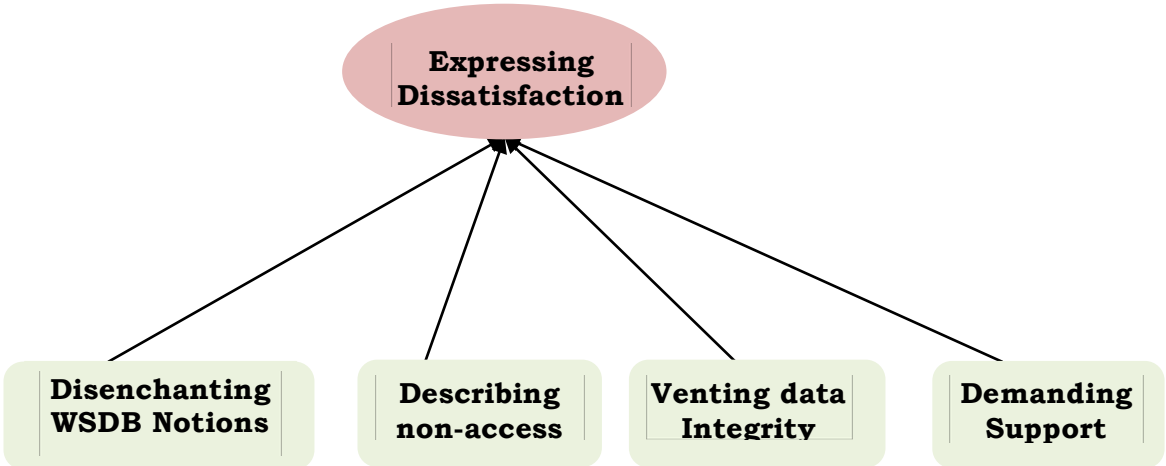


Figure 48: Constructing *Expressing Dissatisfaction*

Some participant stated that the MWE is forcing WSDB use without proper notification and resolution of its limitations. Participant stated:

"*You have glaring gaps in the Water Supply Database…and the problem is they don't have all the information under for water points. The numbers and whatever are allocated by Water Resources in Entebbe*" (Site 12, January)

"*So there are many challenges; I think but yet it is government you know for us we believe you can't replace government and you only have to complement government*" (Site 12, January)

Some participants stated preferences to use their own ICT systems, although they check WSDB to compare data about specific regions.

"*But we are still challenging them to work with a system with minimum error. FLOW is a system with minimum error because for it you keep on updating, you go back to the same water point and you can be able to tell the differences, the changes, the number of people and so on.…Actually for monitoring that Water Supply Database, if it is integrated maybe like with FLOW such that those errors are eliminated*" (Site 12, January)

"*Now there is a new system that has been developed by PRACTICA. PRACTICA, they have piloted boreholes, their metered boreholes but they have an online platform. HEWASA, it is Health Through Water and Sanitation and then there is Joint Effort to Save the Environment, JESE. They are two local NGOs for water. So PRACTICA passed through them to do this*" (Site 12, January)

Participants not from the MWE stated that they did not have the capability to change inaccurate information reflected in the WSDB; and it often took long for errors to be fixed. This reflected loathsome feelings.

"*Actually during that training of April, of October they came with GPS's and they said people you go and collect this information. People were reading wrong Eastings and wrong Northings. Because of the way they are written and these are people who have been collecting the information. But yes still, to the level of the user, the M4W was the only platform that would empower a user to use ICT in order to communicate a need*" (Site 12, January)

Even though some participants stated that they were regular WSDB users, I never saw them use the system. Certainly, Site 9 participant stated that their deputy uses the office computer to download WSDB reports. But since

they make quarterly data submission to the MWE, they do not often use the WSDB because they have required information about their district.

Although some participants expressed dissatisfaction, no one rejected WSDB outwardly. Rather, those that expressed some dissatisfactions wanted WSDB limitations improved, and some of their suggestions included provision of computers, internet, training and data entry possibility.

5.7.4.3 Summary of Sanguine Orientating

Sanguine Orientating represents enthusiasm and discontents about the WSDB being positioned as a central IS. The most significant benefit of the WSDB is increased data submission. Submission of water source data from all districts jumped to over 96% due to the WSDB influence (MWE, 2014).

Sanguine Orientating illustrates successes and optimism about influence and challenges. The lack of data integrity is one such dissatisfaction expressed because it does not reflect real time conditions which can affect decision making. WSDB dissatisfaction emerges from data integrity issues.

During analysis, *Sanguine Orientating* was constructed from conceptual codes and categories that reflect participant views about consequences or effects of its positioning. Categorisation represented holistic views about WSDB significance and its challenges or limitations.

Finally, no matter the limitations or criticisms, participants backed the WSDB. They all expressed support for its continued improvement. I could not find any participants suggesting discontinuation. They absolutely recognise WSDB contribution, potential and influence.

5.8 Evolution from Data to Conceptual Categories

Since I was conducting a study following CGT tenets, I critically focused on its intrinsic fundamental processes that lead to discovery of theory from data. It was crucial that I remain open, with no predetermined ideas to uncover perspectives or concerns. Glaser (1998) asserts that CGTM research

aims to uncover what is going on, and lets concepts emerge from meanings and interpretations manifested from generated data. I followed principles that allow for data conceptualisation like theoretical sensitivity and writing notes or memo.

Glaser & Holton (2004, p. 11) state that researchers must "*have the personal and temperamental bent to maintain analytic distance, tolerate confusion and regression while remaining open, trusting to preconscious processing and to conceptual emergence…He/she must have the ability to conceptualize and organize, make abstract connections, visualize and think multivariately*"

During the study, the initial phase of evolution from data to concepts entailed writing and analysing notes or memos instantaneously during and after each interview, and then transcribing interviews. As similarly articulated by Glaser (1998) and Montgomery & Bailey (2007), memos recorded my developing thoughts or ideas about codes or categories and their interconnections; and were significant in transforming field-notes into theoretical interpretations. The process disclosed substantive codes and categories that were significant for theorisation.

The next phase entailed figuring out codes emerging as core concepts so that the next interviews would focus on theoretical codes. The stage involved changing from substantive codes to theoretical codes. This process is called theoretical sampling. Glaser & Holton (2004, p. 13) explain theoretical sampling as a "*process of data collection for generating theory whereby the analyst jointly collects, codes and analyses the data and decides what data to collect next and where to find them, in order to develop the theory as it emerges*".

I compared, sorted and saturated codes during theoretical sampling; and decided which core codes will be used for subsequent data collection. I adjusted control of data collection to ensure data relevance to the core category and emerging theory. Theoretical sampling allowed delineating of codes to occur, hence specifically focusing on the theoretical code that

accounts for the most data variation. The core category manifested from the theoretical code, although this process yielded more than one candidate.

Three theoretical codes emerged as potential candidates for core category. The first code was *Prospective Positioning* which I described as a process of creating acceptance in the potential of WSDB due to its perceived influence. Conceptual characteristics of *Prospective Positioning* included *Recognising* WSDB potential; *Training* stakeholders on use and benefits; *Creating* and *promoting* stakeholder partnerships for adoption; Acknowledging *dissatisfaction* and availing *solutions*; and *Sourcing* funding to build desired modules that continue to promote WSDB significance.

The second code was *Validating Developments* which I defined as a process that adopts WSDB to set PIs to validate growth. Theoretical properties under *Validating Developments* include *Identifying* projects implemented and their *functionality*; *Symmetrical* and *asymmetrical* collaboration with stakeholders; *Reflecting* on policy influence; *Reconciling* accomplishments; and *Reflecting* on water access, quality, and annual investments.

After meticulous consideration, *Optimizing Perspectives* emerged as the only candidate for core category after sorting and comparing theoretical codes. It emerged as a consequence of participant's expressing their perspectives about WSDB. Optimism about the WSDB benefits is significant towards perceived development influence; and it became palpable that this sanguinity was recognition of MWE's effective WSDB use to enhance performance. Due to repeated sorting, comparing and recursive analysis of concepts, I cultivated *Optimizing Perspectives* theoretical code. *Optimizing Perspectives* provided the best explanation for variation in the data, and recognises the persistent activity of effective WSDB use to manage water sector operations for enhancing development. *Optimizing Perspectives* was parsimonious enough, and all data fit perfectly into it as core category.

5.8.1 Discovery of Theoretical Codes from Substantive Codes

I used my intellectual aptitude and sensitivity to achieve data analysis from low level contexts to higher level conceptual narratives that built theoretical understanding and theory. Initially, it was important to understand the difference between theoretical codes and substantive codes. Glaser & Holton (2004) explain that substantive codes emphasise which data researchers consider important and expose patterns in data; while theoretical codes conceptualise how substantive codes relate to each other. Theoretical codes arise from synthesis of substantive codes, and this amalgamation supports writing about concepts and their interrelations.

Because the core category is any kind of theoretical code discovered, both substantive and theoretical codes represent building blocks for *Optimizing Perspectives*. In this research, I used various names which include *core category*, *sub-core category* (primary and secondary) and *category*. Other conceptual naming used in CGT include *core variable* or *sub-core variables*.

In preceding sub-sections, I explained *Optimizing Perspectives* as emerging from open coding and higher abstract concepts categorised under secondary and primary sub-core categories. Numerous codes generated at lower abstract conceptual levels were significant. Codes reflect perceptions regarding WSDB influence coupled with data integrity concerns. The perceptions combined with interplay steps taken to present WSDB benefits and concerns is embodied by codes, categories and sub-categories. *Figures 29-30* and *Appendix A.5* depict codes and categories constructing *Optimizing Perspectives* as core category and substantive theory.

I elucidated *Optimizing Perspectives* in terms of BSP because analysis processes manifested its construction. BSPs are processual theoretical codes that account for the most data variation, and generate theory through multiple emergent stages (Holton, 2008). BSP interconnects theoretical and substantive codes created through a hierarchical process explicating

Optimizing Perspectives emergence. The primary and secondary sub-core categories of *Optimizing Perspectives* succinctly explain this interconnection.

Without data, it is impractical to perceive WSDB development influence. I recognised the information cycle process in explicating WSDB significance. The WSDB use and its significance support *Optimizing Perspectives* to explicate its effectiveness for sector enhancement. I related theoretical and substantive codes generating *Optimizing Perspectives* using the categories.

During analysis, I classified the *information-cycle* under theoretical process *Visualising Submissions*. The process emerges from increased WSDB endorsement because of improving data integrity and use; and the augmented data submission processes are sustaining data validity and stakeholder adoption of WSDB.

Thus, *Optimizing Perspectives* emerged as a theoretical explanation of perspectives regarding MWEs positioning and recognition of the WSDB's influence on decisions about development. *Optimizing Perspectives* reveals recognition of performance targets achieved due to WSDB. Categorised abstract concepts rationalise WSDB's perceived influence on development.

Theoretical and substantive concepts constructing *Optimizing Perspectives* reveal several characteristics encapsulated from data analysed, and the properties manifest as categories. At the core is a conceptual interpretation of data regarding perceptions about WSDB influence. Concepts constructing *Optimizing Perspectives* are classified under primary and secondary sub-core categories that are recursive BSPs.

I perceived cultivation of *Optimizing Perspectives* as building a multivariate (*involving several categories or variables*) concept with several dimensions that account for multiple variations from the data. Lower level hierarchical codes represent categories at a more abstract concept; while mid-level hierarchy represent specific categories that meticulously relate to multi-dimensionality of *Optimizing Perspectives*. Secondary categories build primary sub-core categories which are at a higher hierarchical level. The

categories are distinct, and yet related based on patterns or variations in data used for generating the core category. They are conceived as multivariate categories. The categories are the main sub-processes developed from data grounded in participant perspectives.

Sub-core categories are key features for constructing *Optimizing Perspectives*, and are intrinsically related to data. Critical to emergence is conceptual data analysis, and the core category emerges from a series of activities or processes. *Optimizing Perspectives* represents explanatory understanding of WSDB perception, and theoretical or substantive concepts generated are representative of how it emerged from category features. Theoretically, *Optimizing Perspectives* reflects perceptions about attained or unattained progress. All categories, processes and sub-processes that cultivate *Optimizing Perspectives* abstractly contribute to explaining WSDB influence.

5.8.2 Evolution from Core Category to Substantive Theory

Discovery of *Optimizing Perspectives* is deliberated in previous sections which reflect explanatory understandings of the theory. The core category was discovered from interpretation of data while undergoing ensuing processes such as line-by-line coding, category generation, theoretical sampling and constant comparison. The emergent substantive theory exemplifies how knowledge is created from theoretical analysis of data using subsequent CGT methods and transposable indictors or concept properties.

Optimizing Perspectives entails determined activities for effective management of water sources by the MWE and stakeholders. This entails use of WSDB to facilitate information sharing and decision making. *Optimizing Perspectives* embodied latent pattern discovered from data and in accordance with the following concepts.

1) It is the most relatable interpretation and connotation for all data elements or categories when compared

2) It is a justifiable understanding or conceptualisation of an interplay between WSDB deployment and elucidated sector development
3) As the best explanatory description of participant perspectives and data categorisation
4) Consequence of a data coding processes that cultivate a '*superlative*' account of participant perspectives. *Optimizing Perspectives* is most succinct explanation, and best fit for categorisation.

Essentially, *Optimizing Perspectives* epitomises manifestation of perspectives that were coded and categorised; and as a core category it accounts for the most representative meaning and data variation while reflecting upon processes that the MWE engages with to manage the sector.

5.8.3 Exploring Substantive Theory

Optimizing Perspectives emerges as the main perspective explaining how participants make effective WSDB use; and it is generated from other categories and their properties. *Optimizing Perspectives* as core category develops into substantive theory, and only categories related to the core category are included in theory. As substantive theory, it comprises of several constructing elements which include primary categories, secondary categories and several codes that cultivated categories. *Appendix A.5* and *Figures 29 to 30* explicate theory in a more illustrative structure. The diagrammatic illustrations present processes and encapsulated categories at different levels of abstraction for conceptual relations.

Categories constructing theory are related because they emerge from the same data, which I analysed around the same research problem - *How do people perceive influence of the WSDB on development in the water sector*? – The question allowed me to organise all data conceptualisations in related groupings. As explained previously, I compared codes and categories during coding, and CGT processes followed (see *chapter 4)* subsequently related or linked concepts. The codes yielded categories, which in turn yielded core category and finally the theory.

Indeed, moving from low level abstract code level to a higher level of sub-core categories was an absorbing and fascinating process, from which constructing theory is understood due to theoretical connections between concepts and data. Emerged codes and categories followed an inductive and interpretive thinking process from which the theory was cultivated.

5.9 WSDB's Current Status

Contexts about WSDB which I obtained from participants provided me with a substantial research setting where I could examine perceptions about its influence. No previous studies have been undertaken about the WSDB since its implementation. This research focused on perspectives about influence perceptions on sector performance plus design, implementation, usage, adoption, positioning and challenges. Although my objective was not to evaluate MWE performance based on WSDB, I was conspicuous that my views would lead to it due to optimistic and pessimistic participant views. The findings constituted expected and unexpected notions informing WSDB and its sustainability.

Currently, the MWE is committed to WSDB evolution due to its positioning as the main data repository. The MIS-Unit ensures continuous WSDB functionality as stated below:

> "*The water supply database is a database where all information about water sources in the sector, in the ministry, in the rural areas and the urban areas as well as some little bit of water for production facilities and irrigation system is stored*" (Site 2, November)

> "*It has of course undergone several stages of development….Actually, as I speak now it has just been, the architecture and the structure and the information requirements have all been sort of like enhanced. Even the visual aspects, the user interface has been changed. All the graphics, the graphs; and all these things they have been enhanced to make it more usable and more user friendly*" (Site 2, November)

The WSDB represents continued progress because of the systems role in tracking progress, provision of accurate information and support for

decision making. Because of these benefits, the MWE is investing in ensuring stakeholder adoption and permitting free access to it as stated:

> "*the users that were targeted are the districts because we realized that the districts actually need to access more the water supply database to make informed decisions while they are allocating their resources within their districts. To equitably serve all the population of the districts….Other users; the NGO's are using it allot, the donors are using this water supply database allot, the general public is also interested…they also can access it*" (Site 1, November)

These findings paint a picture of an important artefact that aims at leveraging technology to influence improved sector performance which leads to development. Although its reported significance has been stated, there are sustainability concerns like reliance on external developers and financing.

5.9.1 WSDB Sustainability

Aforementioned discussions detail concerns about WSDB sustainability. Bearing in mind that the WSDBs objective is to '*provide timely information for the MWE and all stakeholders in WASH, so that decision making which impacts development is enhanced*', it is important that the MWE continues to ensure its operation. My findings established that quarterly data submission by DWOs or TCUs is not inescapably timely. In some instances, there are longer delays. The non-timeliness cultivate data integrity or accuracy issues which has led to some stakeholders like NGOs not to fully trust the data.

> "*The Ministry requires us to submit every 3 months and the submission is paper based….So, the accuracy of the information you see in the database is as good as the people who submit this information. We submit it in a timely basis, so we are supposed to submit it every 3 months; we do that or we do it once a year. So, active districts are able to do it every three months*" (Site 11, January)

> "*it's not well updated… Yet they tell you real-time as if it was real-time or recently updated. So that is the challenge that we have. But that's what the ministry has and from that you can get you can generate reports* (Site 12, January)

Presumptions after WSDB deployment were that data timeliness will be improved. This far, this assumption is not correct based on evidence from participants. Participants from NGOs do not fully trust all the data because and tend to collect their own data which they often contrast with the WSDB.

> "*Most of us we go to it much as we know it is not effective but we start from there, we use it and then we update in our own ways. So if you are talking about in terms of usage, many NGOs and DWO, I think use….because we have access*" (Site 12, January)

Nevertheless, the MWE engages with stakeholders to solve data accuracy. This engagement process is one positive aspect that is encouraging adoption and acceptability. MWE reasons that solving data integrity problems by improving data submissions processes will reasonably enhance WSDB acceptability and significance. As one participant explained:

> "*They engage us, they engage even Non-Government People. Recently they came in; it could have been October there. They came and they wanted an update. They wanted people to correct the wrong information and also to update. They gave them some money to go to the field*" (Site 12, January)

In addition to technical issues, costs of managing and improving WSDB is of concern. Because it was designed by an external consultant, they are responsible for technical issues. Site 2, participant stated in November.

> "*I think, the biggest challenge that we have at the moment is, we are relying on the consultant to sort of to do the technical management of the database"*
>
> *"In terms of absolute costs, it doesn't increase. But in terms of our reliance on external entities, it is a bit risky for us….I think we are lacking in terms of capacity to able to manage the system. We needed to have some software experts to be able to adequately manage the system*"
>
> "*our reliance on external consultant to be able to host and prevent hacking, attacks things like that and even debugging and updating of the system. We are not the ones who do it, it is done through a framework contract with consultants because it is very expensive to hire these software experts*"

During study, there was a general acknowledgement that focusing on timely (real-time) submission and delivery of water supply information is the most challenging limitation. Thus, the MWE was looking for ways to ensure timely delivery of information needs. As pointed out by Site 2 participant.

> "*So in this second phase of the update of the Water Supply Database; we are thinking that we should carry out some form of automation. For field staff they can input it direct, for the districts, they can, the District Water Officer can be in charge of entering any information themselves, and then our role now becomes validation. We don't have to wait every five years to do a validation. We then carry out some sort of like a quarterly validation. Then at any one time we are very sure of the information which we have in the Water Supply Database*" (Site 2, November)

The MWE is focused on ensuring that the WSDB continues to improve and because they have adopted it to support goal six of SGDs which is to "*ensure the availability and sustainable management of water and sanitation for all*" citizens. In Uganda, the MFPED-BMAU (2019) and MWE (2016) briefings give SDG related strategic objectives as: *1) to increase water supply coverage in rural areas while ensuring equity by providing at least each village with one safe and clean water source, and where technically feasible a piped water option considered; 2) to promote improved sanitation services in rural and urban areas including the promotion of hand-washing with soap; 3) to increase water supplies and sewerage services in small towns, large towns, municipalities and cities focusing on the areas earmarked for industrial parks; 4) to improve water resources management to ensure adequate quantity and quality for the various uses focusing on compliance to existing laws and regulations on the use of the resources at all levels.*

The WSDB is now helping fulfil MWEs objectives and UNs overall SDG goals.

5.9.2 Scrutinizing WSDB

Beyond sustainability concerns expressed by participants, there are often un-intended consequences for any ICT initiative. One positive effect of the WSDB is training MWE staff how to use it has enhanced ICT skills. DWO in

some districts have been provided with computers by MWE to improve data handling and work. Some DWOs did not get computers and were still hopeful of receiving them. The MWE is encouraging ICT use for all staff to enhance work operations. Even new technology water points such as smart boreholes are being deployed to enhance the water sector. Descriptions in preceding chapters, pictures (*Figure 15*) and cited interview transcripts substantiate these statements.

The WSDB has enhanced data submission and information accuracy. Initially, the MWE largely had a manual system of data management and validation. However, quarterly data submissions from all districts in Uganda improved to 96%, from 65% in previous years due to WSDB influence. Data accuracy has improved due to data validation mechanism embedded in WSDB such as GPS tracking for water points.

However, some DWOs felt that manually submitting forms duplicates work. They want to input data into the WSDB, so that MWE analysts focus on validation. Because the WSBD has been positioned for their use, they want to use it (*perceived ownership*), and avoid regularly submitting manual forms. Using the WSDB meant that they have to be given computers and internet access which is lacking in some districts.

Finally, WSDB limitations are impacting full adoption by some stakeholders such as NGOs who collect WASH information for districts in which they operate. The data accuracy limitation is a perceived WSDB negative.

5.10 Chapter Conclusion

Through this research's inductive and interpretive philosophical processes, I dissected and analysed collected data using CGT tenets. I rationalised choice of CGT for theoretical development and justified its preference because it allowed itemisation and reconstruction of data for conceptual theory building. This chapter demonstrated how concepts and categories emerged from data into the resultant core category and substantive theory. I

conceptualised data by moving across lower levels of theoretical subtraction to higher levels.

Optimizing Perspectives was obtained from primary and secondary sub-core categories, coupled with several initial codes discussed under *sections 5.6 - 5.8*. This chapter elucidates emergence of the theory from conceptual codes and core category. Evidence in data began with theoretical construction of initial codes and categories, which finally cultivated substantive theory.

In the end, the theory comprised participant's perspectives about perceived WSDB influence on MWE and the water sector development in general. Conceptualisation of raw data entailed transiting from substantive codes to initial theoretical codes, cultivation of primary and secondary sub-core categories, and finally emergence of core category and theory. The transition process included disregarded data, codes, concepts and memos.

This chapter hypothesised a holistic analysis that allowed me to make theory contribution from participant perceptions on consequences of MWE implementing the WSDB in Uganda's water sector.

The next chapter provides a comparative literature review of *Optimizing Perspectives* with selected IS theories to position it within the existing body of knowledge.

Chapter Six

6.0 Comparative Literature Review of *Optimizing Perspectives*

"All experience is subjective"

Gregory Bateson (1904 – 1980)
Anthropologist

6.1 Chapter Summary

This chapter positions *Optimizing Perspectives* within the current research setting by making a comparative literature analysis with existing theories or empirically related studies. This chapter does not rationalise extending, proof or validating extant grounded theories compared to *Optimizing Perspectives*; but rather justifies adopting CGT to build theory that explains problem phenomena from the perspective of those experiencing it as elucidated by (Goldkuhl & Cronholm, 2019; Holton, 2008).

The chapter is divided into multiple elucidatory sections. The first section typifies justification for comparative literature review. Other sections feature comparisons with relatable CGT studies and theories. Because this study is qualitative and interpretive philosophically, credibility cannot be enumerated. Nonetheless, CGTM allowed me to make theoretical findings transparently available. The chapter concludes with substantiation of the conceptual framework *Optimizing Perspectives*, and its positioning within existing literature.

6.2 Why Comparative Literature Review?

This review does not question the credibility of *Optimizing Perspectives* or other theories. Glaser & Holton (2004, p. 6-7) reject the idea of doing comparative literature review with intention to prove, disprove or extend theory by stating that: "*Contrasting the generated theory with extant other*

theories to prove, improve or disprove one or the other neglects or ignores constantly comparing the theories for category and property generation. This contrasting with other theories also prevents modifying the GT generated theory using the other theory as a kind of data".

GT researchers acknowledge that it is relatively possible for other researchers to generate different interpretations. Glaser & Strauss (1967, p. 225) assent that researchers '*readily agree that their own theoretical formulations represent credible interpretations of their data, which could, however, be interpreted differently by others'*. Glaser (1978) recognises this complexity by stating that human social research is intricate and multifaceted.

Hence, the aim of this comparative literature review is to position *Optimizing Perspectives* within the current body of knowledge by evaluating its likeness or disparities. Glaser (1978) affirms a selective comparison that should be conceptual in nature. The comparative theory analysis being conceptual and not contextual means that researchers focus the comparison on concepts and not background or source of data. And because CGT studies are grounded in data, typical comparative literature reviews are predictably shorter, and in-depth reviews are not required. Conceptual results obtained from a specific CGT study may be abstractly different from what is prevailing in literature.

Glaser & Strauss (1967, p. 224-225) claim that reviews do not question the credibility of the cultivated theory. GT researchers have confidence in the credibility of their developed theory and conceptual analysis as long as the research process is fundamentally sound. The theory is equivalent to what the researcher knows systematically about their data. The researcher's conviction about the theory is hard to argue against because it develops from theoretical analysis processes, observations, experiences and participant perceptions.

I adopted Glaser (1998) claim that CGT researchers self-assurance in credibility of their work is based on confidence in the rigorous structured

processes undertaken, coding, theoretical analysis and proposition of an integrated substantive theory grounded in data. In addition, CGT researcher's confidence in their work is based on giving plausible explanations and presentation of theory "*developed through analysis of qualitative data*".

This comparative literature review does not validate or invalidate the CGT approach adopted if it differs from other studies. Elliott & Lazenbatt (2005) satisfactorily claim that there is no international or nationally accepted definition of best GT research practice; however, quality of GT research is evaluated by rigor and fundamental techniques followed. Processes such as constant comparison and theoretical sampling "*provide an integrated research approach to data collection, analysis and checking the quality of research findings*". Thus, this comparison review exemplifies contribution of CGTM in the research area towards the existing body of knowledge in IS.

Although doing comparative analysis of *Optimizing Perspectives* is noteworthy, I was not extending or proving its contribution to extant theories, but rather demonstrating its situation amidst existing literature; and then showing its significance as a theory contribution. Hermeneutics and snowball sampling were adopted to gather and select theories to comparatively relate and analyse with *Optimizing Perspectives*.

For instance, illuminated is a comparative analysis with Socio-Technical theory. Socio-Technical theory explains the relationship between workers and technology, and how organisations can achieve '*joint optimisation*' (*optimisation of people and technology*) to maximise performance and achieve set ambitions (Baxter & Sommerville, 2011; Cartelli, 2007; Li, 2010; Sawyer & Jarrahi, 2014). Socio-technical theory was suitable for comparative analysis because it emerges from the reality that all organizations are socio-technical systems, and workers interact socially with each other and technology to achieve optimal functioning. The chapter explains other considered theories because there is no shortage of studies or theories examining technology effects on communities and organisations.

6.3 Justification for Comparative Literature Review

The diverse nature of IS research has meant that theories, paradigms and methodologies continue to grow and enrich knowledge or literature; and researchers explore and adopt varied theoretical prepositions to cultivate and theorise (Goldkuhl & Cronholm, 2019; Gregor, 2006; Hassan, 2014; Levina, 2021). In this research, the idea of diverse research notions was explored considerably when explicating my philosophical position to cultivate fit between study and suitable methodological choice for theory contribution. Literature from comparisons justify choice and decisions made during the study and the conceptualised results obtained from participants.

One justification for this comparison is to show relative similarity of *Optimizing Perspectives* to extant theories. Comparison is made through application of two procedural processes. Initially, I conducted literature search using abstract criteria to identify and select related concepts. Hermeneutics and snowball sampling were used to find literature. Secondly, literature found was conceptually matched with this research's discoveries to find correlated concepts or words with related interpreted meanings. Comparison was then made with related concepts identified.

Because CGT is the chosen methodology, I agree and adopt Glaser (1978) assertion that any conceptualised theory should be open for literature comparison within or outside the field of enquiry. This led to a boundless literature comparison between *Optimizing Perspectives* and any extant theories in various fields. Thus, the main determination for this comparative literature review is to:

(1) Compare *Optimizing Perspectives* with existing theories in order to position it within existing frameworks of knowledge

(2) Contrast conceptualised results obtained with any related studies if identified

(3) Use *Optimizing Perspectives* and identified theories to explain technology consequences or influence in ICT4D or ISDC research

Glaser & Holton (2004) reject the claim that comparison is intended to prove or disprove generated or extant theory. Rather, literature comparison prevents modifying generated substantive theory using the other theories as a kind of data. Glaser (1978) additionally explains that CGT is undertaken to explain phenomenon of interest using data from participant experiences, and it is not about extending or proving generated theories.

I delimited this research to discovering perspectives regarding WSDB influence on development. I took the approach of delimiting findings to what is perceived as significant or problematic. It was important that theoretical findings from this research are compared to extant theories from relatable literature. My rationale is to position *Optimizing Perspectives* within the existing body of knowledge. According to Glaser (1978), comparative theory analysis is conceptual and not contextual; which means researchers focus on comparison of concepts and not background or source of data. This comparison might seem to extenuate contribution of *Optimizing Perspectives* during comparison because infinitesimal new concepts are proclaimed.

Adopting *Optimizing Perspectives* to explain influence and effective use of WSDB to improve governance or development in the water sector might not reveal much that is new. Additionally, using constructed concepts like *Negotiating Compromises* and *Validating Developments* to explain how stakeholders negotiate and make decisions, and then validate project developments may not reveal anything new. Categories *Infrastructuring* and *Sanguine Orientating* do not unveil much that is new regarding sustained WSDB evolution, and increasing belief among participants in its significance. *Optimizing Perspectives* does not uncover allot of unknowns regarding the MWE positioning WSDB as an information repository. Neither does *Optimizing Perspectives* reveal significant substantial knowledge that is not yet existing in theories or studies related to ICT artefacts.

However, theory perceptions about ICT artefacts and their influence on Uganda's water sector growth is a new phenomenon of knowledge interest because studies are limited. Conceptualised codes and categories are not

exactly comparable to concepts in other theories; and the core category *Optimizing Perspectives* seems unique when compared to theoretical codes in existing theories. This was expected because CGT studies explain phenomenon from the perspectives of those experiencing it; and theory generated provides explanation for stated experiences, and does not extend or prove extant theories (Glaser & Holton, 2004).

6.4 Comparativeness of *Optimizing Perspectives*

I state with confidence that the notion, explanation and meaning of *Optimizing Perspectives* as examined in this research has not been applied before as a theory building concept in IS and other studies in general. Search for *Optimizing Perspectives* in literature generates relatable expressions. This applies to high and lower level abstract concepts that were conceptualised as codes and categories. There are no existing theoretical contributions that can be exactly comparable.

Particulars critical for validating the trust in quality of my research and comparativeness of the theory include: First, philosophical assumptions; that is keeping in mind my ontological, epistemological, and interpretive postulation. Secondly, going through coding phases to determine the core category, and then delineating the study to it. Thirdly, Continually incorporating CGT concepts such as constant comparison of new data against previously coded data, memo writing and sorting which integrates data to the core category and leads to theory formulation.

Glaser (1998) readily agrees that researcher self-assurance in credibility of their work is based on confidence in the rigorous or structured GT processes undertaken which lead to proposition of an integrated substantive theory that is grounded in data. Additionally, researchers should have confidence in conveying credibility of their work by giving plausible explanations and presentation of theory "*developed through analysis of qualitative data*" to satisfy readers. I adopted specific practices to demonstrate transparency and auditability. See *Table 22*.

No	Approach	Description
1	CGTM Fundamentals	I was cognizant of CGT practices such as coding, writing memo or notes, constant comparison, sorting, generating categories and core category
2	Work Narratives	Maintained activity logs about participants, interviews, notes, time, location, summary briefs, analysis write-ups, observations and photographs
3	Interview logs	Created document showing interview transcripts and structure of coding and categorisation process
4	Participant Validation	Emailed participants their transcribed interview logs to get feedback about the transcript and my analysis of it
5	Referencing Data	Cited interview transcripts to stress concepts developed
6	Triangulation	Collected data from sources (especially interviews) which allowed for validation

Table 22: Approaches to manage study transparency

CGTM allowed me to make findings from interviews, codes, memos, notes etc. transparently available in order to trust in my theoretical analysis process. Nevertheless, significance of *Optimizing Perspectives* is that it conceptualises how participants explain effective WSDB use and its perceived influence on development. Examining influence from participant's initially revealed concern about compliance to quarterly data submission processes. Using WSDB, *Validating & Verifying* water sources occurs, and the system has been significant for data management. The WSDB avails countrywide statistics about water access. Enlightening is how *Optimizing Perspectives* conceptualises understanding WSDB influence.

Optimizing Perspectives is an instance of a theoretical code that integrates primary and secondary sub-core categories into a quaternary structure. The fact is existing theories are not comparable with its contemporary conceptual structure. Because reviews are not meant to prove, improve, disprove or determine theory; it is rationally appropriate that comparative

review of *Optimizing Perspectives* with extant theories is undertaken to encompass theories within or outside IS. Nonetheless, it is unreasonable to search and find all literature with concepts comparably related to *Optimizing Perspectives* because it is copious and excessive to make comparisons with every nascent concept that can be theoretically related.

Optimizing Perspectives is a substantive theory constructed from the relationship between four conceptual levels of codes and categories. These integrated and discrete levels include higher level core category, midlevel primary and secondary sub-core categories, and lower level abstract codes. Concepts in the quaternary structure depicts how the core category emerged from integrated data relationships that are valuable towards explaining inference of *Optimizing Perspectives*. Thus, comparison with selected theories from literature indirectly involve relatable concepts.

Before reviewing *Optimizing Perspectives* theory with other theories, it is important to understand what this study entails and its delimits. The research adopted CGT to discover participant views about the WSDB influence. CGTM allowed participants to state their perspectives exclusive of my controls, and set agenda of the research. The theory is not based on pre-framed or '*a priori*' literature analysis but is grounded in data obtained from participants, and delineates findings about WSDB to guide the research in discovering the inferred perspectives.

Glaser (1978, 1998) claims that because CGT studies are grounded in data, typical literature reviews are predictably shorter, and in-depth reviews are not required. Thus, conceptual outcomes obtained from a specific CGT research may be abstractly different from what is already prevalent in literature. This indicates that concepts contributing to a specific substantive theory might be disproportionately different when compared to extant theories in literature. Because I categorised the context of this study as exploratory, I knew it was improbable to find literature concepts precisely similar-to cultivated concepts of *Optimizing Perspectives*. Context of my research is related to ICT4D or ISDC fields, and specificity of data collected

and processes adopted for cultivating theory made it inevitable that meaningful comparisons with other theories would be restricted.

This comparative literature review is delineated by concepts of *Optimizing Perspectives*. It follows Glaser (1978, 1998, 2002) assertion that comparison reviews should be discursive or descriptive, and not critical or passive. Discursive or descriptive entail discovering signs of conceptual fit in the review process that reveal usability of *Optimizing Perspectives* theory. Additionally, comparative reviews reveal how concepts under *Optimizing Perspectives* could be modified or not regarding related erstwhile theoretical concepts found in other theories. However, due to numerosity of theories and literature findings, selected concepts might be included or omitted during theory comparison depending on relevance and theoretical perspectives. Inclusion or omission does not indicate relevance or irrelevance, but rather insignificance given study context and methodology.

Comparative review of *Optimizing Perspectives* is presented to be conceptually delineated; and Glaser (1978; 1992) explains delineation as meaning emergent concepts such as substantive or theoretical codes and categories being compared to theoretical concepts from extant theories in literature. Comparisons can be made with literature from diverse subjects or disciplines, and is not limited to IS. Comparisons provided perspectives on the relevance of *Optimizing Perspectives* to research knowledge.

Comparative review of *Optimizing Perspectives* with grounded and non-grounded theories is explained in the next sub-sections.

6.5 Comparative Analysis with Classic Grounded Theory in Related Research and their Conceptual Categories

What is novel about *Optimizing Perspectives* is that it not only provides an exploratory understanding of WSDB's influence on water sector development or governance at the MWE, but integrates with existing selected theories to explain relevance for artefact theorisation in technology based development research. The next sub-sections discuss theory and category comparisons.

6.5.1 Comparison with Concepts of *Cultivating Recognition*

Tossy (2012) presents Cultivating Recognition as a theory which explains conceptual processes within which e-learning providers in East Africa engage to secure necessary financial support for implementing and recognition of their e-learning projects. Using CGT methodology, the theory presents a hierarchy of categories discovered from respondent perspectives. Cultivating Recognition explains the main concern of e-learning providers which is gaining public acknowledgement or acceptance. The three-stage hierarchical process of the theory is divided into primary and secondary sub-core categories, and lower level properties. See *Figure 49*.

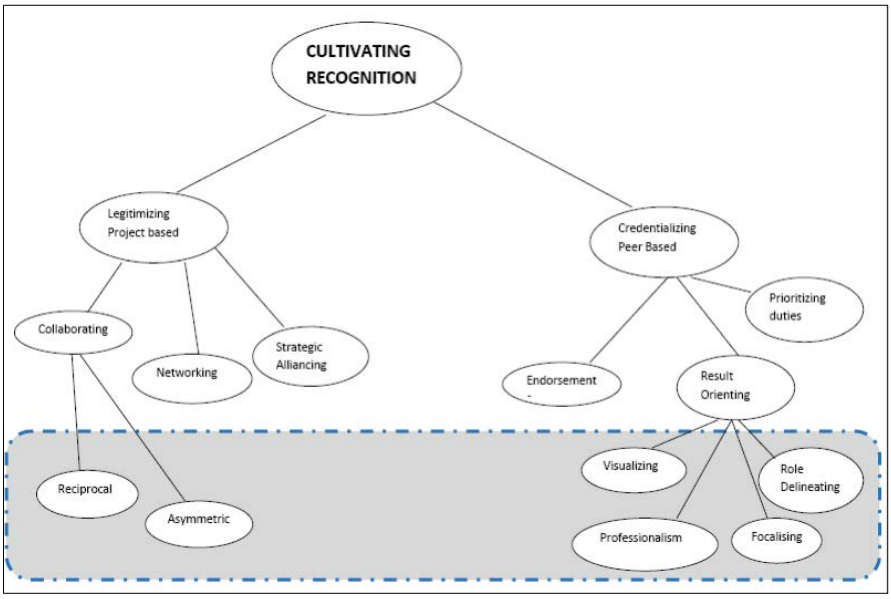


Figure 49: *Cultivating Recognition* abstract framework (source: Tossy (2012))

6.5.1.1 Conceptual Semblance of *Validating Developments* and *Negotiating Compromises* to *Legitimizing*

Tossy (2012) explains *Legitimizing* as a perpetual process of ensuring e-learning projects are delivered, valid and sustainable; and it emerges from secondary sub-core variables or processes *Collaborating*, *Referral Networking* and *Strategic Alliancing*. *Legitimizing* is related to *Optimizing Perspectives* concepts like *Sharing*, *Integration* and *Stakeholder Collaboration*. I categorised these concepts under primary sub-core categories *Validating*

Developments and *Negotiating Compromises*. Relatable conceptual secondary sub-core categories include *Reconciling Undertakings*, *Holistic Collaborating*, *Conjoining Efforts* and *Balancing Partnerships*.

Reconciling Undertakings entails gaining acceptance when *integrating* and *resolving* decisions; and it ensures data and project consistency. Properties of *Reconciling Undertakings* include *Validating and Verifying* data *Submissions*, stakeholders engagement in *Joint Plannings* of projects, *Seeking Exchanges* of information and MWE perpetual undertaking for *Evaluating Implementations* of projects. *Holistic Collaborating* entails stakeholders coordinating by *Sharing* data and *Engaging* in building projects using WSDB information. From participant explanations, the MWE coordinates this process by *Distributing Projects* through *Involving and Engaging Stakeholders* using a *Symmetrical or Asymmetrical Engagement processes* and *Promoting* data sharing.

Balancing Partnerships is managing cooperation and is useful for *Supporting* and *Validating* water projects implemented. The legitimisation process occurs through *Coordinating*, *Prioritising Meetings or Workshops*, *Collaborating* on goals defined from annual MWE *budgeting* and *planning*. During *Conjoining Efforts* the MWE jointly builds partnerships and identifies opportunities. Collaborative meetings like JSR allow stakeholder interaction and WSDB data use. Characteristics that associate *Conjoining Efforts* to *Legitimizing* include *Enabling or Availing* WSDB access, *Controlling Process*, *Interconnecting Stakeholders* to share data and positioning WSDB to allow *Centralizing Interactions*.

All the above category process are conceptually related to *Legitimizing* or *legitimization* of WSDB influence on perception of development.

6.5.1.2 Semblance of *Sanguine Orientating* and *Infrastructuring* to *Credentializing*

Credentializing process creates client belief in ability to execute e-learning projects on time, within budget and according to requirements. It arises

from descriptive variables *Endorsementizing*, *Result Orienting* and *Prioritizing Duties* (Tossy, 2012). Relating *Credentializing* to *Optimizing Perspectives* include primary categories *Sanguine Orientating* and *Infrastructuring*. The categories involve positioning and acceptance of increased belief in WSDB significance. Related secondary categories are *Prospective Positioning, Visualising* data submissions and *Components Building*.

Prospective Positioning is related to *Endorsementizing* because it entails creating increasing belief towards WSDB significance, potential, and its ability to allow data sharing and integration. *Prospective Positioning* creates increased recognition in the potential and significance of the WSDB. Concepts under *Prospective Positioning* include *Identifying Contributions and Opportunities* provided by WSDB, focusing on participants with *Enthusiastic Coveting* or interests, *Training on Potential* for WSDB to influence sector governance through information flow, and MWE managing WSDB *Evolution* which includes undertaking system improvements.

Visualising Submissions creates increased WSDB credence to provide data access. Credence cultivates visualising data, data integrity focus and enabling decision making. *Component Building* entails planning and executing WSDB evolution so that new data requirements are developed.

All these conceptual process are related to *Credentializing or credentialization* of WSDB in governance and managing the sector.

6.5.2 Comparison with *Optimising Professional Life*

Piko (2014) presents Optimizing Professional Life as a new career theory derived from the professional lives of experienced General Practitioners (GP). The theory presents a framework of how GP process their concerns about career sustainment in three-stage processes of *discomfort*, *assessment* and *resolution*. GP achieve the most optimal solution to satisfy need for sustainment in riposte to constraints present in their internal and external environments by crafting feasible solutions that are satisfactory. The processes repeat throughout a GP professional life until concern is resolved.

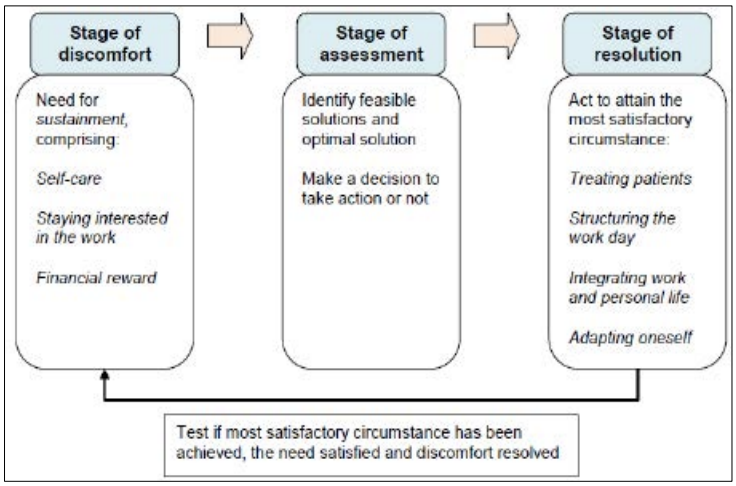


Figure 50: Showing the theory's three stages (source: Piko (2014))

I related the three conceptual stages to specific categories constructing *Optimizing Perspectives*. Both theories were discovered from perspectives that include approaches to decision making processes influenced by experiences and events. Both theories provide perspectives for design and implementing policies that integrate organisational dimensions.

However, the major difference is that *Optimizing Perspectives* is from an IS perspective focused on ICT influence, while *Optimising Professional Life* is about professional lives of GP. The next sub-sections discus comparative analysis with the three stage processes.

6.5.2.1 Comparing *Expressing Dissatisfaction* and *Erroring Handling* with the Concept *Discomfort*

According to Piko (2014), this process focuses on the displeasure associated with GP sustaining their professional life. The stage is characterised by discomfort or unease. Some expressions used by GP to describe their work entailing *needing a break*, *frustrating*, *irritating* and *intense*.

With respect to *Optimizing Perspectives,* comparativeness is interrelated to expressions such as *discontenting, Disenchanting, Demanding Support, Stating Loathsome feelings, fault handling* etc. The stage's concepts relate to secondary categories *Expressing Dissatisfaction* which involves users stating displeasures and *Erroring Handling* under primary categories *Sanguine*

Orientating and *Infrastructuring*. Some characteristics of the category include participants expressing *Disenchanting Notions*, *Demanding Support*, data *Integrity* issues and *Examining* WSDB access issues.

Erroring Handling entails characteristics such as *Managing Technical* issues, *Ensuring Functionality* for daily use, providing solutions to *Executing Errors* in the system and *Validating Data Integrity* using additional data sources. Data integrity was a core error issue expressed because of its effect on decision making. However, data integrity has steadily improved significantly.

Optimizing Perspectives process relates to *discomfort* or *displeasure* expressed by participants regarding WSDB limitations affecting governance.

6.5.2.2 Comparing *Policying Assessments* and *Decisioning* with the Concept *Assessment*

According to Piko (2014), this stage is characterised by GP evaluating options and deciding whether or not to take actions. It includes features such as choosing action or inaction and assessment. During action, individuals are actively involved with *resolving* problems, while in the assessment features include *urgency for action*, *constraints, feasible solutions*, *optimal solution* and *making a decision*. The concept of acting to make decisions and resolve the problem is referred to as *emerging self*.

This stage is related to *Optimizing Perspectives* through assessment of *decisions* and *policy*. I related it to secondary categories *Policying Assessments* and *Decisioning* under the primary categories *Validating Developments* and *Negotiating Compromises*.

Decisioning entails making sense of collectively deliberated assessments. *Decisioning* characteristics include processes of *Commissioning and Decommissioning* projects, *Reflecting on Analytics*, *decision making*, *Delineating Answerability*, *Orienting Effects* of prior decisions made in the previous year and *Focusing on Goals* when making decisions about the future. *Data integrity* was significant when discussing *Decisioning* because of policy impacts. *Policying Assessments* entailed evaluating perceived

decisions, and properties constructing this category are *Recognising Policy Impacts* of the WSDB, *Reflecting Decisions* based on information, *Evaluating Data Inputs* and *Communicating Effects* of policy-centric decisions.

All process described are related to *Assessing* or *Assessment* of sector decisions and policy using WSDB facilitated information.

6.5.2.3 Comparing *Mediating Interactions* and *Reconciling Undertakings* with the Concept *Resolution*

Resolution focuses on GPs attaining the most preferred solution that reflects the professional environment Piko (2014); and is a multi-dimensional mix of strategies, constraints and actions taken to resolve concerns which include: *treating patients*, *structuring the work day*, *integrating* work and *personal life* and *adapting oneself*.

In comparison to *Optimizing Perspectives*, this stage is related to effective WSDB use for *managing challenges* and determining *solutions*. I related it to categories *Mediating Interactions* and *Reconciling Undertakings* under primary categories *Negotiating Compromises* and *Validating Developments*. *Mediating Interactions* entails resolving disagreements and aligning goals for mutually beneficial purposes of improving the water sector. Relatable properties of *Mediating Interactions* include participants *Confronting Challenges* faced, *Constraining Purposes* during information analysis, *Ideating for the Future* by making resolutions, *demanding solutions* and *Brainstorming Results* against constraints or challenges faced.

Reconciling Undertakings is a process of resolving or integrating information based decisions taken. Categories related to *Resolution* include participants engaging in *Validating and Verifying* data submissions, *Joint Plannings* with stakeholders to provide solutions, *Seeking Exchanges* regarding problem resolutions, solution identification with stakeholders and *Evaluating Implementations* for pragmatic solutions. Evaluating solutions for challenges is continuously examined during meetings and workshops. Participants stated that *resolutions* are examined during yearly *Budgeting* and *Plannings*.

All concepts are related to *Resolving* or *Resolution* of challenges.

6.5.3 Comparison with *Reconciling Perspectives*

Adolph et al. (2012) describes *Reconciling Perspectives* as a theory that explains concepts of how people manage the process of software development. Developed using CGT, the theory is a two-stage schematic process of *Converging* the *Perspective Mismatch* to generate a *Consensual Perspective*, and then *Validating* the *Consensual Perspective* by creating *Work Products* that can be objectively evaluated.

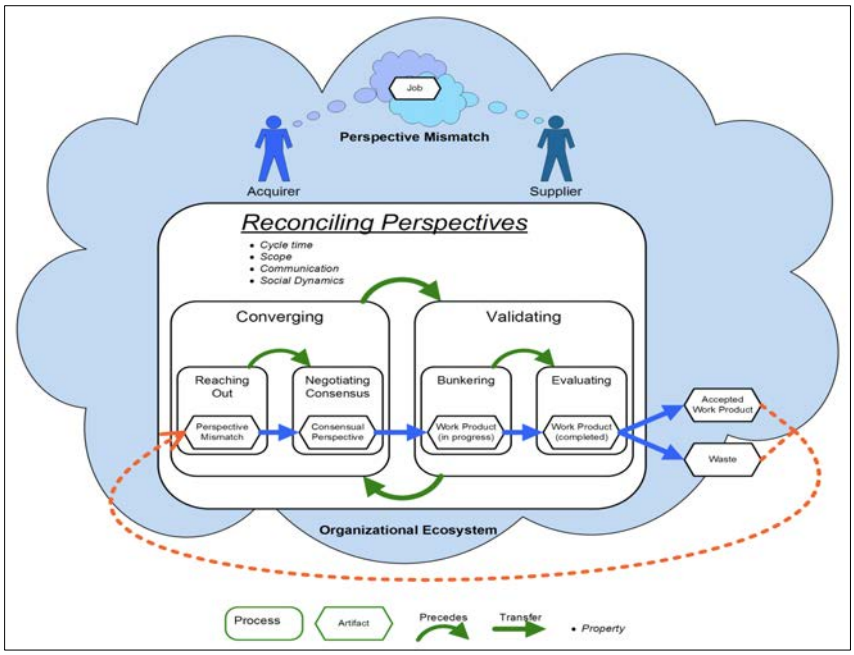


Figure 51: Schematic process of *Reconciling Perspectives* (source: Adolph et al. (2012))

I related categories under *Optimizing Perspectives* to those in *Reconciling Perspectives*. Categories in *Reconciling Perspectives* include *Converging* and *Validating*. *Converging* and *Validating* are relatable to primary categories *Validating Developments* and *Negotiating Compromises* under *Optimizing Perspectives*. *Validating Developments* is a process of examining and setting performance indicators. *Validating Developments* is conceptually related to *Validating* because both processes entail *endorsement* of outcomes. *Validating* is constructed from *Bunkering* and *Evaluating*, and both process involve creating and assessing work products from participants during

software design and acceptance. *Validating Developments* is constructed from processes *Validating and Verifying Submissions*, *Evaluating Implementations*, *Reflecting Decisions*, *Evaluating Data Inputs*, *Communicating Effects* and *Symmetrical and Asymmetrical Engaging* of stakeholders. These properties are conceptually related to outcomes of *Validating* under *Reconciling Perspectives*.

Converging is related to *Negotiating Compromises* because both process involve engagement to reach consensus on issues. *Negotiating Compromises* includes MWE discussing, coordinating, planning and managing projects. *Converging* and *Negotiating Compromises* entail integrating and engaging to reach harmony on concerns. *Negotiating Compromises* is constructed from related properties *Centralizing Interactions*, *Interconnecting Stakeholders*, *Collaborating on Sector Goals*, *Coordinating stakeholders*, *Reflecting on Analytics*, *Orienting effects of prior Decisions*, *Ideating for the future* and *Brainstorming Results* by stakeholders.

Converging and *Validating* conceptually relate to *Validating Developments* and *Negotiating Compromises* because they realise comparable notions.

6.6 Comparative Analysis with Non-Grounded Theory

In this section, I comparatively relate *Optimizing Perspectives* to *Socio-Technical Theory* (STT), specifically principles under STT. The principles are related to *Optimizing Perspectives* conceptual categories.

6.6.1 Comparison with *Social-Technical Theory*

Sawyer & Jarrahi (2014) state that IS has advanced design science or design theory research; and socio-technical approaches to theory is one of the vehicles to pursue design research. *Socio-Technical Theory* (STT) developed from the notion that organisations comprise of two sub-systems: *technical sub-system* and *social sub-system*; and work places want to achieve '*joint optimisation*' of the two sub-systems to maximise performance (Cartelli, 2007; Trist, 1981). STT specifies concepts against which consequences of IS

transfusion and empirical understandings is explored to explain progress research (Li, 2010; Trist, 1981). Sawyer & Jarrahi (2014) proclaims:

> "*sociotechnical approaches to studying ICT and IS provide useful intellectual guidance to advance our theorizing on technological artifacts, and how people's work practices and organizational arrangements are afforded by technological resources and inhibited by technological constraints….This provides a useful alternative to both the standard models of IS and other emerging approaches seen in IS*"

Lee (2001, p. iii) describes IS as examining "*more than just the technological system, or just the social system, or even the two side by side; in addition, it investigates the phenomena that emerge when the two interact*". I explain WSDB influence on development and governance as related to SST.

STT manifests from this aspect to explain performance improvements within organisations as an example of *joint optimisation* of *technical* and *social* aspects utilising people's adaptability to achieve goals through synchronised coordination with technology (Trist, 1981; Trist et al., 2013). Cartelli (2007, p. 2) explains STT as determining *joint optimisation* of the two sub-systems once organisations maximise performance after interdependency of subsystems are recognised; and, "*any design or redesign must seek out the impact each subsystem has on the other*".

The WSDB which I regard as a technical subsystem has been adopted by the MWE and stakeholders. I sought to identify perspectives about its influence by interviewing participants working on its development-oriented effect on work life and decision making processes.

I related *Optimizing Perspectives* to STT by following Li (2010, p. 202) assertion that STT endeavours to "*identify the dynamics between technology and the social, professional, and cultural environment*" within which a particular technology is used. I adopted Sawyer & Jarrahi (2014, p. 4) assertion that STT research "*is premised on the interdependent and inextricably linked relationships among the features of any technological object or system and the social norms, rules of use and participation by a*

broad range of human stakeholders", and "*mutual constitution of social and technological is the basis of the term sociotechnical*".

Cherns (1976, 1987) lays out several STT principles which are applicable to understanding technology implementation or effects on organisations or communities. Bostrom & Heinen (1977) extended socio-technical perspectives by characterizing social aspects of IS as emphasizing employee tensions within an organisation. I adopted STT principles and relate them to categories under *Optimizing Perspectives*. Principles are:

6.6.1.1 Comparison with *Minimal Critical Specification*

This principle explains that "*no more should be specified than is absolutely essential*", and "*designers should ascertain what is essential*". In addition, we measure IS success and effectiveness less by quality of design but by quantity of ideas or preferences; and design decisions should be presented for better socio-technical resolution (Sawyer & Jarrahi, 2014, p. 10).

The principle when correlated to *Optimizing Perspectives* ascertains what is essential for WSDB functionality, usage and adoption. I related it to categories *Component Building* and *Decisioning*. The former is under primary category *Infrastructuring*, and the latter under *Negotiating Compromises*. *Component Building* ensures execution of new requirements. *Refining Requirements* is undertaken to improve WSDB. Initially, the MWE is *Seeking Funds* needed to pay for new requirement designs; and engages in *Implementing, Testing* and *Evaluating Designed Modules*. Finally, *Training* occurs as way to *Communicate* new WSDB improvements, although there were complaints about training not being good enough amid lack of access.

Decisioning reflects on making resolutions and sense with collectively deliberated judgements that affect the sector. MWE and stakeholders use the WSDB to deliberate decisions that set about *Focusing on Goals*. Goals are undertaken by *Commissioning and Decommissioning* water projects. Data about existing projects is assessed through *Reflecting on Analytics*, decisions are made through *Delineating Answerability* of roles and

responsibility for projects. The MWE undertakes *Orienting effects of prior* decisions while *Confronting Challenges* that are new, old or existing.

Component Building and *Decisioning* are conceptually related to the principle of *Critical Specification* because they explain essential modules required at specific times from technology systems and their effect.

6.6.1.2 Comparison with *Sociotechnical Criterion*

The principle explains that "*solution to problems should be devised by the groups that directly experience them, not by supervisory groups*" (Sawyer & Jarrahi, 2014, p. 10). The principle examines IS variances, how they arise, how they should be collectively discussed by stakeholders and how solutions are devised by those affected by the system.

With respect to *Optimizing Perspectives*, the principle discerns what is essential to solving WSDB information challenges. I correlated it to categories *Conjoining Efforts* and *Holistic Collaborating*; all under primary sub-core categories *Negotiating Compromises* and *Validating Developments*.

During *Conjoining Efforts*, all stakeholders coalesce to build partnerships and identify opportunities; and engage in *Decisioning* impertinent for sector development. JSR and joint workshops organised by MWE allow interaction and decision making. Challenges are discussed, and solutions collectively devised. Several characteristics associate *Conjoining Efforts* to this principle. By *Enabling or Availing Access* to WSDB, MWE *Controls Processes* that entail use, data update mechanisms, and challenges associated with functionality. A key characteristic related to the principle is *Interconnecting Stakeholders* through sharing data and communicating or managing issues. Finally, by centrally positioning the WSDB, the MWE was *Centralizing Interactions*.

With *Holistic Collaborating,* stakeholders coordinate by *Sharing data* and *engaging* in building communal projects. Utilities and NGOs plan and build new water sources in conjunction with MWE; which harmonises and communicates through *Data submissions* made by DWO. Annually, the MWE performs *Budgeting* and *Distributing Projects* related to water sources.

This involves *Symmetrical and Asymmetrical Engaging* of stakeholders by utilising WSDB data in engagements. The engagement processes are opportunities for making decisions and devising solutions to challenges. MWE sees engagements as opportunities to address water access problems.

Conjoining Efforts and *Holistic Collaborating* are conceptually related to *Sociotechnical Criterion* because they all entail solutions being devised by stakeholders that directly experience concerns solved by the IS artefact.

6.6.1.3 Comparison with *Boundary Location*

This principle describes the existence of environs within which work undertakings pass from one group to others. Boundaries '*facilitate knowledge sharing*' by grouping people and work activities based on technology, territory and time; and that '*all groups should be able to learn from one another*' (Sawyer & Jarrahi, 2014, p. 10).

I associated this principle to WSDB *Evolution*, *Data Cycles*, and *Decisioning* concerns under *Optimizing Perspectives*. I related it to categories *Reconciling Undertakings* and *Amplifying Access*. These categories are all under primary categories *Validating Developments* and *Infrastructuring*. *Reconciling Undertakings* entails stakeholder unison when integrating and resolving data issues and decisions. It ensures that information and decisions agreed upon are consistent. Stakeholders coordinate during *Joint Plannings* and are engaged in information *Seeking Exchanges*. *Engaging* occurs through mechanism like email, workshops and meetings. During engagement, stakeholders are *Validating and Verifying Submissions*.

Because different stakeholders focus on different districts, it is reasonable that data would differ. The WSDB aids MWE in information *Reconciliation*, and stakeholders learn from each other about districts in which they operate. Stakeholders are *Evaluating Implementations* of water projects. These characteristics associate *Reconciling Undertakings* to this principle.

Amplifying Access entails increasing WSDB adoption, allowing access, *data sharing* and increased *engagement*. Properties of this sub-core category

include *Promoting WSDB Use* through *Mediating or Authorising WSDB Access*. The MWE engages in *Administering WSDB Operations* for stakeholders that require comprehensive access. However, most have restricted access, meaning access to limited WSDB dashboards. Some stakeholders engage in data *Sharing to Contrast* with their collected data.

Reconciling Undertakings and *Amplifying Access* are conceptually related to the *Boundary Location* because they relate to facilitating data and knowledge sharing, and examine technology effect amongst stakeholders.

6.6.1.4 Comparison with *Incompletion*

Incompletion elucidates that "*design is an iterative process. It never stops*" and newer changes "*require continual revisions of objectives and structures*" (Sawyer & Jarrahi, 2014, p. 11). This notion perfectly describes evolution technological artefacts within organisations, and emphasise that as soon as technologies are implemented, their consequential effects and new requirements will denote need for newer redesigns, and the multifunctional approach in design is required for evaluation and review.

In relation to *Optimizing Perspectives*, this principle relates to evolution of the WSDB plus its effects on MWE. The principle asserts incompleteness of all IT systems, and the WSDB is no different. I related it to categories *Component Building* and *Erroring Handling*, all under primary sub-core categories *Infrastructuring* and *Sanguine Orientating*.

Component Building ensures that iterative WSDB changes are planned and executed. The MIS-Unit at MWE is engaged in design by *Refining Requirements* for new modules, *Seeking Funds* needed to pay for the design and involving relevant stakeholders during design. Next is *Implementing and Testing designs* and then *Evaluating Designed Modules*. After, the next phase entails *Training of WSDB Users* as way to *Communicate* new modules.

Erroring Handling entails management of WSDB functionality so that stakeholders realise their data needs. The MIS-Unit supports *Managing Technical Problems* and *Ensuring Functionality*. Technical issues include

enabling user access, ensuring WSDB availability and managing data entry. Like all IT systems, there are challenges and the MIS-Unit is responsible for *Executing Errors* and *Validating Data Integrity* to ensure WSDB reliability.

Component Building and *Erroring Handling* are conceptually related to *Incompletion* because they all associated with system designs, errors and *evolution*; and as soon as any artefact is implemented, then new data-centric consequential effects necessitate evaluation and newer redesigns.

6.6.1.5 Comparison with *Information Flow*

This principle states that IS must be *designed to provide information*; to the point where action based on that information is needed. Sawyer & Jarrahi (2014) states that information provided by the IS should reside in a place where it is needed for action by users whose efficiency is being monitored.

In relation to *Optimizing Perspectives*, this principle relates to WSDB positioning by MWE as a central data source, and its influence on data collection. I associated information flow to categories *Prospective Positioning*, *Amplifying Data Access* and *Visualising Submissions*. These categories are all under the primary categories *Infrastructuring* and *Sanguine Orientating*.

Prospective Positioning creates increased acceptance about WSDB potential for stakeholder adoption. The MWE engages in *Stating*, *Identifying Contributions and Opportunities* that the WSDB provides; and manages *Enthusiastic Coveting* for the kind of positive effect presented. MWE is involved in stating WSDB benefits and possibilities, and thereafter *Managing System Evolution* for new required modules.

Amplifying Access entails WSDB access so get required information. This process is relevant for enhancing data sharing and engagement. It avails insights on how the WSDB is improving data availability. Properties of this category include *Promoting Use* by *Authorising Access* to stakeholders. The MIS-Unit engages in *Administering WSDB* operation and access.

Visualising Submissions creates increased credence towards WSDB use. Increased *endorsement* for data integrity and validity by stakeholders enhances its acceptance. Processes entail *Reports Generating*, *Displaying, Viewing Data Results* and *Ascertaining Data Validity*. Tracking data submitted from districts has resulted in *Augmenting Submissions*. DWO now fulfil data submission obligations due to WSDBs tracking functionalities.

Prospective Positioning, *Amplifying Data Access* and *Visualising Submissions* are conceptually related to the principle of *Information Flow* because they all convey WSDBs provision of data to users whose work efficiency is required.

6.6.2 Limitations Against Social-Technical Theory

Ghaffarian (2011); Sawyer & Jarrahi (2014) denote that despite STT approaches inspiring IS researchers, there are limitations with respect to understanding artefact influence. Clegg (2000) asserts that the principles are not sufficient for making a significant contribution to IS design practice; and that they are effective when supported by other methods.

Other studies expressing limitations of STT state that its focus is mostly on managerial conception and less on human cantered design approaches. In general, STT has limited impact on methods despite reported rhetorical enthusiasm for socio-technical assertions in IS (Avgerou et al., 2004; Ghaffarian, 2011). Ghaffarian (2011, p. 1499) claims that despite the desirable principles, STT "*failed to appeal to information systems researchers and practitioners, and subsequently lost ground to emerging best-practices*".

However, I still found STT significant due to the numerous literature studies that adopting it, and I was able to correlate its concepts with emerged categories described in chapter 5 sub-sections *5.7 - 5.8*.

6.7 Chapter Conclusion

This chapter engages in a comparative literature review of concepts in existing in grounded and non-grounded theories and relating them to

Optimizing Perspectives. This is done in congruence with Glaser (1978) assertion that theories should be open to literature comparison within or outside the field of enquiry. Glaser & Holton (2004) reject the assertion that comparative literature reviews are intended to prove or disprove new theory by explaining that the aim is to prevent modifying new theory using other theories as a kind of data.

The theories discussed do not represent the full range of theories available, because an exhaustive theory comparison is not the objective of the chapter. The chapter positons the theory *Optimizing Perspectives* and its conceptual categories within the existing body of knowledge. Compared theories were selected because of their relationships to the data categories generated, comparable perceptions of identifying main perspectives or concerns, and theory developed from participants insightful experiences. Some theories identified for comparative analysis had technology and non-technology components, and adopted CGT.

Since the comparative literature review is not the main objective of this research, I have undertaken the process to substantiate and position *Optimizing Perspectives* theory within existing body of knowledge and literature. I determined that *Optimizing Perspectives* can be related to existing grounded theories and other theories in IS.

Chapter Seven

7.0 Analytical Appraisal of CGTM: Experiential Perspectives During the Research

"There is no better than adversity. Every defeat, every heartbreak, every loss, contains its own seed, its own lesson on how to improve your performance the next time"

Malcolm X (1925 - 1965)
Civil Rights Activist and Minister

7.1 Chapter Summary

This chapter explains my experiences of using CGTM in this study which I consider to be a contribution towards ICT4D or ISDC research. I explore opportunities, limitations, challenges and problems faced from embracing CGT. In Addition, I discus implications of using CGT for examining influence of ICTs; and inferences grounded from the experience of adopting CGT. Although this chapter is the smallest, it is significant because it authenticates theoretical findings from my experience of using CGT.

My experience of using CGT is congruent with assertions from Adolph (2013; Andrade (2007) and Tossy (2012) who describe CGT as an effective and easy to adopt qualitative method that is feasible for extensive usage in low resource settings analogous to SSA. Tossy (2012) further argues that CGT is a cost-effective method that can be adopted to conduct socially contextual research that includes socio-economic and cultural effects of IS.

CGT like other research methodologies has pros and cons in its application. In ICT4D, CGT adoption is still emerging, and during this research, I confronted challenges which I had to navigate and resolve effectively. This chapter elucidates seven issues experienced after adopting CGT which then predispose assumptions, objectivity and research findings. These include: 1)

initial limitation of being a novice CGT researcher; 2) *inconveniency in choosing from several GT variants*; 3) *method complexity*; 4) *usage of highly abstract and dense conceptual language*; 5) *dependence on researchers' cognition*; 6) *proactivity and skills*; 7) *limited research literature in ICT4D or ISDC*; 8) *intricacy in comparative literature review process of theory*; and 9) *complexity in repudiating my preconceptions*.

This experiential chapter preludes thesis conclusion.

7.2 Researcher's Limitations

With this study being my first research adopting CGT, I considered myself a novice CGT researcher. I read and understood the methodology before practically undertaking its fundamental tenets effectively. Several CGT articles were extremely helpful, but GT articles such as (Elliott & Higgins, 2012; Hughes & Jones, 2003; Matavire & Brown, 2013; Müller & Olbrich, 2011; Urquhart et al. 2010) which describe application of GT in IS were very valuable. I found myself conducting research in an area with limited IS literature and knowledge; and I had to conduct intricate measures to overcome challenges faced from adopting CGTM. This is a task I allowed myself to undertake which some might find incredible to do.

I was cognisant of the fact that I had to check my potential bias or knowledge about ICT in Uganda by concealing my professional experiences and objective or subjective views in order to let participants express their perspectives. CGTM supports proper etiquette and engagement with participants during interview encounters. I encouraged participants to express their views rather than influencing them with my perspectives.

I overcame this limitation by understanding the approach and developing a new substantive theory following its rigorous tenets.

7.3 Multiple Variants and Method Complexity

Since the discovery of GT by Glaser & Strauss (1967), the method has been increasingly used in diverse research areas; and it has evolved into multiple

variants. Matavire & Brown (2013) state four distinct GT approaches that have been adopted in IS. To adopt a specific GT approach, I followed Heath & Cowley (2004) assertion that rather than debate relative merits of each method, researchers should select an approach that best suits their cognitive style and develop analytic skills by doing research.

I selected CGT which has increasingly become a method of choice in IS because of its emphasis on generating theory from data, and it contextually suited this study based on my reasoning.

Challenges faced include: need to completely understand the method and its fundamentals, justifying suitability for this research, incorporating it to examine research questions, and knowing adjustments to make without compromising method integrity. As a novice at CGT, this was demanding because it took me some time to clearly understand fundamental nuances. Those experienced in CGT use acknowledge that it is insufficient to merely have an intellectual understanding of its principles, because the experience from literally doing the research is very significant to fully comprehend it.

I would like to categorically state that the experiential process of adopting and understanding CGT was quite challenging and rewarding as well.

7.4 Abstract and Dense Conceptual Language

I found CGT conceptual language usage dense and confusing, and its nuances highly abstract. Explanations about what theories are (*formal and substantive*) was a little sophisticated. This forced to me to read exemplar CGT articles to comprehensively understand the method and how to implement it. Being a non-native English speaker ensued that I required time to understand all nuances as evidenced by copious articles read and cited in thesis. CGT uses highly complex language descriptions that is not easily explained, and proficiency in language competence provides for better understanding.

As for the dense conceptual language, I had to cope with reading and receiving mentor support. I am grateful to Prof. Irwin Brown for giving me supportive articles and documents that clarified CGT approach. Additionally, experienced CGT researchers explain that fully understanding it is not only intellectual, but requires an experiential perspective. Glaser (1992) explains that experiences from conducting research using CGT teaches researchers how to deal with understanding hidden patterns, behaviour and letting data concepts emerge intuitively without forcing. Reading, learning and understanding alone does not demonstrate how to practice CGTM. Researchers need pragmatic experiences to learn how to deal with confusion, and not to force emerging conceptual elements.

Since Glaser (1978), numerous articles by Glaser and many scholars further explain CGT so that it is correctly used in research. The articles succinctly enlighten CGT to the research or academia community.

7.5 Substantial Dependence on the Researcher's Cognitive Proactivity and Skillset

CGT researchers acknowledge that it is relatively possible for other researchers to generate different interpretations of the same data. Glaser & Strauss (1967, p. 225) assent that researchers '*readily agree that their own theoretical formulations represent credible interpretations of their data, which could, however, be interpreted differently by others*'. Glaser (1978) recognises this complexity by stating that human social research is intricate and multifaceted; therefore, researchers need adequate training, practice and mentorship to undertake studies using the method.

CGT method relies profoundly on researcher's analytical skills, cognitive understanding, interpretations, flexibility and proactivity to generate conceptual codes and categories. Experience helps in identifying emergence of the core category, which is then elevated to substantive theory prominence. Elliott & Higgins (2012) denote that CGT for novice researchers can be particularly complicated because of lacking skillsets.

To undertake this research, I read extensively about GT and its variants. I adopted Heath & Cowley (2004) suggestion that novice researchers should select an approach that best suits their cognitive style and develop analytic skills through doing research. I selected Glaserian GT, and I was guided by several exemplar articles, my supervisor and Prof. Irwin Brown who have successfully supervised several PhD students that have adopted GT.

7.6 Limited Literature in ICT4D or ISDC Research

Recent ICT4D or ISDC studies postulate that adoption of ICTs advance development of organisations or society (Alderete, 2017; Mthoko & Khene, 2018; Qureshi, 2015; Walsham, 2017). Walsham (2017, p. 18) describes ICT4D as "*concerned with the use of ICTs for international development*". Toyama's (2011, p. 75) classical work on technology as an amplifier for development argues that technology projects "*are most successful when they amplify already successful development efforts"*.

Because I examine the WSDB which the MWE implemented to bring change, I elucidate its influence on the water sector to develop theory. Adoption of CGT in ICT4D or ISDC research is still emerging, and CGT research investigating development influence of ICT artefacts is still emerging.

Literature adopting CGT is non-existent in Uganda's water sector despite growing use of ICTs and mobile technologies. In SSA CGT studies were in e-learning, e-health, education, psychology and other ICTs in general. Despite literature challenges, I still founding adopting CGT extremely useful because the method perfectly blended with this research's overall contribution.

7.7 Comparative Literature Review Complexity of Generated Substantive Theory

Desirability of CGT is that other than developing theory, researchers do not need to extend, prove or validate extant theories. The basic idea is to build theory explaining phenomena from the perspective of those experiencing it. All concepts generated are grounded in data; and are not proven, but they

are suggested. New theory does not need to pay homage to legacy or extant theory, but rather brings new specific meanings, understandings or concepts (Glaser, 2002; Holton, 2008). Glaser & Holton (2004, 9. 5) rejects the intention to prove, disprove or extend theory by stating that:

> "*Contrasting the generated theory with extant other theories to prove, improve or disprove one or the other neglects or ignores constantly comparing the theories for category and property generation. This contrasting with other theories also prevents modifying the GT generated theory using the other theory as a kind of data*"

This notion creates some complexity with literature comparisons. Comparative literature reviews make direct comparisons between concepts in the new theory and those in extant theories. This puts augmented demands on researchers to ensure that comparisons are not just about comparable categories, but conceptual meanings or identifications of categories.

For this study, I used *Optimizing Perspectives* as a key word when searching for literature about related theories. Likewise, I used primary and secondary categories during the search process. *Chapter 6* presents theories selected that I envisaged to be comparable to *Optimizing Perspectives*.

7.8 Complexity in Suspending Preconceptions

GCT approach requires researchers to suspend their prevalent knowledge or preconceptions to learn from participants, and develop theory regardless of their objective or subjective views. A priori predispositions should be set aside because researchers may occasionally undertake research in an area they have sufficient or even limited knowledge. CGT researchers implement intricate measures to overcome each knowledge circumstance, although it can be challenging to suspend individual preconceptions and world views.

Despite my existential knowledge about Uganda, I made a conscious effort during exploration to suspend prior knowledge by asking questions, letting participants speak freely without interruptions and not presenting my viewpoints for participants to respond to. CGTM is supportive in this

process because checking own prejudices and views is wholly enunciated and extremely invigorated.

7.9 Chapter Conclusion

This chapter clarifies my experiences of adopting CGT method by explicitly declaring how I started out as a novice and overcome knowledge requisite challenges to undertake this research. I described several experiential challenges confronted that included among others suspending my own preconceptions, complexity with adopting CGT, managing interview encounters with participants, language density and undertaking a comparative literature review of *Optimizing Perspectives*. I described how I managed to resolve the challenges. The next chapter elucidates research conclusions, contribution to knowledge and implications for future studies.

Chapter Eight

8.0 Conclusions, Contribution of the Research to Knowledge and Implications for Future Studies

"It always seems impossible until it's done"

Nelson Mandela (1918 - 2013)
Anti-Apartheid Activist & Former President of the Republic of South Africa

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8.1 Chapter Summary

This chapter concludes the entire research presentation and is summarily relevant towards understanding of the whole study, methodological processes adapted to examine research problem, findings from qualitative interviews, analytical process and the theory developed; which is the main knowledge contribution. The chapter is divided into multiple sections and subsections that present consequential concepts; and elucidate how I make use of CGT, inductive and interpretive approaches to discover findings. This is then followed by subsections which quickly re-articulate *Optimizing Perspectives*; and how it answers study questions, purpose, motivation and theoretical contribution.

The chapter illuminates implications of study findings towards artefact theorisation within IS research community and practitioners. I adopt, relate and present the theoretical contribution based on four theoretical generalisations proposed by Walsham (1995a). The chapter concludes with explanations of how I conducted this interpretive research, presentation of study contributions, reflections, limitations and avenues for future research.

8.2 Participants, Question and Methodology

Research questions focused on how participants working in Uganda's water sector perceived influence of WSDB initiative on progress in the water

sector. Participants worked under three distinct stakeholder groups which include MWE, UWASNET and NGO. Their work entailed data submission, management of water points, data management, planning and analysis, policy evaluation, community engagement, stakeholder collaboration and ICT support.

I adopted CGT to collect and analyse data, and then produce theory grounded in data. Emails and phone calls were used to schedule interviews, and to receive secondary data such as reports and policy documents. Interviews were all conducted in person. I adopted semi-structured interviews, and they consisted of multiple sections that addressed WSDB concepts encompassing technical information such as influence perspectives, its initiation, design, deployment, usage, challenges, participant experiences and consequences. Additional interviews focused on follow-up concepts determined from initial interviews.

Following CGT tenets, the discovered theory conceptualised how and why users have optimistic perspectives about WSDBs developmental influence.

8.3 Study Reflection

Before undertaking the research, I determined that that there is limited artefact theorisation literature in SSA, and specifically Uganda's water sector which is the focus of this research. In addition, studies related to the adoption of GT are limited, and a systematic literature analysis of the water sector did not find any. I surmised that limited literature is due to the fact the IS field is still growing in SSA, and most ICT4D research is just getting published. This research aimed to contribute to this knowledge gap.

This research was based on the premise that If we understood how ICT artefacts influence organisational processes and specific developmental concepts, then we can augment theorisation perceptions. CGTM was fit for theory development; and theory cultivated provides a framework for understanding participant perspectives.

Examining the WSDB influence required thoughtful analysis of participant responses. Participants gave me an understanding of how the WSDB has augmented data submission. DWOs are data activators, and they play a crucial role of collecting and submitting data. The WSDB's potential to track quarterly data submissions has exceedingly influenced data management. Consistent submission of data has had a multiplier effect of not only attaining critical information, but increased communication channels between MWE, stakeholders and all staff across the country. MWE (2014) stated that country-wide data submissions increased over 96% due to WSDB utilisation. At the MWE, I observed data entry and analysis practice.

The thought inspiring this study was need to theorise influence of the WSDB on Uganda's water sector development. I began the study by attempting to understand the consequences and benefits of WSDB. Data was collected from participants working for different stakeholders. The data included how WSDB is used for planning, budgeting and policy. Participants stated how the WSDB has supported improved data collection, access to information, and decision making. My analysis revealed WSDB significance in facilitating country-wide access to information about water points. The MWE has additionally accentuated WSDB use so that stakeholders take advantage of its intended benefits.

As discussed previously, the WSDB is now positioned as MWE's main ICT initiative for access to water point information. The WSDB positioning provoked thoughtful considerations aimed at investigating its possibility to influence growth. Some questions reflected upon were: (1) Is it possible for the WSDB to provide consistent information despite infrastructural challenges? (2) Can we credit the WSDB with water sector growth or development based on its influence on decision making? (3) Is the WSDB influencing interactions among stakeholder and how the sector operates?

To answer the reflective questions, I reflect on Toyama's (2011) classical work on technology as an amplifier for development. Toyama's (2011, p. 75) consequence is an amplifier theory for ICT4D asserting that "*technology*

projects in global development are most successful when they amplify already successful development efforts". And Qureshi (2015) assertion that development organisations should first determine necessity of ICT interventions when solving developmental problems. Relatedly, I was interested in developing a theory about developmental influence of the WSDB on the water sector.

The WSDB is now perceived as a developmental ICT artefact because it was positioned by the MWE (*a water sector developmental institution*) to support its development-oriented programmes. Toyama's (2011, p. 81) amplifier theory reflected the assertion with the statement "*technology projects should seek to amplify the impact of existing institutions that are already contributing successfully to development goals. Instead of leading the charge with technology, technology is best employed as support and amplifier*".

However, the WSDB still has challenges. The system does not provide real time information. One DWO requested improvements or new technology enhancement that could track daily functionality of water points. This request backed Toyama (2011, p. 80) assertion that successful ICT4D projects require that for "*technology effectively to address development problems, it's necessary that you already have competent, well-intentioned people....then it would obviate the explicit need for an external technology push – capable people pull in, or come up with, their own technology*".

Some challenges reflect irregular WSDB use by stakeholders. One participant from an NGO stated seldom WSDB use because of data integrity issues. Quarterly (*every 3 months*) data submissions does not reflect real-time conditions. Some stakeholders run their databases which they consider more reliable, and only check WSDB to contrast with their data.

From theorising participant's data collected using CGTM, the core category and theory *Optimizing Perspectives* emerged emphasising how the MWE makes effective WSDB use to influence ways in which the water sector operates. This perspective conveys an explanatory narrative about WSDB

influencing the water sector. Theoretical explanations contribute answers to the main research question stated in *Chapter One*.

Optimizing Perspectives was cultivated from several codes and categories generated from initial line-by-line coding. The codes and categories reflect multiple themes based on an explanatory understanding of WSDB influence. Cultivating, comparing and contrasting categories contributed to an understanding of the interplay between WSDB usage, positioning and its general effect on the water sector.

CGT allowed presentation of reasoned evidence from data. *Optimizing Perspectives* acknowledges evidence of WSDB amplifying existing developmental processes. I discerned instances of WSDB contributing to ways in which the MWE effectively manages the water sector data. Thus, *Optimizing Perspectives* elucidates MWE's effective adoption of WSDB to support growth in Uganda's water sector. This parallels Toyama's (2011, p. 77) assertion that technologies have a positive effect "*only to the extent that people are willing and capable of putting it to positive use*".

8.4 Interpretive Principles upon which this Research was Conducted

In chapter three, I discussed interpretive aspects that nominally informed the research and illuminate methodology as well as theory cultivated. During initial research commencement, I reflected upon my philosophical and methodological assumptions. Critically understanding and adopting interpretive reasoning, while embedding its rationale into the research without worrying about subjective or objective preconceptions was distinctly considered.

I searched articles examining interpretive inferences for qualitative research to augment my interpretive experience. I obtained several articles that examine how interpretive field research is conducted and assessed. Klein & Myers (1999) was crucially significant because there are benchmark fundamental and interdependent principles for conducting and evaluating

interpretive studies in IS. *Table 22* presents descriptions of how each principle was fundamentally adopted for this research.

No	Principle	Description of Fundamental Adaption
1	Hermeneutic Circle	Specified essentials to understand ICTs in the water sector, which include contexts about WSDB implementation, influence, consequences and research area. I engrossed myself in an endless loop of deciphering meanings from participant perspectives.
2	Contextualisation	Having in-depth knowledge of Uganda, its history, status of the water sector and ICT sector strengthened research context. In addition, traveling to five different districts for interviews ensured that I accrued thousands of travel kilometres to obtain contextually rich information. I acquired water sector information about districts, towns or villages. Chapters one and two present this context.
3	Interaction Between the Researcher and Subjects	I was cognizant of the fact that interactions with participants could influence their views because I was perceived by some as an ICT expert due to my experience and PhD research. I recognised that introducing myself as a doctoral student had some influence on behaviour or attitude because a PhD is seen as one of the highest forms of education in Uganda. Nevertheless, participants stated responses to research questions, and I obtained rich data despite my inherent trepidations.
4	Abstraction and Generalisation	Reflects idiographic manifestations into theoretical concepts distinct from generalisation. This exploratory study is a qualitative examination of participant perceptions regarding WSDB implementation and influence on growth. Methodological processes and philosophical

		assumptions led to a conceptual understanding of study problem and emergence of *Optimizing Perspectives* substantive theory.
5	Dialogical Reasoning	Requires researchers to confront preconceptions. Reasoning free of bias, subjective or objective views was vital. Preliminary work from literature did not interfere with insights emerging from data. Because one must state their philosophical assumptions, and their strengths and weaknesses. I clearly stated my world views and I was open to concepts emerging from data. As the study progressed, I was extremely sensitive not to bias to findings.
6	Multiple Interpretations	Examines contexts of study along with different viewpoints and reasons. Requires understanding differences expressed in data and interpretations. During data collection, I had recorded and non-recorded interviews. I wrote notes for non-recorded interactions. they helped establish rapport and permitted extra interviews. I reviewed literature in documents such as SPR. Some data differed in reports and interviews. The contradictions led me to get deeper views of the divergence.
7	Suspicion	Entails sensitivity to possible participant distortion of their descriptions. It is about understanding meanings by elaborating what is behind participant words and their implicit or explicit vested interests or agenda. I selected different stakeholders or groups of participants working in Uganda's water sector. My assumption was that they would provide more perspectives due to differing interests or multiple opinions. I was prudent because I wanted to uncover implicit or explicit perceptions; and I believe I was to identify and code the perspectives.

Table 23: Application of interpretive principles adapted from Klein & Myers (1999)

8.5 Contribution to Knowledge and IS Research

Research investigating developmental influence of ICT artefacts in specific sectors of SSA is very limited. In addition, studies adopting CGT to undertake ICT4D studies are limited but continuing to increase. Due to the literature limitations, I undertook to investigate influence of the WSDB artefact which was implemented by Uganda's MWE to manage the water sector. CGT was adopted to cultivate theory from qualitative data. Theory generated represents a contribution to knowledge in IS or ICT4D research.

As a justification for adopting CGTM towards theory development and knowledge contribution in IS, I reveal Gregor (2006, p. 613) assertion that "*a characteristic that distinguishes IS from other fields is that it concerns the use of artifacts in human-machine systems*" and theories generated "*are practical because they allow knowledge to be accumulated in a systematic manner and this accumulated knowledge enlightens professional practice*". I embrace Lee (2001, p. iii) claim that IS theories examine "*more than just the technological system, or just the social system, or even the two side by side; in addition, it investigates the phenomena that emerge when the two interact*".

As a consequence of this research's main purpose, the theory *Optimizing Perspectives* emerged to provide a conceptual explanation; while proving contribution to theoretical and practical perspectives.

8.5.1 Theoretical Contribution

According to Gregor (2006, p. 611), the goal of theory is for analysing, explaining, predicting, or prescribing; and theories must have constructs which are conceptual properties. Gregor (2006) and Hassan (2014) denote that theories educate us about study phenomenon, and increase our understanding of the world with new insights or concepts. Gregor (2006) describes IS theories as concerned with use of artefacts in human-machine systems, and exposure of social phenomena which emerges from the interaction.

Optimizing Perspectives theory is this research's main contribution to existing knowledge, and it elucidates consequences of WSDB's progressive influence from the perspectives of participants. The perspectives explicate qualitative perceptions; and as a researcher, I consider the theory to be a substantial contribution to knowledge in IS, ISDC or ICT4D. Thus, I succinctly state from *Optimizing Perspectives* that improvements in the water sector coupled with deployment of ICT artefacts such as WSDB have an ancillary relationship.

Because there were no in-depth theoretical studies about the WSDB's developmental influence on the MWE and water sector, this research cultivated an exploratory substantive theory. I categorised the research exploratory because it was attained from a study area that has limited or no research undertaken. CGTM's systematic coding and analysis processes generated basic concepts which cultivated *Optimizing Perspectives*. *Optimizing Perspectives* is an original theory generated from an interpretive study within a specific domain of enquiry; and a rigorous analysis of data.

By adopting Gregor (2006) description of theory, I consider *Optimizing Perspectives* an exemplar theory that analyses and explains artefact influence in this substantive area of enquiry. The theory emerges from an investigative analysis or interpretation of data, and it offers concepts identifying developmental influence as well as evidences explaining perceptions through which influence is stated. The WSDB has strengthened data collection, analysis processes, transparency, accountability, decision making and MWE's effectiveness in managing the water sector.

This research allowed me to provide theoretical answers for reflective questions stated in *Chapter One*. In the end, analysis of raw data cultivated *Optimizing Perspectives* following principles CGT. Chapters *four* and *five* explain methodological processes followed, illustrations, conceptualisations and interview quotes. The research or theory adhered and achieved Glaser's four criteria for evaluating GT, presented in *Table 23*.

No	Criteria	Description
1	Fit	Achieved through deliberation, evaluation, analysis and comparison of data; rather than forcing
2	Work	Exhibited through the illustrative way in which core category and theory emerged from data
3	Relevance	Reflects understanding of WSDB's progressive influence in Uganda's water sector; and it is a pertinent subject when understanding ICT artefacts in ICT4D or ISDC research
4	Modifiability	Theory created can be analytically enriched by other studies and new data. However, Glaser (1998) describes modifiability as new data not refuting preceding theory, but only provides an analytical challenge.

Table 24: Four GT criteria adhered to and achieved

Because I adopted an interpretive approach, I integrated concerns for theory construction using Walsham (1995a) four theoretical generalisations and Klein & Myers (1999) interpretive principles. Theoretical generalisations are achieved because the theory has transferable interpretations to comparable settings. See *Table 24*.

No	Theoretical Generalisations	Adaptive Description
1	Concept Development	Entails processes where the MWE uses WSDB for data storage, decision making and distribution to stakeholders. This is done through providing WSDB access, joint meetings like JSR and SPR publication
2	Generating Theory	Theory created stresses consequences of deploying WSDB by MWE, and focuses on how participants perceive its developmental influence
3	Drawing Specific Implications	MWE coordinates WSDB use and interactions with stakeholders. Coordination influences data sharing and water source project implementations
4	Contributing Rich Insights	How WSDB mediated information is adopted for planning, budgeting, decision making and policy

Table 25: Theoretical generalisations adapted

I consider *Optimizing Perspectives* a theoretical contribution to knowledge towards understanding influence of ICT artefacts. The theory is satisfactory and resilient enough to integrate new data or concepts; and is open for adaptation by researchers who wish to enhance and refine it.

8.5.2 Practical Contributions

Stakeholders in Uganda's water sector benefit from this research and theory by evaluating any ICTs implemented to bring development-oriented change. Cultivated ideas, categories and theory can be applied to related settings so that organisations get the most out of ICTs. Thus, this theoretical contribution provides concepts focused on ICT artefact influence.

For the MWE, its main objective of is to ensure provision of safe drinking water for all citizens in Uganda. Water is a basic need, and MWE's adoption of ICTs is irrelevant if people do not have access to water. ICT support for water service delivery for overlooked places like rural areas is wonderful. Deploying development-oriented ICTs should improve people's water conditions to be considered relevant.

Success or failure of any ICT initiative has policy influence regarding adoption and use of other technologies. Decision makers focus on understanding benefits of the technology, and how information mediated through ICT can be espoused for development. The MWE uses ICTs like WSDB to make reports and budgetary decisions; and reports such as the annual SPR has influence on how decisions are made and implemented. The WSDB plays a crucial role in ensuring integrity of data collected because of validation mechanisms. Previous manual systems had challenges of data duplication and fragmentation. Stakeholders access the WSDB, and they can question its data during all-inclusive workshops and conferences organised by the MWE.

Like most ICT initiatives, sustainability is a concern that needs critical consideration. Despite being initiated by the MWE, the WSDB was funded by donors while technical issues and updates are still done by consultants.

In addition, the WSDB was not envisioned for income or revenue generation. This is expensive, and concern was voiced by the MIS-Unit manager.

> "*the biggest challenge that we have at the moment is, we are relaying on the consultant to sort of to do the technical management of the database….to be able to host and prevent hacking, attacks things like that and even debugging and updating of the system*" (Site 2, November)

> "*In terms of absolute costs, it doesn't increase. But in terms of our reliance on external entities, it is a bit risky for us. And therefore, if I might give an explicit answer to challenges facing management, I think we are lacking in terms of capacity to able to manage the system*" (Site 2, November)

However, WSDB's institutionalisation has given the MWE reliability as a critical source of water sector data, and it is now becoming part of the collective. Some participants did not know how the MWE runs the WSDB, but they are nevertheless glad to use the system. *Optimizing Perspectives* which is this research's theory contribution conceptualises effectiveness of the WSDB. The theory rationalises perceptions about WSDB and its impact on workflow processes at the MWE. The theory provides theoretical insights that can engage with practical issues regarding success of ICT interventions.

Practical contributions have been realised from lessons learnt about WSDB deployment, decisions or policies made about the water sector and its continued evolution. Such practical lessons can be adopted to new e-government ICT interventions.

8.5.3 The Substantive Theory

The major objective of this research was to generate theory highlighting experiential perspectives collected from participants. Using CGT, the theory was generated accentuates the concept that the MWE makes effective WSDB use to achieve progress. The WSDB has changed several ways in which the MWE operates, and its benefits are conveyed through participant descriptions and individual experiences. Other than their actions, participants perceive WSDB as having amplified process of data submission, analysis, decision making and stakeholder engagement.

Interviews were coded and categorised into primary and secondary categories that cultivated the core category and theory. *Figures 29* and *30* in *chapter five* depict theory emergence. The categories comprise processes obtained from participant descriptions, and an understanding of the MWEs positioning of WSDB. Descriptions represent ways in which participant's express consequences of WSDB deployment and its effect on how the sector manages data access processes, decision-making, computer infrastructure, stakeholder engagements, sharing and policy.

Thus, *Optimizing Perspectives* theory is derived from the core category; and is an amalgamation of concepts or categories surmised from participants' descriptions.

8.6 How CGTM Adoption and *Optimizing Perspectives* Explicate Understanding of WSDB Influence

This section deliberates two concepts or notions about WSDB. First, how *Optimizing Perspectives* expounds its progressive influence. Secondly, how CGT analysis advances understanding influence of ICT artefacts.

8.6.1 How *Optimizing Perspectives* Expounds WSDB Influence

The MWE has implemented several ICT initiatives with capricious success. The WSDB is one of few successful initiatives. *Optimizing Perspectives* reveals some concepts illuminating reasons for WSDB success. Additionally, the concepts advance understanding effects of ICT interventions. Despite the theory focusing on WSDB, other ICT initiatives can benefit from it. Conceptualised theory evidences expound reasons for success, scale-up beyond pilot phase and benefits of its influence.

8.6.2 How CGTM Adoption and *Optimizing Perspectives* Advances Theoretical Contributions of Interventions

With the notion that output from this research will provide a theoretical explanation of how participants perceive progress influence of WSDB, I

chose CGT as method for analysis. Glaser (1978) asserts that CGT is a simple non-technical but intensive method that ensures induction as a means of un-covering perspectives and not those derived from existing literature. Studies by Adolph et al. (2012) and Andrade (2007) adopted CGT because it emphasised theory emergence from data, provided flexibility using several data collection methods, emphasises freedom to follow leads as new ideas emerge and develops a theory of practice.

My experience of using CGT is congruent with Tossy (2012) and Andrade (2007) assertion that it is an effective and easy to adopt qualitative method that is feasible for extensive usage in low resource settings analogous to SSA. ICT studies in SSA that reflect examining their development influence lament failures, negligible contribution to practice and limited literature to advance ISDC or ICT4D research. Similarly, varied realisations demand embracing alternative methods like CGT to enhance ICT4D understanding.

Findings from adopting CGT are beneficial because, other than focussing on technical concepts to examine ICTs, CGT concentrates on people's perceptions, and is useful when technologies are embedded in professional or social lives of people.

As a prerequisite, Tossy (2012) cautions novice CGT researchers to first understand the method before undertaking major research because it can be difficult to understand based on literature alone. Tossy (2012) recommends readings, workshops and seminars with experienced practitioners.

Finally, this study contributes to qualitative IS research, literature and theory about Uganda's water sector. The theoretical and practical contributions are based on detailed data evidence to back up claims. As previously stated, *Optimizing Perspectives* theory emerged as an inferential contribution. The theory provides perspectives about WSDB artefact, and advances ICT implementations from perspectives generated.

Although this research's contribution is mainly academic, it has practical inclinations. *Optimizing Perspectives* summarily conceptualises perceptions about WSDB augmenting information processing and decision making to bring developmental change. The theory is contributory to understanding development-oriented artefacts deployed.

In the end, generating *Optimizing Perspectives* using CGTM provides guidance on how researchers studying ICT4D contexts in SSA conduct qualitative studies or data analysis in a systematic and rigorous approach that lead to theory development.

8.6.3 Contribution towards Understanding Artefact Interventions in the Water Sector

Other than the theoretical outcome, a major contribution is understanding possibilities and consequences of implementing ICT artefacts. IS practitioners can make use of *Optimizing Perspectives* to augment artefact deployments. This research advances knowledge and learning using concepts or categories constructed from participant perspectives.

Adopting CGT to conduct the study provides for an essential methodology that has not been fully utilised in SSA's ISDC or ICT4D research. Tossy (2012) argues that CGT is a cost-effective method that can be adopted to conduct socially contextual research that includes socio-economic and cultural effects of IS. Due to the WSDB, *Optimizing Perspectives* provides sufficient concepts for understanding social aspects about ICTs. Theory constructs are relevant and proportionately essential for assessing rationale; and can be associated to new artefact interventions. WSDB's success is attributed to lessons learnt from past ICT failures under the MWE.

From this research, I learnt from the experience of adopting CGT; and I recommend its usage in understanding IS related research in SSA.

8.7 Limitations, Learning Outcomes and Future Research

Because this research relates to Uganda's water sector, it means that it had boundary limitations despite opening more opportunities for ICT4D or ISDC research. Lack of related CGT studies in Uganda, and generally in the water sector was a major limitation. There were no studies of similar scope and context; and CGT research identified tackled e-learning, software engineering, ICTs and Health. Reviewing these articles was useful for me because it supported exploring applicability, appropriateness, scope and context of this research relative to grounded theory.

The CGT approach adopted and presented throughout this research was limited by the researcher's initial experience. Nevertheless, I undertook all determinations to ascertain, apply and present a consistent CGT approach from its tenets. However, I feel like my initial lack of proper expertise might have delayed or decreased quality that a more experienced researcher would have managed appropriately. Investing some time in new CGT projects, interacting with experienced CGT enthusiasts or participating in seminars under the Grounded Theory Institute[31] where I could interact with experienced researchers would have been extremely beneficial.

All data collected in CGT though trivial is significant because it might yield meaningful concepts, insights, patterns or results. Hindsight from my experience would have helped me not to take every insignificant data detail for granted; hence taking notice of everything. For instance, during initial interviews, some DWO complained of not being given computers; and to them, this was a sign of '*inconsideration*' because other DWOs had been given. But at the time, I simply took it as a sign for '*lack of funds*' purchase computers by the MWE. More experience would have prepared me to be more aware, and it would not have taken me long to realise that '*being inconsiderate*' was in fact one of several indicators for *optimization of*

[31] http://www.groundedtheory.com is the official site of Dr. Barney Glaser and Classic Grounded theory, which is dedicated to helping scholars learn CGT from being a novice to a teacher

Perspectives. Despite experience being an issue initially, the theory cultivated at the end subsequently followed fundamental CGT tenets.

In addition, extra introspection or vitality to fundamental CGT concepts like developing theoretical sensitivity and writing notes or memos would have been very imperative prior to doing this study. Glaser & Holton (2004) claim that undertaking CGT concepts in purist form often requires experience gained from investing time, energy and instruction. More comprehension of theoretical sensitivity led me to the belief that I should not have generated data until I had knowledge of more coding families applicable to the study.

Memo writing was challenging. Writing memos on they fly was delicate because I had to analyse data from substantive conceptions to theoretical notions exclusive of forcing. Excellent adoption of CGT requires daintiness in handling memos, which I found somewhat or sometimes elusive.

Like memo writing, constant comparison was strenuous due to numerous codes generated. During comparisons, data is broken down into instances which are related to find similarities and differences. I found considering, integrating and discarding codes overwhelming for fear of dropping significant concepts. I meticulously accomplished comparison although benefits from experience would have been ideal.

Despite limitations, I meticulously followed CGT tenets, and the substantive theory *Optimizing Perspectives* was generated because of the diligence. CGT proved useful for understanding WSDB consequences, and concepts in *Optimizing Perspectives* can be examined for applicability to related contexts.

8.7.1 Self-criticism and Reflection

After selecting the research topic, and due to cognisance towards my philosophical assumptions and CGT adoption, I often wondered whether I was doing or following CGT method appropriately. The delimit led me to meticulously understand every process before any activities.

Upon reflection, I suggest sentiments that optimistically impacted the research. Primarily, a complete understanding of CGT before undertaking it is ideal. It felt like a crash-course during the study. Attending at least one seminar under the Grounded Theory Institute would have been invaluable towards preparing me for what I was about to experience. Absence of prior CGT knowledge certainly slowed my understanding and usage.

Additionally, I would incorporate additional data collection approaches in the research design like controlled quantitative techniques, observation and document reviews to benefit from extra insights. Because theory is developed from data, some CGT studies suggest flexibility in adopting more techniques so that more data collection opportunities are feasible. For instance, Andrade (2007) includes surveys which is quantitative.

Increasing the number of participants could contribute to richness in data. I would have increased participant numbers, but the number interviewed for this qualitative study was good enough. The condensed time of the study, coupled with the time required to request and get new interviews with staff at MWE was one problem I did not want to go through again. Nevertheless, I believe I would still come up with comparable conclusions or concepts due to saturation, and my erstwhile inferences progressed expertly.

As discussed previously, more time dedicated to understanding would have been ideal; and this includes proper understanding of concepts augments that entail the research. I could have invested time and patience in data collection. I felt like I was bit swift with data collection because of time bound limitations. Perhaps more time could have contributed richer data, but I believe that inferences would still be analogous.

Finally, despite declared limitations, the quality of this study and theoretical contributions meet benchmarks, though I still feel like my performance could be greater.

8.7.2 Future Research

This research's substantive area analysed perspectives about the WSDB influence. The WSDB is an ICT initiative implemented by Uganda's MWE to manage the water sector. As indicated before, qualitative data was collected from participant interviews using CGTM. Data was conceptualised to produce a substantive theory that is relevant for understanding implications for adopting CGT in exploring influence of ICT initiatives in SSA.

Because I categorised this research as exploratory, other researchers can augment or enrich it. Critical examination of WSDB's data management process, coupled with an understanding of how it facilitates multifaceted information dissemination are future research areas.

Future studies will endeavour to push the context of research and theory *Optimizing Perspectives* on its greater implication and application to IS in general. This will enhance the value of the theory and its overall knowledge contribution to IS literature in general.

Perceptions from stakeholders such as Civil Society groups is a good avenue to examine how WSDB mediated information influences policy decisions and planned projects from Civil Society organisations. In addition, examining implications of snowball approach of selecting study participants is a great avenue for future research.

Supplementary comparative literature review of *Optimizing Perspectives* and related primary or secondary sub-core categories can be done. The categories as explained in *chapter five* can be extended to enhance understanding of perceptive about contribution to research and practice. For instance, researchers could invigorate quality analysis to refine and determine how quarterly asymmetric data submissions and WSDB use processes are presented under *Expressing Dissatisfaction*. I believe categories such as *Validating Developments, Negotiating Compromises, Infrastructuring* and *Sanguine Orientating* can be enhanced. Improved categorisation to enrich the theory gives extra theoretical understanding of WSDB influence.

Finally, the end goal of CGT is to discover a formal theory transcendent of time and place from substantive theory. Glaser & Strauss (1967, p. 79) assert that a substantive theory is grounded in research from a specific area. Substantive theories are a '*stepping stone to the development of a grounded formal theory*' and to reformulate previously established ones. A formal theory from *Optimizing Perspectives* and ancillary substantive theories can be developed to examine ICT artefacts in specific sectors of SSA, and provide conceptual elements for successful implementation of ICT initiatives that demand community-oriented development focus or welfare.

8.8 Thesis Finale

This research began with the enthusiasm to understand developmental influence of ICT initiatives in SSA. Recent ICT4D studies examine development influence, consequences, effects, success and failures of ICTs; and I wanted to contribute theoretical knowledge or literature. Studies by Avgerou & Walsham (2017); Gigler (2011); Jacobs et al. (2018); Ponelis & Holmner (2015); Qureshi (2015); Walsham (2012, 2017) reflect and investigate ICTs development-oriented contributions, impact and whether we are or not exploiting ICT for a better world. These exemplar studies enhanced my research interest to explore, examine and theorise about ICT consequences.

Experience researching ICTs in the WASH sector of SSA guided me to undertake research about Uganda's own water sector. I selected the WSDB implemented by Uganda's MWE, as a development-oriented ICT case study. Instead of adopting presumptuous concepts about the WSDB, this research explored to analyse and contextualise distinct perceptions from experiences of those working in Uganda's water sector. The goal was to examine perceptions regarding development-oriented influence of the WSDB, and its positioning by the MWE as an ICT intervention for the water sector.

I designated this research as exploratory because there were no related studies using similar methodological approaches. I adopted CGTM backed by qualitative, interpretive and inductive approaches. Philosophically, I first

reflected upon my ontological and epistemological beliefs before choosing CGT. I adopted Guba & Lincoln (1994) assertion that ontology and epistemology should inform choice of methodology. Rationally, preference for CGT is justified from: (1) n*eed to build theory from data about specific phenomenon*; (2) *exploring adoption of CGT in understanding perspectives about ICT initiatives implemented with a development-oriented purposes*.

Additionally, adoption of CGT was because other than its emphasis on developing theory from data, researchers do not need to extend, prove or validate extant theories. CGT notion is to build theory explaining phenomena from the perspective of those experiencing it. Glaser & Holton (2004) objects to comparisons with the intention to prove, disprove or extend a new or old substantive theory. And that new generated theory does not need to pay homage to legacy or extant theory, but independently brings new specific meanings, understandings and concepts.

Elliott & Lazenbatt (2005), notably asserts that there is no universally accepted best GT research practice. Nevertheless, I consider CGT processes described in *chapters 3,4* and *5* to be fundamentally sound, and rigor in techniques undertaken is credible. My rigorous CGT techniques are adapted from principles described in Glaser (1978, 1998, 2002), Glaser & Strauss (1967); and exemplar studies like Adolph et al. (2012); Andrade (2007); Higgins (2007) & Tossy (2012).

According to Glaser (1978), the discovered theory is an integrated set of hypotheses not findings. Credibility of theory is won through its integration, relevance and workability; but not by illustration as if it were proof. New concepts generated are grounded in data, and are not proven but suggested. New concepts created are grounded in data, and are not proven but suggested by researchers doing analysis.

Glaser & Strauss (1967, pp. 225) state that GT researchers '*readily agree that their own theoretical formulations represent credible interpretations of their data, which could, however, be interpreted differently by others*'. Theoretical formulations from similar data can be interpreted differently by

other researchers; which influences proposition of theory constructions. However, confidence in credibility of differing conceptual analysis or theory is backed by rigorous undertaking of CGT tenets; while keeping in mind features that allow for validity, verifiability and evaluation such as fit, workability, relevance and modifiability.

The idea that other researchers can provide differing interpretations did not influence my conceptual constructions because my backing is from Glaser (1978, 1992) declaration that self-assurance in theory credibility is based on confidence in structured processes undertaken such as inductive analysis, coding, core category discovery and proposition of an integrated substantive theory. Confidence in theory credibility is from plausible explanations and presentations of *theory generated through analysis of qualitative data*.

My new substantive theory *Optimizing Perspectives* was developed from an interpretation of participant perceptions about WSDB influence and its consequences. The MWE implemented the WSDB with the aim of providing solutions for data management and data based decision making challenges faced. The overall goal was to use ICTs in managing the sector. Participant perspectives precipitously reflect that effective WSDB use by the MWE to enhance water sector performance in-spite of existential impediments.

I consider *Optimizing Perspectives* to be a substantial theoretical contribution to knowledge in ICT4D or ISDC research. Explicitly, the theory addresses participant perceptions about consequences of implementing the WSDB artefact. *Optimizing Perspectives* reflects knowledge themes, and highlights optimistic description about WSDB influence. Another major contribution is the way in which CGTM is adapted to develop theory.

Because of this research, I proclaim that adoption of ICTs is not only about delivering excellent experiential technologies, but it is about unearthing distinct perceptions of how the technology enhances work activities, decision making processes and overall sector progress. Stakeholders need to experience how service delivery or work-related programmes are supported by ICTs to augment use and optimism. I agreed with Toyama (2011) claim

that organisations amplifying development programmes should rationalise ICT deployment, and I succinctly state that the MWE's development goals have been supported by the WSDB.

Optimizing Perspectives is discovered because of CGTM adoption, and a research journey undertaken to scrutinise and interpret WSDB influence. The theory originates from participant's explanatory perspectives. Researchers intending to undertake a comparable study may or might not come up with analogous theory or theoretic construction. Glaser & Strauss (1967, pp. 224-225) claim that incessant intermeshing of data collection and analysis influences how the research ends; and the emerged theory is equivalent to what researchers systematically know about their data.

Finally, I would like to make a disclaimer that this thesis and theory developed or presented does not proclaim to come up with undisputable or absolute factualness. The study emerges because of a research journey undertaken to understand how Uganda's MWE is leveraging ICTs and WSDB artefact to manage the water sector; and to achieve goal six (6) of the UNs SDGs that concern safe water access for all people.

The theory and concepts discovered about the WSDB, and theorisations from ICT initiatives using CGT has not come to an end; and is ostensibly going to continue throughout my academic career. Testing the discovered theory in related substantive areas, and constructing new substantive or formal theory is genesis for future studies.

Appendices

Appendix A.1: Interview Sites

Table below shows a detailed list of interview locations, organisations, sites and participant roles. Site numbers indicates different interview places.

District	Organisation	Site Number	Participant Role
Kampala	MWE	1	ICT & Data Analysts
Kampala	MWE	2	MIS-Unit & Data Analysts
Kampala	MWE	3	RWSSD Staff
Kampala	UWANSET	4	Manager
Kampala	NGO	5	Manager
Kapchorwa	MWE	6	DWO
Kapchorwa	NGO	7	DWO
Kween	MWE	8	DWO & Assistant
Mbale	MWE	9	DWO
Mbale	NGO	10	Staff
Kabarole	MWE	11	DWO
Kabarole	NGO	12	Staff

Appendix A.2: Interview Schedules and Ethical Concerns

After obtaining ethical approval from Department, interview sessions were scheduled with participants. Meetings were scheduled months or weeks before, and days before or promptly during data collection. Contact was initiated with participants through email and phone calls. Before each interview, I introduced myself formally, and then went further to explain the research's purpose which was to understand their perspectives and concerns about the influence of WSDB on MWE's goal of managing and developing the water sector.

Participants were encouraged to speak freely because this research was purely academic and it would not harm them or their livelihoods in any way. I informed participants that their quotes were to be anonymously published, and no one would track their identities. This is a major condition to obtain ethical approval in the Department of Information Systems.

As recommended by Glaserian CGT, some initial interviews were conducted without tape recording to establish rapport and to make participants speak more freely with me. This process is analogous to having normal conversations in which engagement with participants is colloquial. This was done in order to plan for necessity of any additional interviews with specific participants. Additional meetings were conducted for specific conceptual findings and to allow participants reflect on their previous or new responses. Memos or notes were written during and after all interview sessions.

Finally, choice of participants and locations was an important consideration. Participants were chosen from different locations of the country in order to enrich the research with insights from multiple areas. *Figure 3* shows a map of interview locations. Purposive sampling and snowball approaches were followed during participant selection. Interviews sessions were conducted in a variety of places that included offices, cafeteria, restaurant, boardroom, public bar, hotel lounge and in a home.

Appendix A.3: In-Depth Interviews

Table presents a detailed list of participants with their roles, districts, dates, interview durations and locate. Participants names are coded to abide by ethical conditions. The study had over 30hrs of interviews.

Participant	Participant Role	District	Date	Duration	Interview place
P1	Data Analysist	Kampala	21st January 2016, 19th November 2016	30-45 Minutes	Office
P2	Data Analysist	Kampala	21st January 2016, 19th November 2016	30-45 Minutes	Office
P3	Water Engineer	Kampala	3rd December 2015	30-45 Minutes	Office
P4	Data Analysist	Kampala	20th January 2016	30-40 Minutes	Office
P5	UWASNET Manager	Kampala	22nd January 2016, 20th November 2016	30-40 Minutes	Boardroom
P6	DWO	Mbale	27th November 2016, 9th January 2017	30-45 Minutes	Hotel Lounge
P7	NGO Staff	Mbale	16th November 2016, 25th January 2016 7th December 2015	20-30 Minutes	Cafeteria
P8	DWO	Kabarole	5th January 2017	45-60 Minutes	Restaurant
P9	NGO Staff	Kabarole	6th January 2017	30-45 Minutes	Restaurant
P10	DWO	Kween	2nd February 2016, 30th October 2016	30-40 Minutes	Boardroom
P11	Admin staff	Kween	2nd February	20-30	Office

			2016, 30th October 2016	Minutes	
P12	DWO	Kapchorwa	3rd February 2016	30-45 Minutes	Office
P13	Community Member	Kapchorwa	3rd February 2016, 3rd November 2016	20-30 Minutes	Office Garden
P14	NGO Staff	Kampala	23rd January 2016, 9th December 2015	20-30 Minutes	Cafeteria
P15	MIS-Unit Manager	Kampala	18th November 2016, 4th January 2017	30-45 Minutes	Office
P16	MIS-Unit Staff	Kampala	18th November 2016	20-30 Minutes	Office
P17	NGO Staff	Mbale	5th December 2015, 29th October 2016 5th December 2015	30-45 Minutes	Restaurant
P18	NGO Staff/ Community Member	Mbale	1st February 2016, 4th December 2015 October 18th 2016	30-45 Minutes	Cafe

Appendix A.4: Sample Coded Interview

Interview Transcript	Initial Summarized Coding	Open Codes Generated (Line-by-line Coding)	Key Code or Categories
Who Designed the WSDB? We engaged a private firm; a company to do the design. But Loy (Assimwe Loy) should be able to give you the name of the firm of you want. But, yes we drafted terms of references, sent them out, the companies had to bid for the work and evaluation was done. And then the best evaluated bidder got the assignment to design. But I forget the specific name of the company, but it is also a company that has been in the water sector for a while	• Involving a private firm to design WSDB • Seeking out developers • Developing scope for WSDB design activity (Stating terms of reference) • Unsure/ Forgetting the design firm's name • Evaluating of the firm • Selecting of the firm	• Involving Stakeholders • Seeking developers • Defining roles and Scope • Defining requirements • Designing/ Developing system • Evaluating bids and skillsets • Choosing designer	• Seeking development • Engaging stakeholders • Defining requirements • Designing project • Evaluating bidders and skills
Where Stakeholders and users involved? Yes. The way we did it has been more of a product that we; I wouldn't say that it is prototyping method of development because in prototyping you develop a small component and a small component but this one we went full scale but continued to grow the product. We developed something then we started using and then where they were gaps, we have continued to; even now we it is still product in development.	• Involving stakeholders • Phase by phase designing of usable WSDB Components • WSDB still undergoing development	• Involving Stakeholders • Phase designing • Modulating implementations	• Involving Stakeholders • Implementing modules in phases
Yes, more components, more features, more reports, customizing depending on the changes and the requirement of the users.	• Customizing components • Changing needs for system use are always communicated • Requirement analysis	• Customizing components • Communicating features • Identifying	• Customizing components • Communicating features • Refining

	from users • Identifying changes • Refining what is needed • Optimizing system functionality	requirements • Refining needs • Optimizing functions	requirements • Optimizing use
Mainly this firm working closely with the IT MIS department	• Interacting during design	• Interacting with users	• Interacting during design
What users have access to WSDB? I would want to categories them; probably that will give you a better view in terms of who uses. We have now, I would say staff or yes staff in the water sector, I mean staff in the ministry of water but then we also look at the stakeholders in the water sector. We have given access to the districts, we have given access to the NGOs in the water sector, we have given access to the public. Somebody can go in as a guest and guest. Just that the level of access defers for security reasons and those other things. So those are the users. Even you if know the URL you can go there as guest and you will be able to see some information. The districts also have their own credentials that they use to access the system.	• Categorization of users based WSDB access • Giving access to WSDB to all users in the water sector • Access levels given to different users • Security concerns led to access levels given • Safe keeping of information • Districts use their own access methods to access WSDB	• Categorizing users • Permitting access • Accessing of system • Defining role of users • Storing concerns for information	• Categorizing user roles • Permitting access • Accessing system Storing information concerns
Who gives access permissions? Yes, IT we give but the developer also because he is still in charge of system, he also gives. The two of us.	• Giving WSDB access privileges • Mediating use	• Authorizing access • Mediating use	• Authorizing access • Mediating use
Is it accessible country wide? Yes, because it is hosted on the internet and accessible.	• WSDB accessible country wide • WSDB runs on the internet	• Accessing from anywhere • Hosting on the Internet	• Accessing from anywhere • Hosting on the Internet
How is data entered into? Now, we have not automated data collection	• Manual forms used to collect data for date	• Collecting information is	• Collecting information is

yet. Yes, we have not yet automated data entry. We still do manual forms. One the technology; we have looked at several technologies but none of them has been, can address all the things/ all the issues that we would want. One you need probably like a smartphone to able to access the web app. Now the people who collect data do not have access to the smartphones. We want, if you give them those smartphones it means that you must also buy data for them to be able to push that information on to the server. We also want to ensure that the District Water Officer participates so that he owns that data. Now all this can be done on the form. He looks that form, he acknowledges that I agree by appending his signature. And then; now we receive they are able to access these data forms from the same portal. Both update and for new water sources. For new water sources, it's a completely new form. Now, for those that are existing, we want to look at the functionality, we want to look at the level of yield, we want to look at its M&E or O&M; how those components are. And then also those User Committees, you know those things. Yes, so we still receive data on forms manually and then it is entered here at the center. We have data entrants. I think if we entered we found a young man seated there. And the forms are there. These are the very forms that come in from the districts. You know our districts are divided into regions and these are the regions where you see TSU something, TSU something. There are districts that fall in those districts.	entry • considered automation but no technology decided upon • Still determining a plan for automation of information submission • Data collectors need access to smartphones for automation • Still optimistic about smartphone use • DWO should be involved • New forms used to submit new water sources • Exiting water sources have update forms • Data entered at the MWE head offices • Data is prepared under TSUs from the districts • DWO are responsible for water sources and are accountable for data submitted	manual • Determining WSDB automating plan • Stating optimism for future • Preparing of data by DWO • Being responsible for data entry • Being responsible for submission of data • Optimizing information flow process and data entry • Defining accountability	manual • Determining WSDB automating plan • Stating optimism for future • Preparing of data by DWO • Being responsible for data entry and submission • Optimizing information flow process • Defining accountability

Each district has its own DWO, now he is responsible for water sources in that particular districts.			
And they post the forms to the regions? These forms, these manual forms they can download from the portal. But those that are unable to download, we usually download and send by mail to them. Send by mail the printout. Some of them say we don't even have a printer, and if Loy as access to a working printer and she has paper and she has toner; she also prints and hands them hard copies and then they go and fill hard copies and then bring back.	• Forms sent to DWO that cannot download manual forms • Email communication used • Confronting lack of services such as printing • Optimizing work on data submissions • Overcoming service obstacles	• Communicating needs • Overcoming challenges • Optimizing data submissions • Confronting service lack • Downloading information needs	• Communicating needs • Overcoming challenges • Optimizing data submissions • Confronting services lack
Have they been trained to use the system? Yes the same people who do entry when they are back they do data entry but part of their duty is also to train those users on how to access the system. Where do they go, how do they print the forms, how do they access the reports because, now what they are not trained in is data entry because they don't do. But filtering through the reports, printing forms; that yes they are trained.	• Training data entry users and DWO •	• Training of users	• Training of users
Can other stakeholders access? Yes I have told you the NGOs.	• Stakeholder access to system	• Stakeholders accessing system	• Accessing system
If yes, what information can they access through? This is basically reports and they able to filter through and see the various reports that are on that system. For example, how many water sources are in the particular sub-county, how many of them are functional as per the system. But that might be different from what is on	• Filtering to access important data and reports • Answering queries about functionality of water sources • Validating of data by the users	• Filtering data • Answering • Querying needed system data • Optimizing access and use • Validating of data • Distributing	• Filtering data • Querying system data • Optimizing system use • Validating data • Distributing of projects

ground. Because the Hand Pump Mechanic can go there today repair for example a water pump and then walk away and then the following day its down again. Musa: It's not functional. And yet he has just updated that it is working. Yes, he just updated. Of course he has repaired, updated his form and you know taken back the form to the office. So, they are able to see those reports, water sources, the distribution of water sources in an area or in the entire districts, the functionality levels, if there exists Water User Committees and probably the composition.	• Distributing of water source across regions and districts • Viewing functionality of water source points • Optimization of system use and data access • Determining existing water user committees	Information • Viewing functionality existing data	• Viewing water source functionality
How information is shared by numerous stakeholders? What do you mean. All these guys have access. They come. Now those that know don't need to come to request for that information. Some still do, probably they do not have access to; they have not been setup to access the system. Initially they come and usually we ask them to write. Yes, they write to the PS and you know communicate and then the approval comes through, and then we create an account and give them access. But they do.	• All stakeholders can accessing the WSDB • Requesting of information by stakeholders who don't have access to WSDB • Communicating by stakeholders if they need any information • Approving WSDB user accounts through	• Seeking information • Communicating across stakeholders • Stakeholder coordination • Authority approval	• Seeking information • Coordinating stakeholders • Approving accounts • Communicating amongst stakeholders
challenges related to the use, management, maintenance and update? Challenges; we've not been able to host it internally. We are currently paying a service provider to host the application. Reason being, we want the system to be as available as much as possible. So, whenever we have a problem	• WSDB is Challenging to host because of technical issues • Paying service provider to host WSDB • Internet breakdown challenges	• Lacking Infrastructure • Technical challenges • Infrastructure breakdown • Traffic	• Infrastructuring lack • Challenging technical problems • Overwhelming by system traffic

with our internet at least the application will always be available, whenever we have a problem with power the application will be available. But also at the time we updated, we hadn't got enough, a server that will handle those so many connections coming in given that; like during the day which is the time that these guys are accessing the system; we have our staff who are also using that internet for various things. So we thought that probably that would overwhelm the traffic.	• Occasional Blackouts affect system access • Overwhelming user traffic causing accessing issues		
Which service provider hosts the system? Is it a telecom company? Yes, a telecom company but it is not local.	• International company hosting the system	• Making system hosting international	• Internationalizing system host
Each time you have new requirements you have to send to the developer? Challenges related to use? Of course, yes, the requirements keep changing. That is a problem for the developer. And then like I said because it is more of an in house developed application Yes, that partly but also the gaps have been many and some features you find they are not working as expected. So, we keep have you know back and forth. This is not working right, the computations here is not okay. So, that also proves to be a challenge. The other one is when our internet is slow then data entry also becomes a problem. When we do not have internet then data entry cannot be done if we don't have internet here. We still rely on internet to do data entry. Maintenance and update; I think these guys are	• Requirements keep changing • In-house development • Contacting developer for every need • Designing challenges for new features • Back-and-forth between developer and users • Slowing of the internet • Inputting of data not done when internet speed is slow • Internet reliance • Availability of developer	• Changing requirements • Relying on Internet • Continuing to engage developer • Designing of new needs • Connecting to slow internet is challenging • Inputting affected by internet speed • Availability of designing team	• Changing requirements • Relying on Internet • Continuing to engage developer • Designing of new needs • Connecting to slow internet is challenging

really available. Yes, the developers. Every time we need changes made, they've really come in and addressed them.			
WSDB User engagement? The minor changes that happen now, sometimes am also not notified but in the initial stages we used to have meetings where they would present. This is what it is able to do, this is how it flows, from here you do this at the start. We had so many of those meetings and then even the bosses would come in and you know some of them would say why do you put our data on the internet; no it should be private, whoever wants they should come and ask. But eventually they agreed to have access privileges. Even the design of those reports; we want to this, we want to see that.	• Meetings used for conducting presenting • Showing functionality and significance system • Concerns over data on the internet • Involvement of leadership during design • Making information private and not public • Opening to suggesting and evaluating concerns for design of system • Accessing roles defined	• Discussions conducted during presentations • Brainstorming meetings Conducted • Concerns over safekeeping of data on the internet • Involving leadership to influence process • Suggesting and Evaluating concerns • Defining access roles	• Presenting discussions • Brainstorming meetings Conducted • Concerns over safekeeping of data on the internet • Involving leadership to influence decisions • Suggesting and Evaluating concerns • Defining access roles
Perception of WSDB? *No, in the building it is, I don't know about out there but in the building, it is good. I would say, not good but very good.*	• Feeling like the WSDB perception is excellent • Excellent perception/ Good reviews about the WSDB	• Finding good WSDB perceptions • Reviewing is very excellent	• Finding good perceptions • Reviewing is excellent
Most staff are happy about it? *Yes, they are happy about it, they believe the statistics and those who have participated they know that they are not statistics that you know somebody sat under the tree and produced or cooked, no. The perception I would say, generally it is good. Because it helps them look up those statistics, allocation of resources and*	• Reviewing WSDB has been positive • Verifying and Validating results are output from the WSDB • Feeling like the perception of the system is very good	• Optimistic reviewing • Validating system is good • Verifying undertaken for data • Relying on data from WSDB • Planning and	• Optimistic benefits • Validating system is good • Verifying undertaken for data • Relying on data

yes even access to information. Because it is them it guides them when it comes to planning. "And they rely on it because every time the rural department even ***Water For Production*** *if they are going will first come and say we want to see which areas are not well served", or which areas are do not have water sources at all, and then your able to see. Even decommissioning some of the sources, the system is able to produce and say this water source last produced water maybe six or seven years ago. But of course, like any other system it also has its own limitations.*	• Guiding, planning and resource allocating done because of the WSDB • Relying on WSDB by department and water for production • Aiding distribution and allocating of resources • Ability to Viewing of areas serviced and those lacking • System has limitations	guidance for decision making • Perceiving system has been excellent • Allocating of resources done • Accessing information • Reliance • Distribution undertaken due to WSDB • System has limits	from WSDB • Planning and guidance for decision making • Perceiving system has been excellent • Allocating of resources done • Accessing information • Relying on WSDB data • Distribution undertaken due to WSDB
But in terms of validity, the system does some good level of validation; they are able to tell that these figures are not right because we expect you to be within a certain range and then usually we even hand these forms back to the district and we tell them that it doesn't match what we think it should be. And then they take it back , collect and resubmit. For example, those areas we know that in for example in central the water source must fall with in this region. Remember we even look at the coordinates; so if somebody submits as a water source in central but the coordinates his giving are in Mbarara then we would certainly know.	• Validating is provided by the system for data submitted • Overcoming obstacles such as outlier figures • Coordinating for mapping of water points is provided • Verifying coordinates done by maps	• Improving Accuracy • Validating provided • Overcoming outliers • Mapping undertaken for verifying	• Improving Accuracy • Validating • Overcoming outliers • Mapping done for verification
And how often do they submit? Quarterly. Every four months they produce an update. Actually, every three months.	• Submitting water source information quarterly in a year	• submitting	• Submitting
Every three months. So they have to make	• Collecting of data about	• Collecting of	• Collecting of

sure all these points are functioning. The water points? No, you see the approach is to use the **Hand Pump Mechanics**. **To get to which pumps are working?** Yes, because they move. They know the locations of these water sources, they do repair these water sources; so they know where these are. So even the District Water Officer may, yes they might know but they are not as reliable as those Hand Pump Mechanics because for them that is what they do or like their full time job so they give you more accurate information. I think a Sub-County has like two or three; yeah so they move around these water sources. Even the community calls them, every time they have a problem they call them	water functionality by staff • Moving within districts allow them to collect this data • DWO relying on HPM to give more accurate information about functionality of water sources • DWO not as reliable about functionality themselves • Involving community in submitting water source problems	information • Functioning of water sources verified in the system • Challenging to get data • Relying on HPMs • Determining accuracy • Involving community	information • Functioning of water sources verified • Relying on others for data • Determining accuracy • Involving community
all the people who access	• All stakeholders and staff meant to access and use the WSDB	• Promoting stakeholder access	• Promoting public access
something is not working as expected.	• Communicating non-functional components	• Communicating system challenges • Functioning issues	• Communicating system challenges • Functioning issues
No, I said they don't do any data entry. No, all the data ins entered here. All of it. We are not giving them access to enter.	• DWO not involved for inputting of data into WSDB • All data input done at the MWE	• Inputting of information not done by DWO • Inputting undertaken at MWE	• Inputting of information not done by DWO • Inputting undertaken at MWE
We want to have some level of control. But they are able to see what we have entered on their behalf and they are able to tell that I think this is not proper and this is not as reported in the	• MIS controlling entry of information to WSDB • Viewing of district information done by	• Controlling of information entry • Viewing of information done by	• Controlling of information entry • Viewing of information done

system or we gave you data and you have not updated because even that they are able to see. We submitted data but you guys have not updated in the system and then we tell them that we have a backlog, we are trying to you know update and ensure that whichever data come in first is what is entered then when we get to yours then we will be able to enter it at all. But we have full time data entrants, there are rare cases when their data takes long. Actually, the biggest problem we have is some of them submit late.	DWO • DWO can query missing and un-updated data • Experiencing backlogs by data entry staff which often affects timeliness of data entry • Late submitting of data leads to longer inputs to the system	all stakeholders • Enquiring of information can be done • Experiencing of delays in submitting data • Non-real-timing of information	by all stakeholders • Enquiring of information can be done • Experiencing of delays in submitting data • Non-real-time accessing of information
Incomplete, yes some of them actually submit at the end of the quarter. At once yes. But you see when they submit at once you might find you collected data in Feb (meaning February), you going to submit it in November, things like functionality have changed probably multiple times; so that does not give like a true picture and the system keeps that history. We are able to see that at this, for example last financial year coverage for this location was so much, now coverage in this location has either reduced or gone higher. And you can logically be able to, did we decommission or did they construct new sources. What explains the increase or decrease. …even that has the population increased in this location, yeah and those are the few that we don't have control over because these we get from either **UBOS** (Uganda Bureau of Statistics)	• Incomplete submitting of data due to deadlines • Some submissions done at once the end the year • Water source functionalities changes not reflecting on late submissions • Changes of water access can be viewed through system • Decommissioning and construction of water sources can be explaining • Explaining/ reasoning increase or decrease of water points can • Obtaining population statistics from UBOS	• Submitting of incomplete data due to deadlines • Needing to Reflect late data entered • Late submitting of data • Requiring to decommission old projects • Explaining water access decrease or increase • Obtaining statistics for decision making	• Submitting of incomplete data due to deadlines • Needing to Reflect late data entered • Late submitting of data • Requiring to decommission old projects • Explaining water access decrease or increase • Obtaining statistics

Appendix A.5: Codes and Categories

The table presents all codes and categories constructing the core category and theory Optimizing Perspectives.

Codes Generated during Data Analysis	Relevant Codes/ Categories	Secondary Sub-Core Categories	Primary Sub-Core Categories	Core Category Constructed
Validating, Endorsing, Verifying, Exchanging, Amplifying, Discerning, Sharing Data, Examining, Distributing Projects, Developing, Functionality, Equity, Negotiating, Categorising, analysing, Reconciling, Planning, Joint Plannings, Coordinating, Imposing, Interaction, Undertaking, Involving, Engaging, Streamlining, Initiating, Tracking Performance, Evaluating Data Inputs, Recognising Policy Impacts, Seeking Exchanges, Analysing of data, Reflecting Decisions, Correcting submitted data, Improving, Decisioning, Policy Making, Assessing project implementations, Interacting, Planning around Projects, Communicating Effects, Involving and Engaging	Validating and Verifying data submissions	Reconciling Undertakings	Validating Developments	**Optimizing Perspectives**
	Tracking Performance			
	Joint Plannings			
	Seeking Exchanges			
	Evaluating Implementations			
	Recognising Policy Impacts	Policying Assessments		
	Reflecting Decisions			
	Evaluating Data Inputs			
	Communicating Effects			
	Promoting Data Sharing	Holistic Collaborating		

Stakeholders, Improving, Seeking Opportunities, results-orienting, Optimizing Perceptions, Collaborating, Manifesting, Prioritising, Collaborating, Symmetrical Engaging, Asymmetrical Engaging, Promoting System use, Symmetrical and Asymmetrical Engaging	Distributing Projects			
	Involving and Engaging Stakeholders			
	Symmetrical and Asymmetrical Engaging			
Optimise, Delineating, Answerability, Optimizing, Perspectives, facilitating, Negotiating, Compromising, Amplifying, Manifestation, Coordinating, Optimizing Concepts, Commissioning, decommissioning, Conceptualisation, Enabling or Availing Access, Balancing, Partnering, Constructing, negotiate, undertakings, Conjoining, Sharing Efforts, Decision Making, Mediating stakeholders, Interactions, Coordinating stakeholders, Collaborating, Developing, Orienting effects of prior Decisions, Compromising,	Centralizing Interactions	Conjoining Efforts	Negotiating Compromises	
	Interconnecting Stakeholders			
	Controlling Processes			
	Enabling or Availing Access			
	Prioritizing Meetings and Workshops	Balancing Partnerships		
	Collaborating on Sector Goals			
	Coordinating stakeholders			
	Partnering with stakeholders			

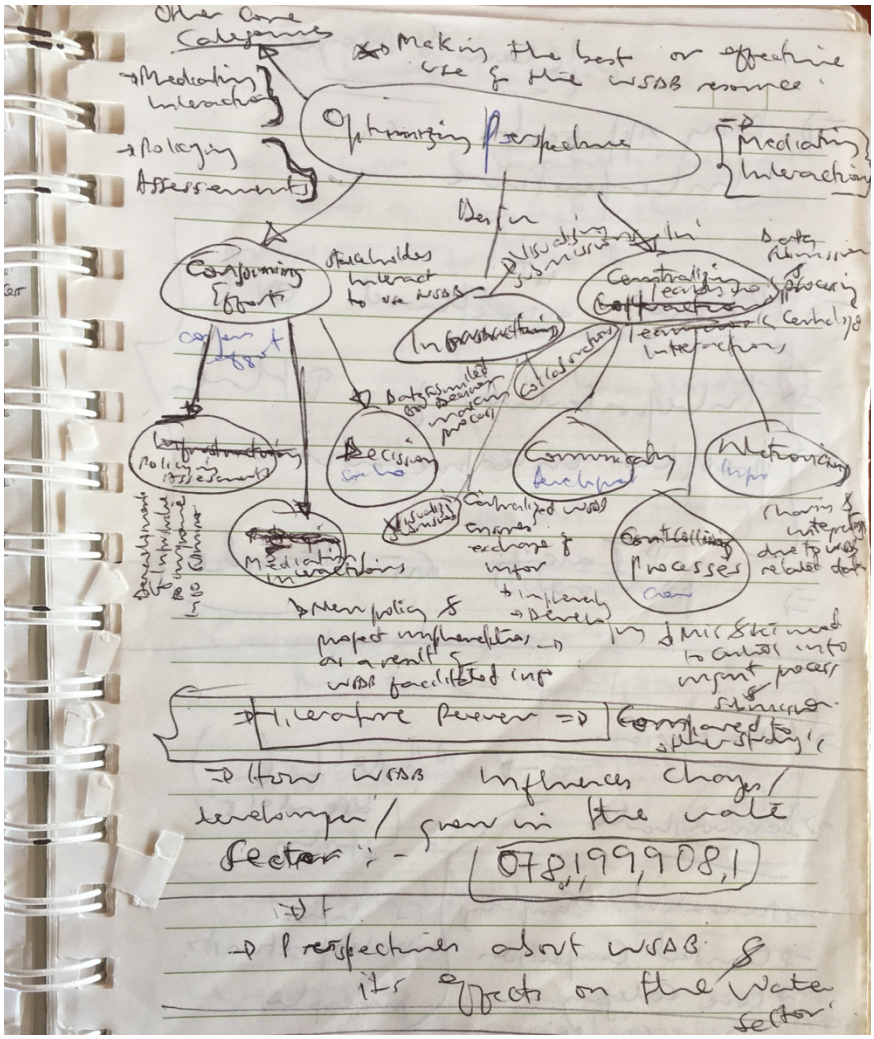
Controlling Processes Coalescing, Opportunities, Building networks, Centralizing Interactions, Partnering with stakeholders, Focusing on Goals, Interconnecting Stakeholders, managing, Administering, Brainstorming Results, Realising, Cooperation, Funding, Prioritizing Meetings/ Workshops, Collaborating on Sector Goals, Ideating for the future, Negotiating opportunities and challenges, Planning, Budgeting, Conflicting, Strategizing, Centralising, Confronting Challenges, Reflecting on Analytics, Conjoining tasks	Negotiating opportunities and challenges			
	Commissioning and Decommissioning	Decisioning		
	Reflecting on Analytics			
	Delineating Answerability			
	Orienting effects of prior Decisions			
	Focusing on Goals			
	Confronting Challenges	Mediating Interactions		
	Constraining Purposes			
	Ideating for the future			
	Brainstorming Results			
Designing, Implementing, Using, Evolving, Sustainability of System, Infrastructure Building, Reports Generating, Amplifying, Initiating, Managing, Training, Visualising, Requiring new Components, Augmenting	Reports Generating	Visualising Submissions	Infrastructuring	
	Displaying or Viewing all Data			
	Augmenting Data Submissions			
	Ascertaining Data Validity			
	Refining Requirements	Components Building		

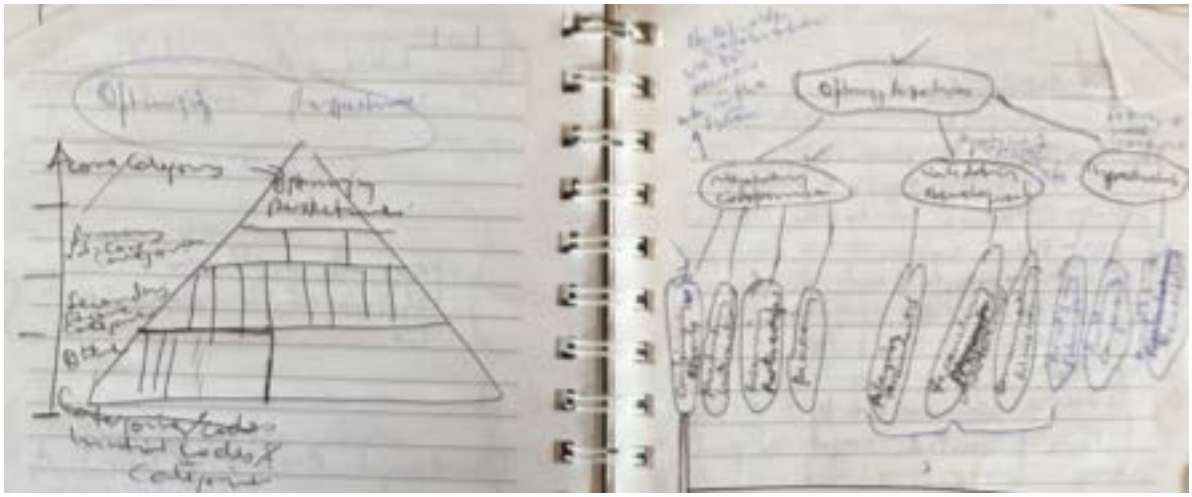
Data Submissions, Preparing, Centralising, Making Submissions, Submitting, Inputting, Ascertaining Data Validity, Implementing and Testing Designs, Optimizing WSDB usage, Implementing and Testing Designs, Accessing, Improving data Validity, Displaying or Viewing all Data, Training of WSDB Users, Mediating or Authorising Access, Component Building, Validating Data Integrity, Refining Requirements, Sharing Data to Contrast, Executing Errors, Evaluating Designed Modules, Seeking Funds, Enhancing data Access, Coordinating, Engaging, Stakeholders, Administering WSDB operations, Promoting WSDB Use, Robust Measuring, Managing Technical Problems, Ensuring Functionality	Implementing and Testing Designs			
	Evaluating Designed Modules			
	Training of WSDB Users			
	Seeking Funds			
	Administering WSDB operations	Amplifying Data Access		
	Mediating or Authorising Access			
	Sharing to Contrast			
	Promoting WSDB Use			
	Managing Technical Problems	Erroring Handling		
	Ensuring Functionality			
	Executing Errors			
	Validating Data Integrity			
Disenchanting WSDB Notions, Reflecting on inaccurate Information, Discontenting, Validating errors, Optimizing Solutions,	Identifying Contributions and Opportunities	Prospective Positioning	Sanguine Orientating	
	Managing System Evolution			

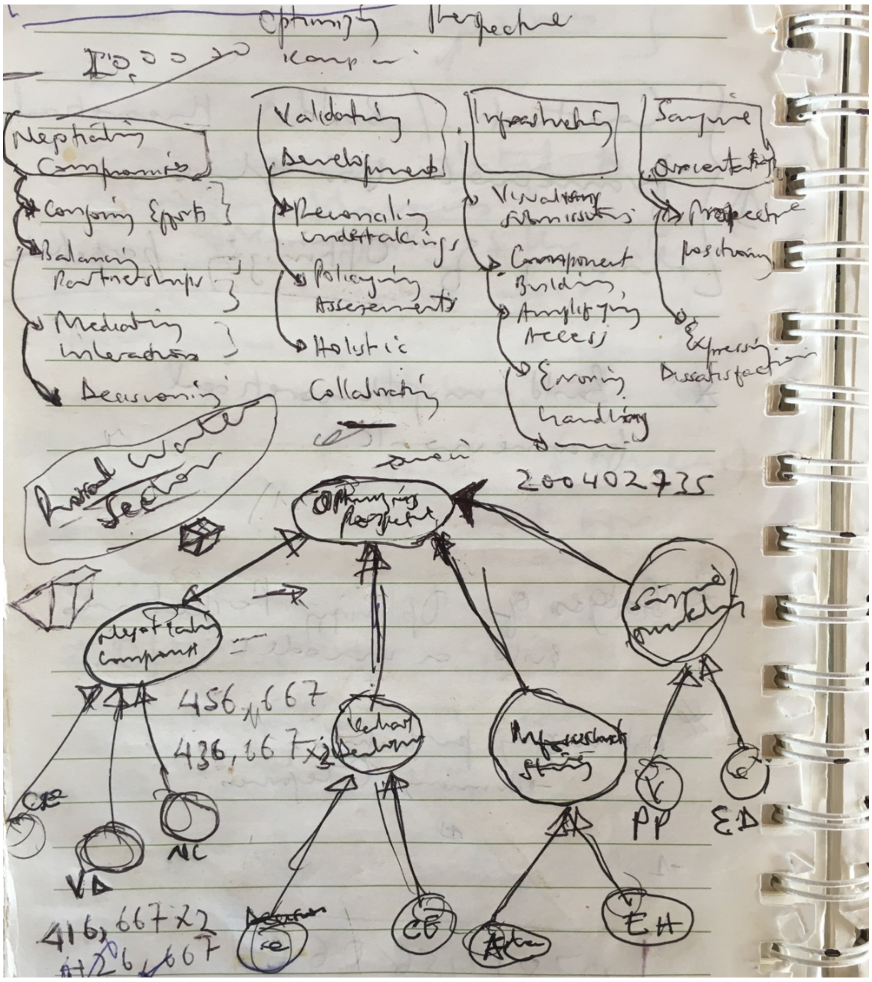
fault handling, Validating Integrity, Optimism, Illuminating, identifying Contributions and Opportunities, Positioning, Resolution, Enthusiastic Coveting, Centralising, Increasing belief, Managing System Evolution, Providing data required, Engaging, Training on Potential, Demanding Support, Sanguine Enthusiasm, Incorporating Stakeholders in use, Examining Non-Access, Expressing Viewpoints on use, Stating Loathsome feelings	Training on Potential			
	Enthusiastic Coveting			
	Disenchanting WSDB Notions	Expressing Dissatisfaction		
	Examining Non-Access			
	Validating Integrity			
	Demanding Support			

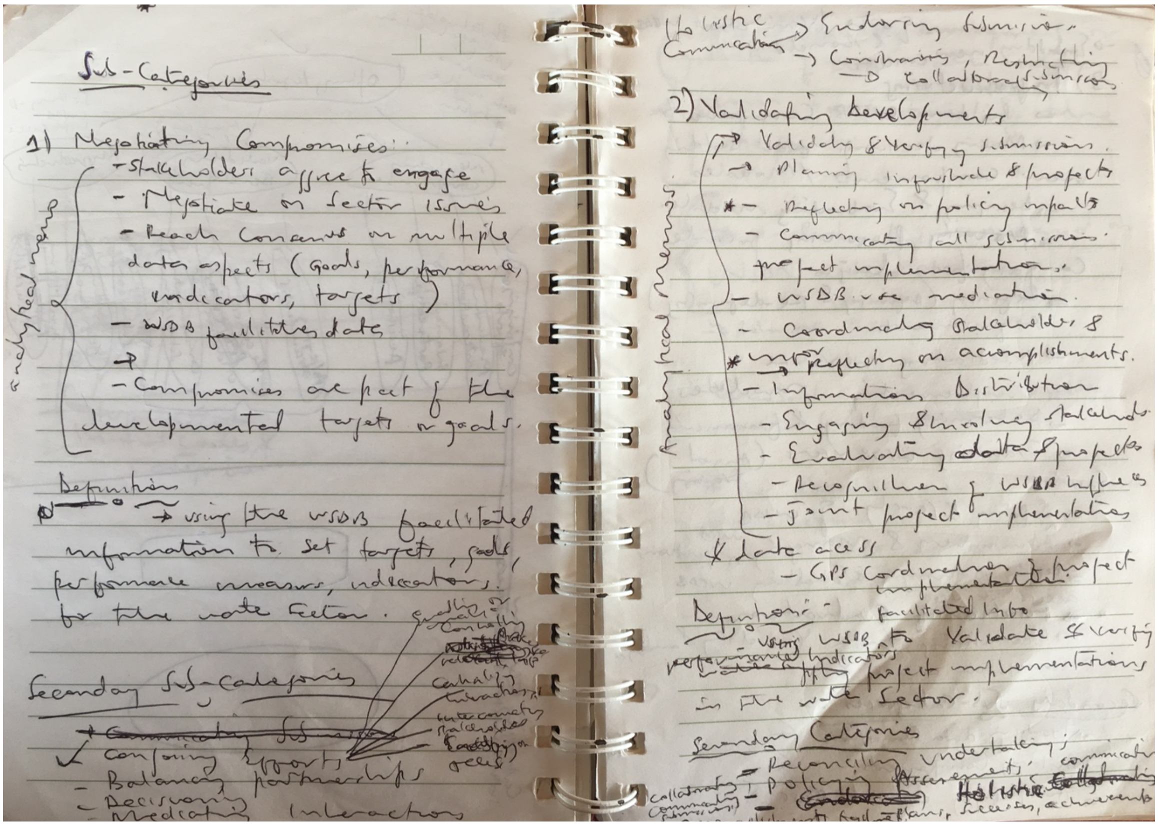
Appendix A.6: Illustrations of Theory Emergence

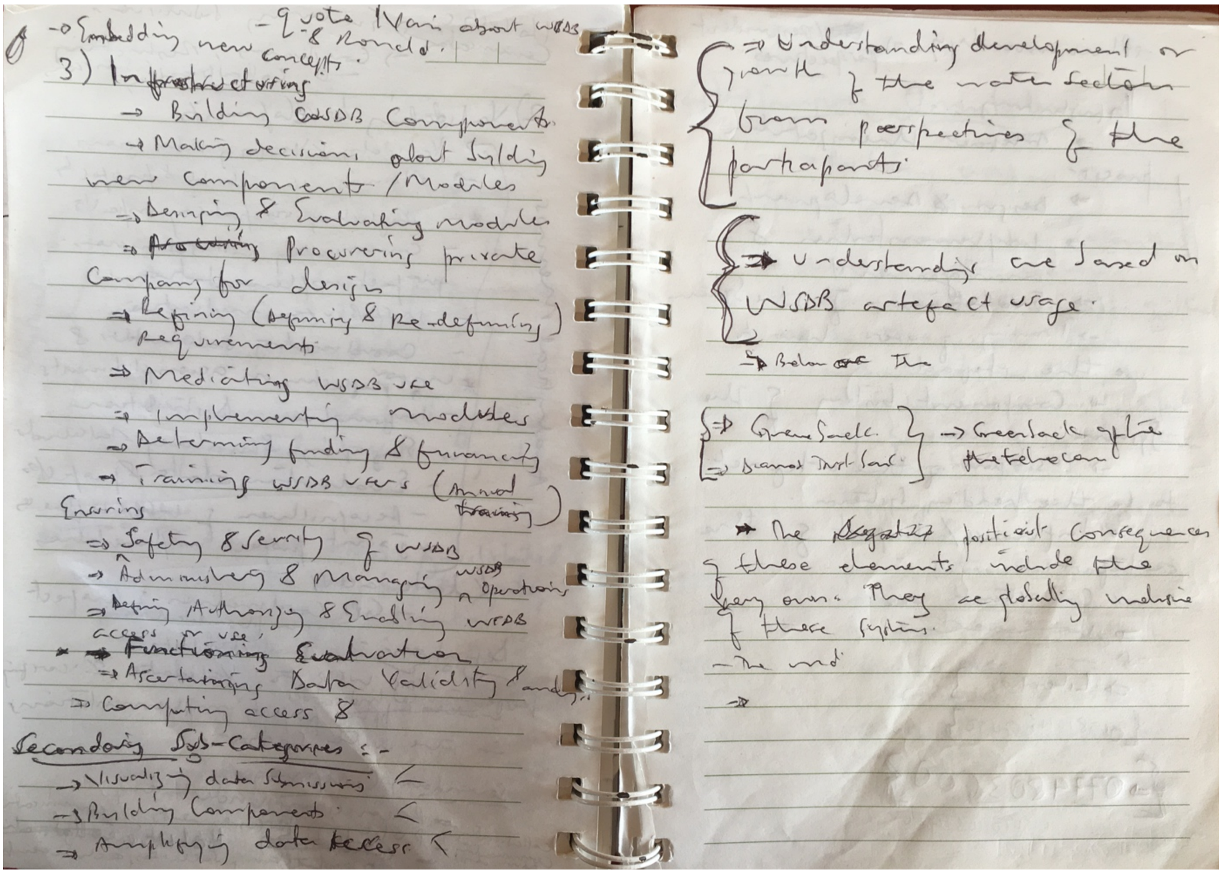
These abstract diagrams illustrate my analytical thoughts leading to how the theory emerged. The diagrams are from my notebooks.






Optimizing Perspective
Negotiating Compromises
Validating Development
Conforming Efforts
Balancing Partnerships
Mediating Interactions
Decisioning
Reconciling undertakings
Policying Assessements
Holistic Collaborating
Component Building
Amplifying Access
Errors Handling
Prospective positioning
Expressing Dissatisfaction
Rural Water Sector
200402735
456,667
436,667 x 2
416,667 x 2
VD
NC
PP
ED
CB
EH


Sub-Categories
1) Negotiating Compromises
- Stakeholders agree to engage
- Negotiate on sector issues
- Reach consensus on multiple data aspects (goals, performance, indicators, targets)
- WSDB facilitates data
- Compromises are part of the developmental targets or goals.
Definition
Using the WSDB facilitated information to set targets, goals, performance measures, indicators for the water sector.
Secondary Sub-categories
Conforming Efforts
- Balancing partnerships
- Decisioning
- Mediating interactions
2) Validating Developments
- Validity & verifying submissions
- Planning infrastructure & projects
- Reflecting on policy impacts
- Communicating all submissions
project implementation
- WSDB use mediation
- Coordinating stakeholders &
- Information Distribution
- Evaluating data & projects
- Joint project implementation
- GPS Coordinates & project implementation
Definition
Secondary Categories
- Reconciling undertakings
- Policying Assessements



- Quote Nari about WSDB
- & Ronald.

-> Embedding new concepts.

3) Infrastructuring

-> Building WSDB Components
-> Making decisions about building new components / Modules
-> Designing & Evaluating modules
-> ~~Procuring~~ Procuring private company for design
-> Refining (defining & Re-defining) Requirements
-> Mediating WSDB use
-> Implementing modules
-> Determining funding & financing
-> Training WSDB users (Annual training)

Ensuring
-> Safety & security of WSDB
-> Administering & Managing WSDB operations
-> Defining Authorizing & Enabling WSDB access or use
-> ~~Functioning~~ Evaluation
-> Ascertaining Data Validity & ...
-> Computing access &

Secondary Sub-Categories :-
-> Visualizing data submissions <
-> Building Components <
-> Amplifying data access <

-> Understanding development or growth of the water sector from perspectives of the participants.

-> Understanding are based on WSDB artefact usage.

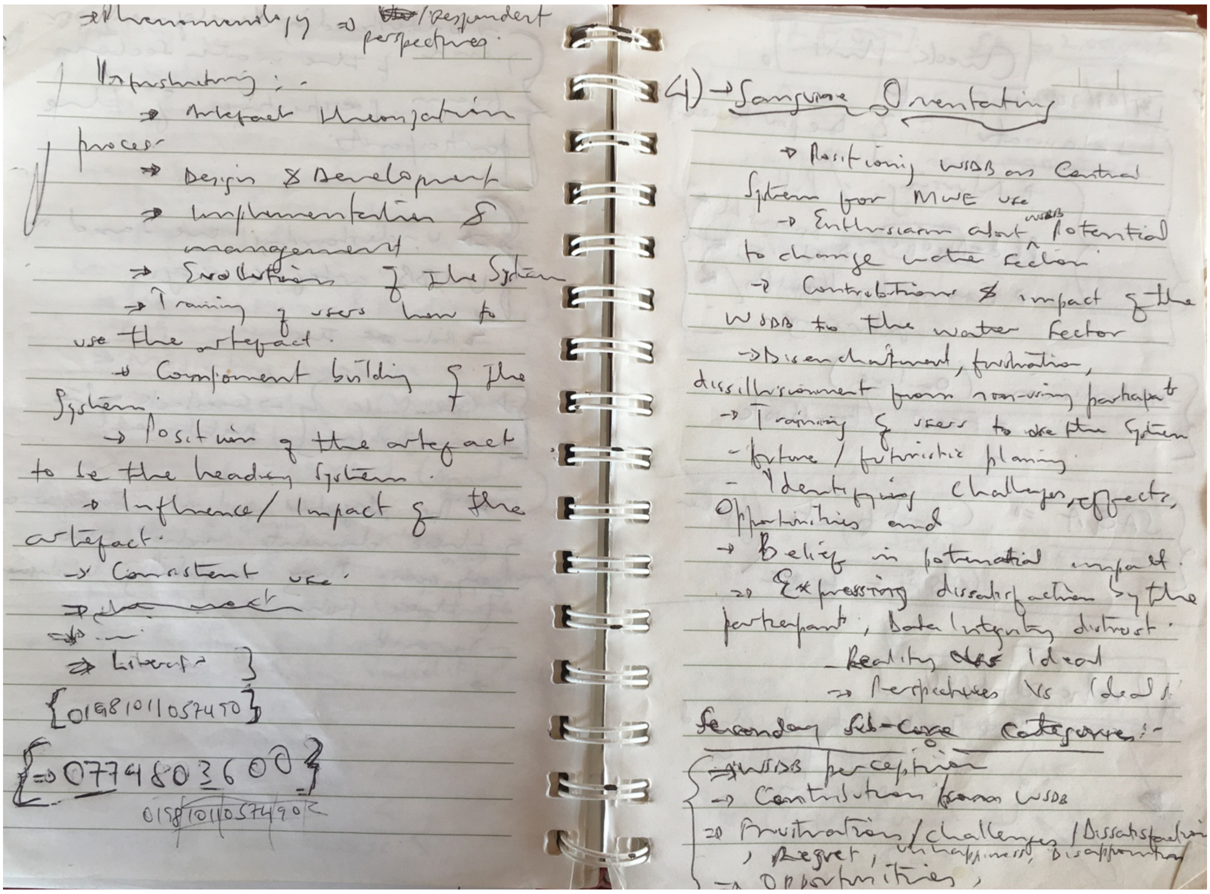
-> Below are The

-> Green Scale
-> Scanner Tool Scale
-> Greenback of the ...

-> The ~~negative~~ positive consequences of these elements inside the ... . They ... of these systems.

— The ...

->



-> Phenomenology -> ~~the~~ / Respondent perspectives.

Infrastructuring :-
-> Artefact Incorporation process
-> Design & Development
-> Implementation & management
-> Evaluations of the System
-> Training of users how to use the artefact.
-> Component building of the System.
-> Position of the artefact to be the leading System.
-> Influence / Impact of the artefact.
-> Consistent use.
-> ~~...~~
-> ...
-> Liberate

{01981011057490}

{=0774803600}

0198/1011/057490

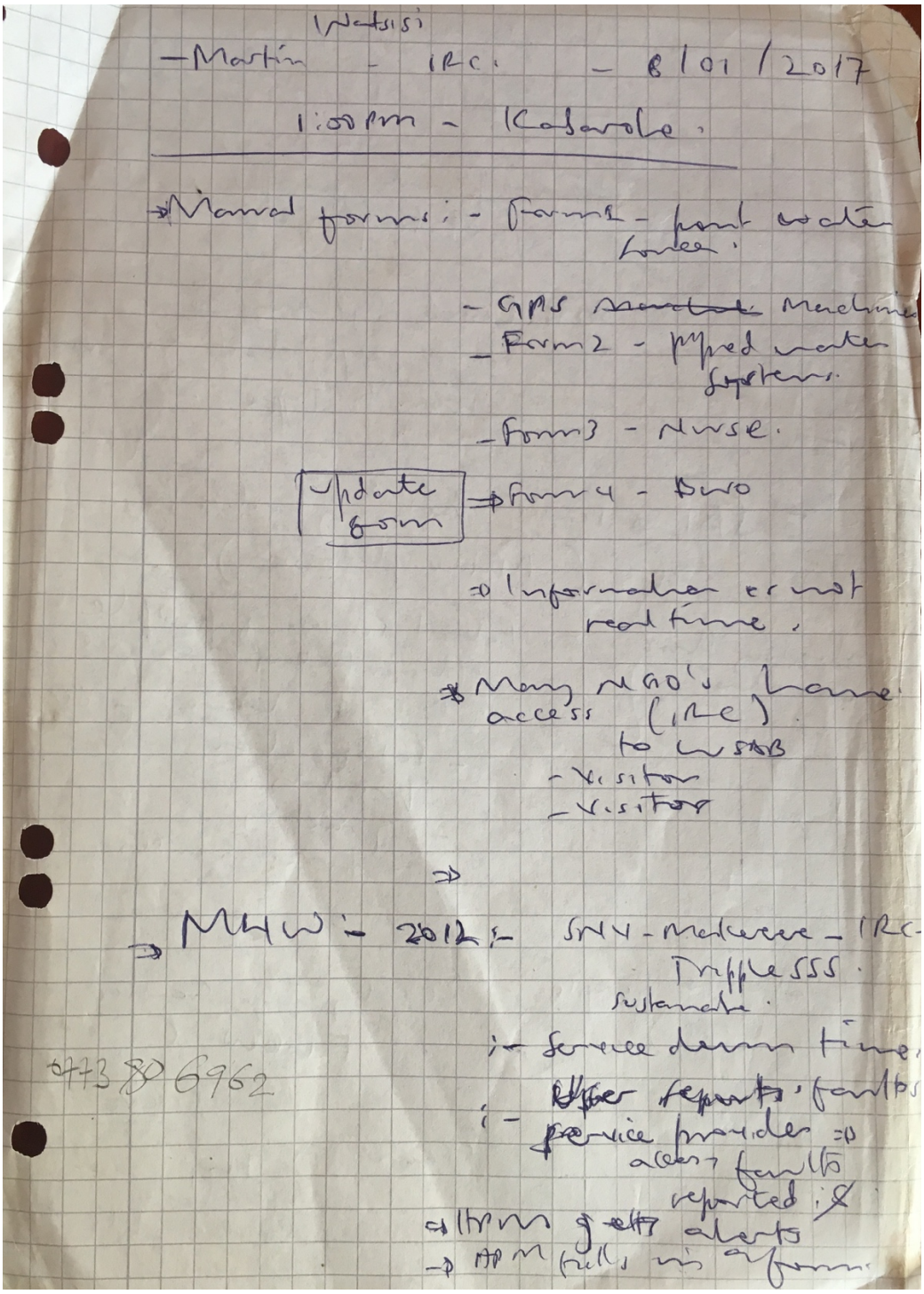
4) -> Sanguine Orientation

-> Positioning WSDB as Central System for MWE use
-> Enthusiasm about WSDB potential to change water sector
-> Contributions & impact of the WSDB to the water sector
-> Disenchantment, frustration, disillusionment from non-using participants
-> Training of users to use the System
- future / futuristic planning
- Identifying challenges, effects, Opportunities and
-> Belief in potential impact.
-> Expressing dissatisfaction by the participants, Data Integrity distrust.
- Reality vs Ideal
-> Perspectives Vs Ideal

Secondary Sub-Core Categories :-
-> WSDB perception
-> Contribution from WSDB
-> Frustrations / challenges / Dissatisfaction, Regret, unhappiness, Disappointment
-> Opportunities,

Appendix A.7: Written Notes Sample

A sample of written notes from an interview.



⇒ Interactive tool

Challenges :- Rural water managed.

How ⇒ private people not paid by government.

SMS based system ⇒ some people don't know how to type.

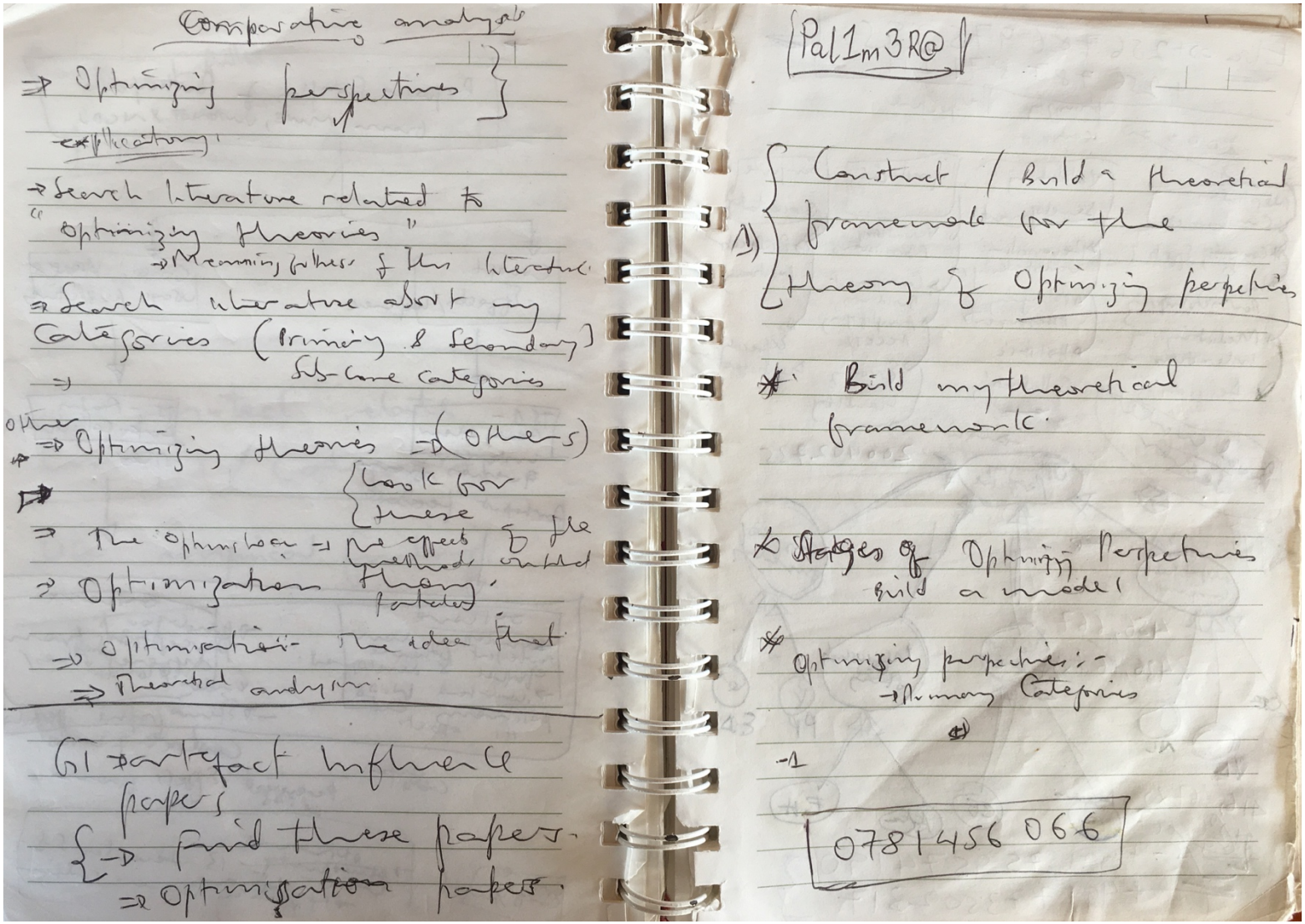
~~Gott~~

RC - SDI ⇒ Service Delivery Indicators (MWW platform)

Collecting this information
- Actual services of people that they receive. Analyse level of service
- Satisfaction
- Quality
- Quantity
- Performances

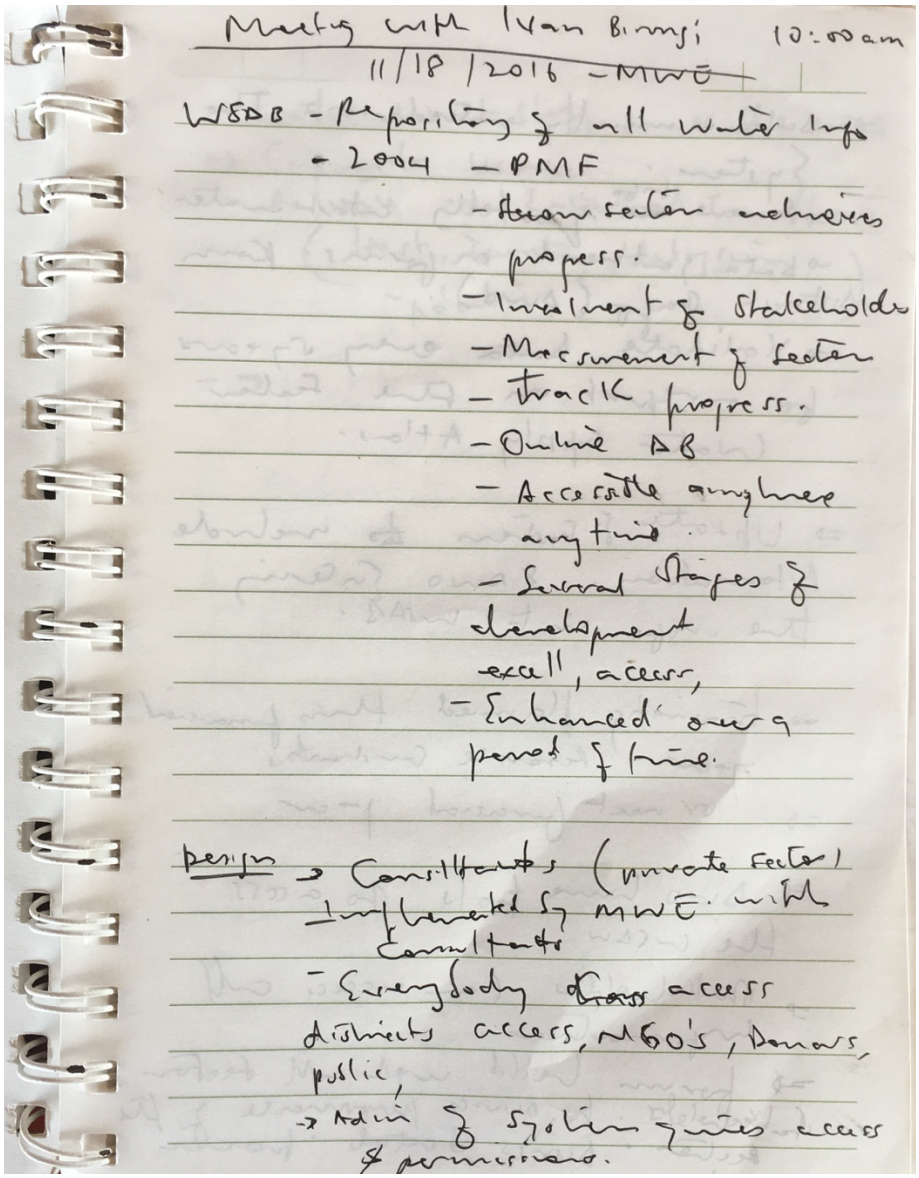
Water for people :- (WFP) ICT system called FLOW (Field level operation watch) ACKWO

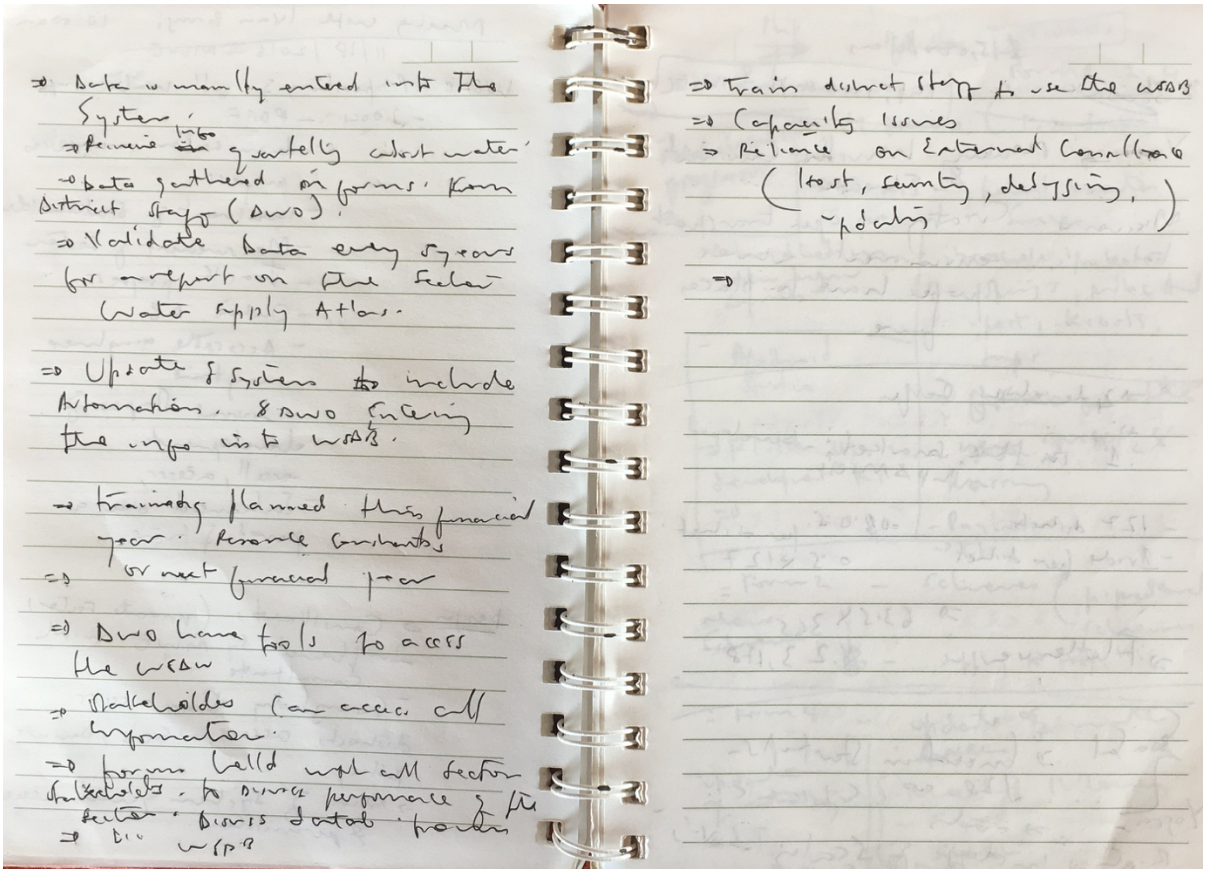
FLOW - Mapping -
- Interactive
- Android platform


Comparative analysis
⇒ Optimizing perspectives
⇒ Search literature related to "Optimizing theories"
⇒ Search literature about my categories (primary & secondary)
⇒ Optimizing theories ⇒ (others)
⇒ Optimization theory.
⇒ Theoretical analysis
GI artefact influence papers
⇒ find these papers.
⇒ Optimization papers.
Pal1m3R@
1) Construct / Build a theoretical framework for the theory of Optimizing perspectives
* Build my theoretical framework.
* Stages of Optimizing Perspectives
* Optimizing perspectives :-
0781456066

Appendix A.8: Sample Memo

Figures below depicts memo that could pass out as notes.


Meeting with Ivan Bimyi 10:00am
11/18/2016 - MWE
WSDB - Repository of all water info
- 2004 - PMF
- Across sector achieves progress.
- Involvement of Stakeholders
- Measurement of sector
- track progress.
- Online DB
- Accessible anywhere anytime.
- Several Stages of development
excell, access,
- Enhanced over a period of time.
design → Consultants (private Sector) Implemented by MWE. with Consultants
- Everybody access access
districts access, NGO's, Donors, public,
→ Admin of System gives access & permissions.



⇒ Data is manually entered into the System.
⇒ Receive info quarterly about water.
⇒ Data gathered on forms from District staff (DWO).
⇒ Validate Data every 5 years for a report on the Sector Water supply Atlas.

⇒ Update of systems to include Automation. & DWO entering the info into WSDB.

⇒ training planned this financial year. Resource constraints,
⇒ or next financial year

⇒ DWO have tools to access the WSDW

⇒ Stakeholders can access all information.

⇒ forums held with all sector stakeholders. to discuss performance of the sector. Discuss data. provides
⇒ ... WSDB

⇒ Train district staff to use the WSDB
⇒ Capacity issues
⇒ Reliance on External Consultants (Host, security, debugging, updating)

⇒

=> Data is manually entered into the System.

=> Receive info quarterly about water.

=> Data gathered on forms from District staff (DWO).

=> Validate data every 5 years for a report on the sector Water supply Atlas.

=> Update of system to include Automation. & DWO entering the info into WSDB.

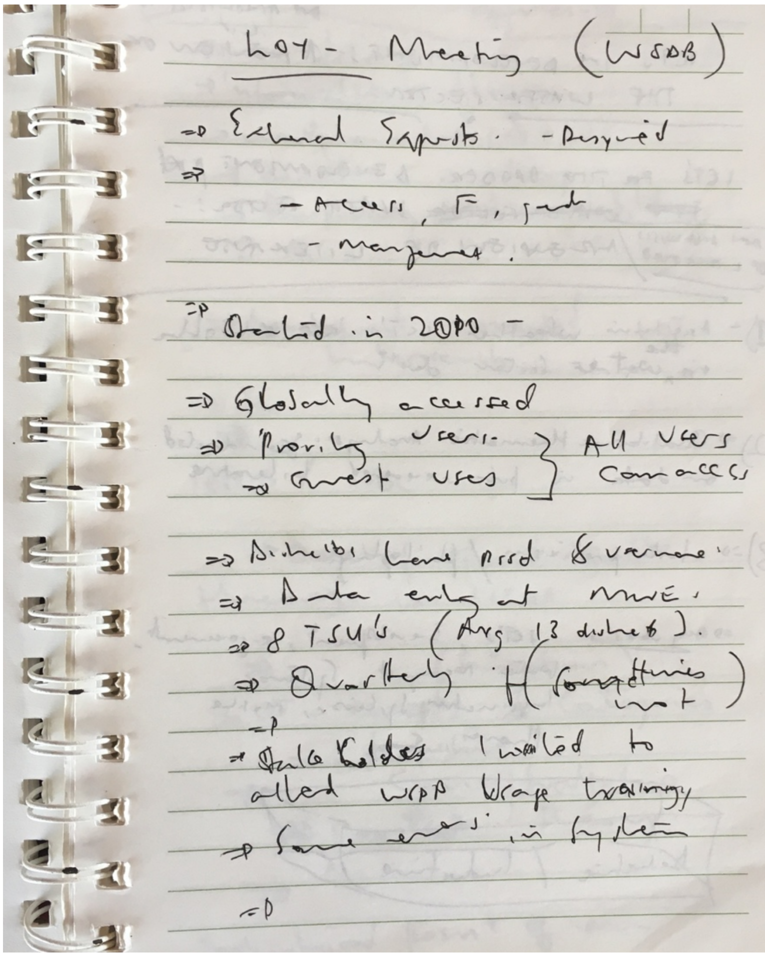
=> training planned this financial year. Resource constraints
=> or next financial year

=> DWO have tools to access the WSDW

=> Stakeholders can access all information.

=> forums held with all sector stakeholders. to discuss performance of the sector. Discuss details provided

=> [illegible] WSDB



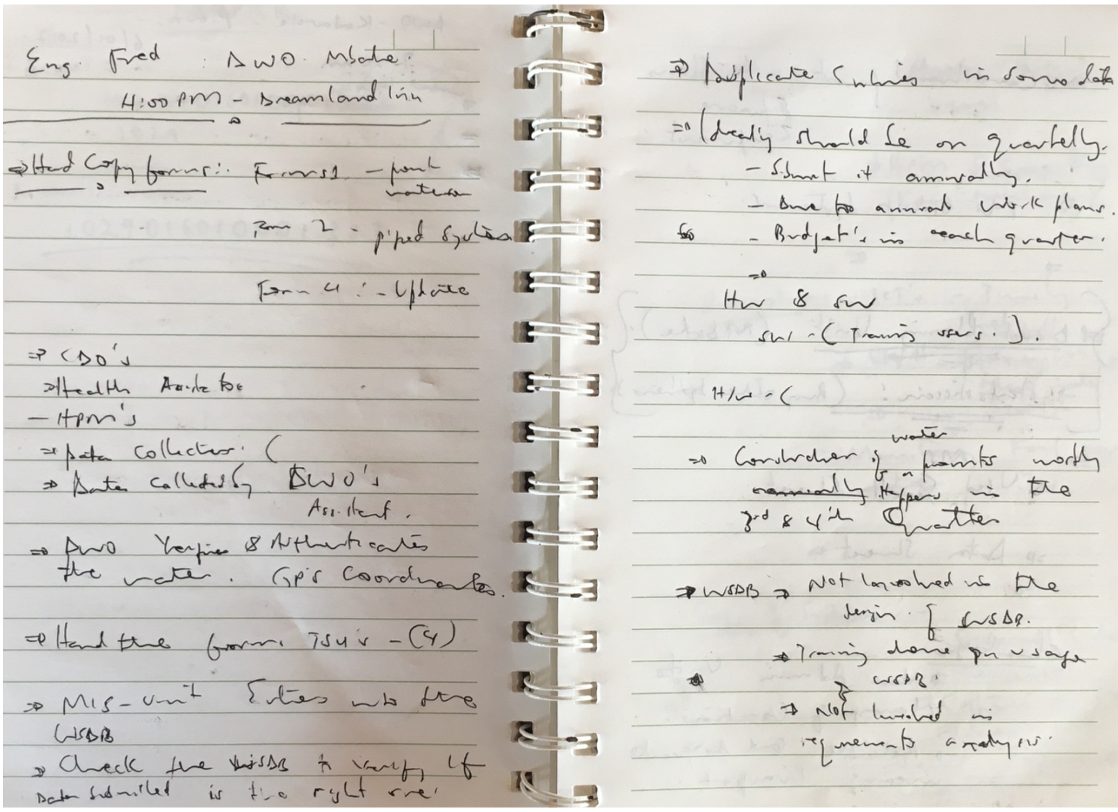
HOY - Meeting (WSDB)

=> External Supports - Required
=>
- Access, IT, fund
- Management.

=> Started in 2000 -

=> Globally accessed
=> 'Priority users' } All users
=> Guest uses } can access

=> Districts have read & write
=> Data entry at MWE.
=> 8 TSU's (Avg 13 districts).
=> Quarterly (sometimes not)
=> Stakeholders invited to attend WSDB usage training
=> Some errors in system
=>

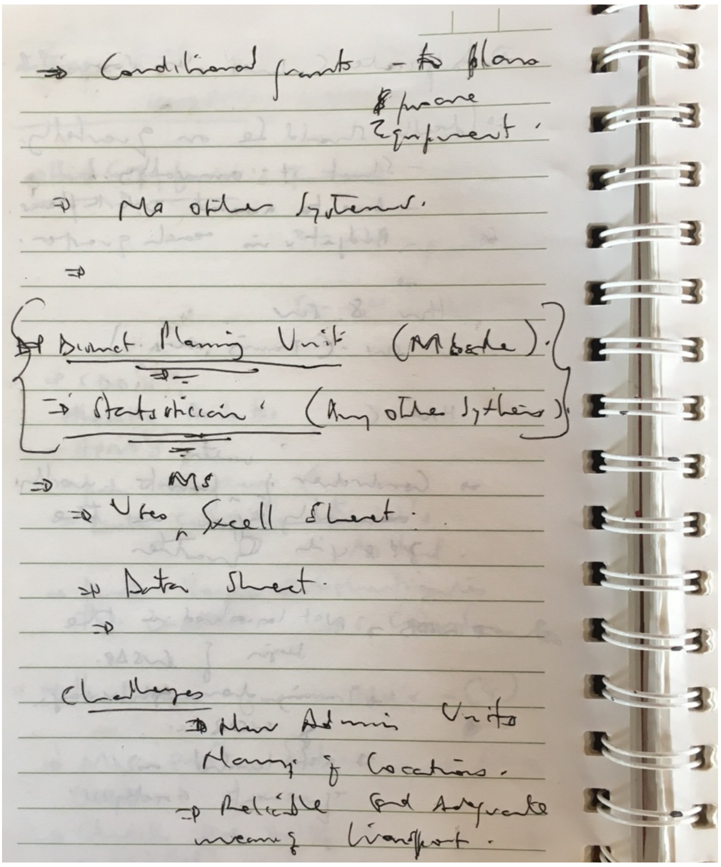


Eng. Fred : DWO Mbale.
4:00 PM - Dreamland Inn

=> Hard Copy forms: Form 1 - point water
Form 2 - piped systems
Form 4 : - Update

=> CDO's
=> Health Assistants
- HPM's
=> Data Collectors (
=> Data collected by DWO's Assistant.
=> DWO Verifies & Authenticates the water. GPS Coordinates.
=> Hand the forms TSU's - (4)
=> MIS - unit Enters into the WSDB
=> Check the WSDB to verify if Data submitted is the right one

=> Duplicate Entries in some data
=> Ideally should be on quarterly.
- Submit it annually.
- Due to annual work plans.
- Budget's in each quarter.
=> HW & SW
SW - (Trains users).
H/W - (
=> Construction of water points mostly normally happens in the 3rd & 4th Quarter
=> WSDB => Not involved in the design of WSDB.
=> Training done for usage WSDB.
=> Not involved in requirements analysis.


⇒ Conditional grants – to plans & procure Equipment.

⇒ No other Systems.

⇒

⇒ District Planning Unit (Mbale).

⇒ Statistician (Any other Systems)

⇒

⇒ Uses MS Excell Sheet.

⇒ Data Sheet.

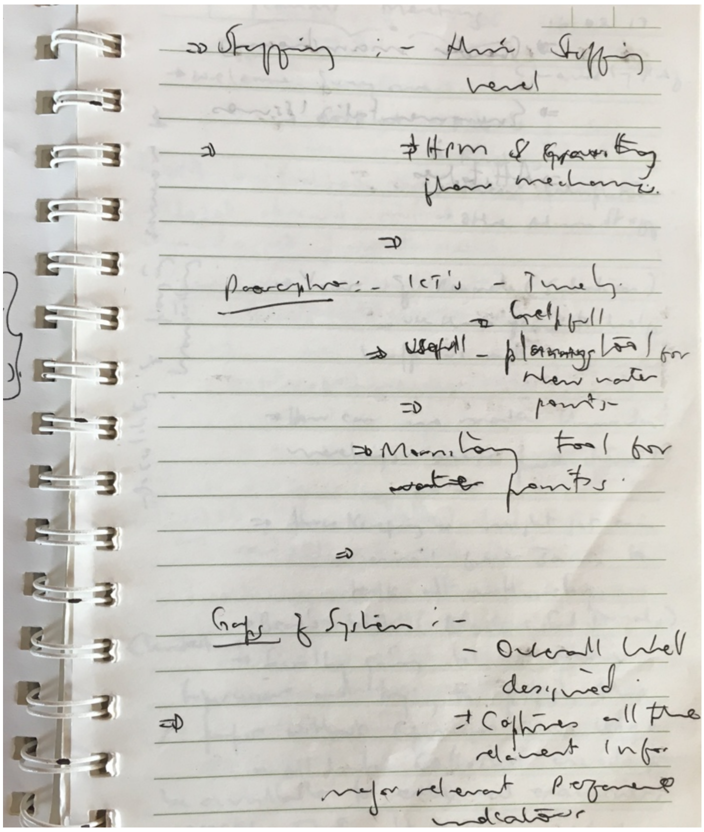
⇒

Challenges

⇒ New Admin Units

Naming of Locations.

⇒ Reliable and Adequate means of transport.


⇒ Staffing: – Low staffing level

⇒ ⇒ HPM & Operating plans mechanisms.

⇒

Perception: – ICT's – Timely

⇒ Helpfull

⇒ Usefull – planning tool for new water points.

⇒

⇒ Monitoring tool for ~~water~~ points.

⇒

Gaps of System: –

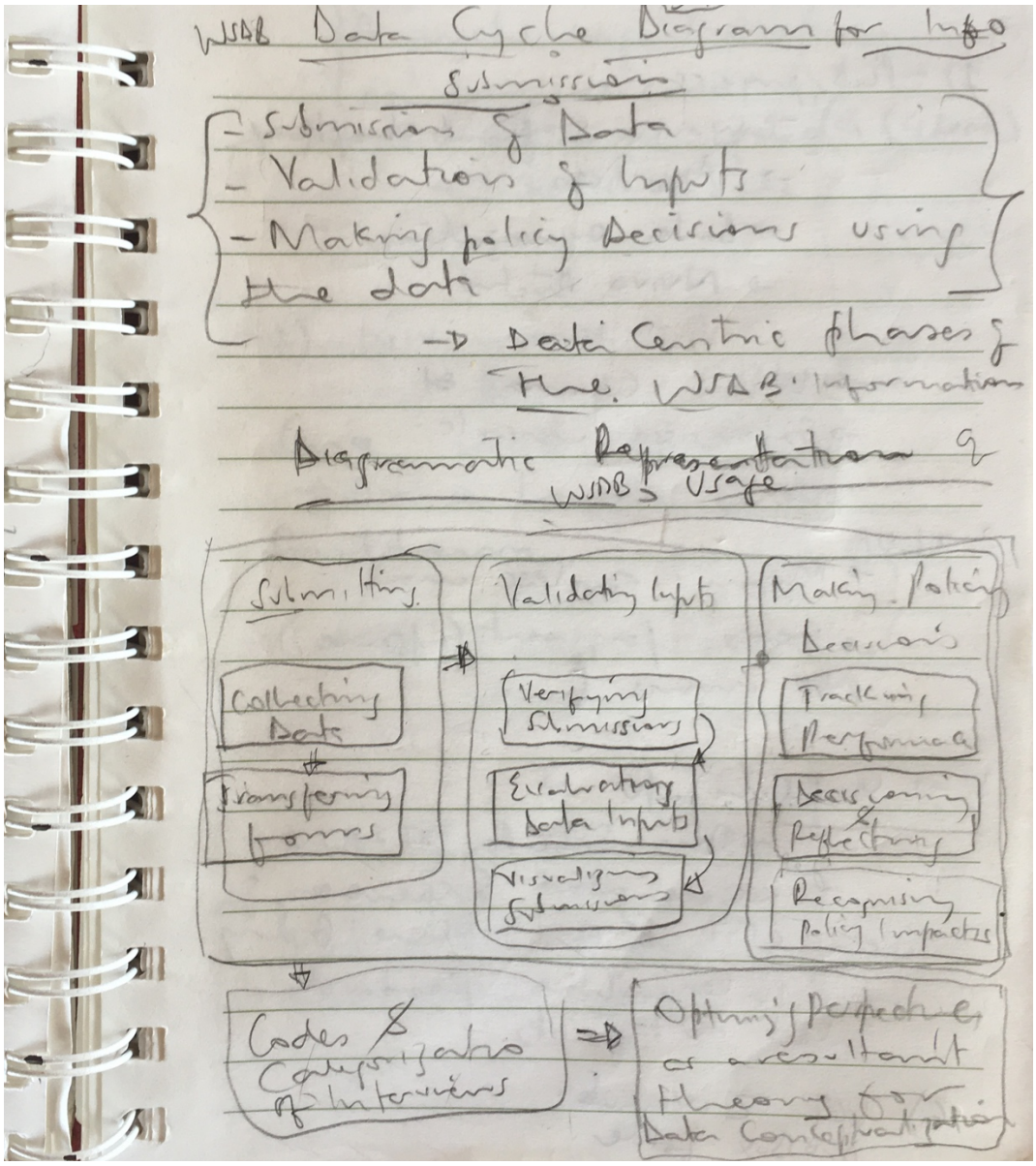
– Overall Well designed.

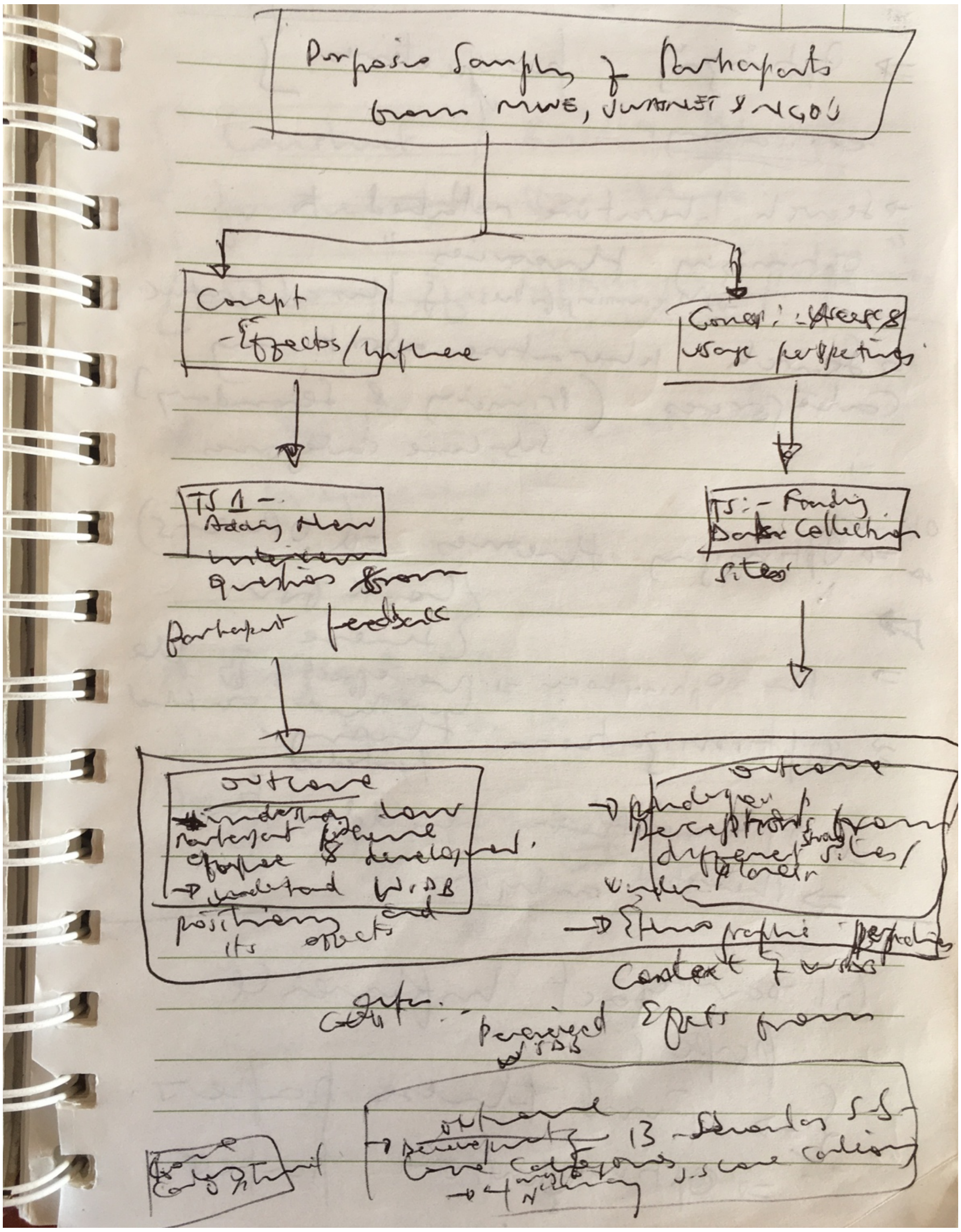
⇒ ⇒ Captures all the relevant infor

major relevant performance indicators

Appendix A.9: Illustrations of Concepts

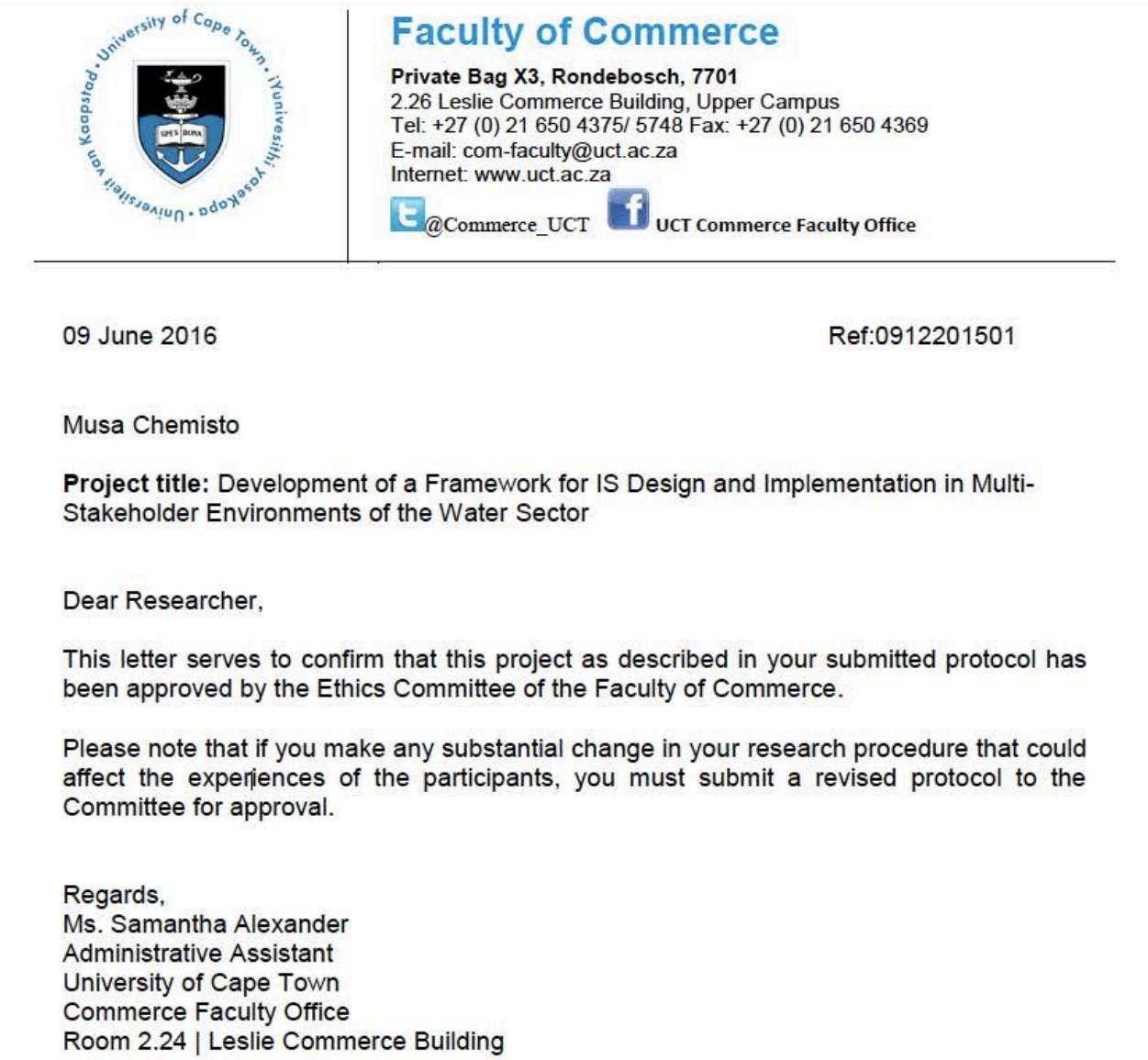
Below are diagrammatic illustration of how concepts emerged in my notes.




Purposive Sampling of Participants
Concept
outcome
outcome
Context

Appendix A.10: Ethics Approval Letter

This letter proves ethical clearance to undertake the research.



Faculty of Commerce

Private Bag X3, Rondebosch, 7701
2.26 Leslie Commerce Building, Upper Campus
Tel: +27 (0) 21 650 4375/ 5748 Fax: +27 (0) 21 650 4369
E-mail: com-faculty@uct.ac.za
Internet: www.uct.ac.za
@Commerce_UCT **UCT Commerce Faculty Office**

09 June 2016 Ref:0912201501

Musa Chemisto

Project title: Development of a Framework for IS Design and Implementation in Multi-Stakeholder Environments of the Water Sector

Dear Researcher,

This letter serves to confirm that this project as described in your submitted protocol has been approved by the Ethics Committee of the Faculty of Commerce.

Please note that if you make any substantial change in your research procedure that could affect the experiences of the participants, you must submit a revised protocol to the Committee for approval.

Regards,
Ms. Samantha Alexander
Administrative Assistant
University of Cape Town
Commerce Faculty Office
Room 2.24 | Leslie Commerce Building

Appendix A.11: Ethics Approval

This from is for ethical approval.

UNIVERSITY OF CAPE TOWN

FACULTY OF COMMERCE

Igniting Knowledge and Opportunity

Please note that you will be required to upload a scanned copy of this form in order to submit your online ethics application. Please ensure that all the required signatories have signed the form in their respective blocks.

By submiting this form I certify that I have read the the Commerce Faculty Ethics in Research policy found on http://www.commerce.uct.ac.za/Pages/ComFac-Downloads

I hereby undertake to carry out my research in such a way that

- there is no apparent legal objection to the nature or the method of research; and
- the research will not compromise staff or students or the other responsibilities of the University;
- the stated objective will be achieved, and the findings will have a high degree of validity;
- limitations and alternative interpretations will be considered;
- the findings could be subject to peer review and publicly available; and
- I will comply with the conventions of copyright and avoid any practice that would constitute plagiarism.

Signed by:

	Full name and signature	Date
Principal Researcher/Student:	Musa Chemisto	2016-07-15

This application is approved by:

Supervisor	Prof U Rivett	15.07.2016
HOD (or delegated nominee – for all Honours Projects):		30/07/2016
Chair: Faculty EIR Committee (only for postgraduate research at Master and PhD level)		

Appendix A.12: Contact and Consent Letter

This was given to participants before they agree to any interview.

Department of Information Systems
Leslie Commerce Building
Engineering Mall, Upper Campus
OR
Private Bag X3 - Rondebosch - 7701
Tel: +27 (0) 21 650 2261 Fax: +27 (0) 21650 2280
Internet: http://www.commerce.uct.ac.za/informationsystems/

November 26, 2015

Request to conduct research and interview participation consent form

Dear Sir/Madam,

In terms of the requirements for completing a Doctoral Degree in Information Systems at the University of Cape Town a research study is required.

The researcher, in this case Musa Chemisto, has chosen to conduct a case study entitled 'Development of a Framework for IS Design and Implementation in Multi-Stakeholder Environments of the Water Sector'. The researcher would like to request permission to conduct this case study at your organization. The objective of the research is to explain why sector coordination has persisted as a problem in Uganda's water and sanitation sector while also suggesting possible solutions or ICT solutions that can alleviate sector coordination problems. The research will also investigate the different stakeholders involved in the rural water supply sector and then determine how these stakeholders coordinate and share information.

Your participation in this research is voluntary. All information will be treated in a confidential manner and used exclusively for the purpose of this study. No individual names will be recorded or published. You will not be requested to supply any identifiable information, ensuring anonymity of your responses. You can choose to withdraw from the research at any time for whatever reason, in accordance with ethical research requirements.

The data collection method will be one-on-one interviews with a small group of the staff responsible stakeholder coordination, information gathering, information storage, and information sharing; and water supply service delivery. The interviews will be conducted at a chosen premise and will last 45 minutes at least. If you are willing to participate in this study, kindly sign the attached form and return to me at your earliest convenience.

Should you have any questions regarding this research, please feel free to contact me on [+27784809289] or email: [msxche002@myuct.ac.za]

Your participation in this study would be greatly appreciated, but is entirely voluntary.

Sincerely,

Musa Chemisto
Researcher \ PhD Student, (UCT)
Department of Information Systems
University of Cape Town
Email: msxche002@myuct.ac.za

Prof. Ulrike Rivett
Research Supervisor
Department of Information Systems
University of Cape Town
Email: Ulrike.rivett@uct.ac.za

Research Participant Consent Form

I, _____, consent to participate in the research on 'Development of a framework for information systems design and implementation in Mult-stakeholder environments of the water sector'.

I am aware that participation is voluntary and that I may choose to withdraw from this study at any time, should I choose to do so.

_____ _____

Signature Date

Appendix A.13: Interview Protocol and Guide

The illustrations below show sample topic guides, themes and questions conceptualised before initiating the research.

Theme Guides and Interview Questions

Musa Chemisto – PhD Student (University of Cape Town)

Location	Ministry of Water and Environment – Dept. of Rural Water Supply
Theme Guide	**Semi-structured interviews Questions**
• Organization Structure	– What is the structure of RWS department? – What other stakeholders do you work with to deliver services to rural communities? (Who else do you work with)?
• Workflow	– What is the role of the RWS department? – How does work get done in the RWS department? – How do you coordinate with other stakeholders? – Are there any challenges related to coordination? – What policies do you have in place to support workflows? – How do you share information with other stakeholders?
• Service delivery	– How do you provide and fund water services to rural districts? – How do you get information from rural districts? – How is service delivery appraised? – How would you rate the current performance with regards to water services to rural communities?
• Stakeholder coordination	– Why is stakeholder coordination important to RWS? – How do you coordinate with other stakeholders in order to deliver services to communities? – Are there any challenges related to stakeholder coordination? (information flow, NGO's, stakeholder coordination, local government and rural communities) – What solutions do you have available for engaging with other stakeholders?
• Current IT systems in use	– What systems do you have in place to support information flows in RWS? – How do you share information with other Agencies? – What challenges do you face regarding information flow? – Do have systems that support information flow and sector coordination? – Are the system shared with other stakeholders? – Any challenges with the systems? – How can they be improved? – What do you see as barriers to using ICT solutions in Rural Communities?
• Suggestions for solutions	– What solutions have you considered or thought about to improve RWS services?

Location	Non-Governmental Organizations (Rural Water Sector)
Theme Guide	**Semi-structured interviews Questions**
• Organization Structure	– Who persons are responsible for delivering water services to districts and communities in your organization? – What exactly do they do?
• Workflow	– How do you gather WASH related information? – What information do you collect from your project areas? – How is information used and managed? – Do you share information with other stakeholders? – How do you relate with the MWE and local district leaders or community?
• Service delivery	– How do you provide water supply services? – How do you monitor and evaluate water services delivered? – Any challenges faced? – What solutions do you have for the challenges
• Stakeholder coordination	– How do you engage with other stakeholders to deliver services? – Do you share certain water supply projects? – What platforms do you have available for engaging with other stakeholders and communities? – How do you involve the community? – Are you involved in RWS policy formulation with all stakeholders?
• Current systems in use	– How do you collect information from you project areas? – Do you use technologies/ IT systems to collect the information? What technologies do you use? – Do you share access to the systems with other stakeholders? – Any challenges with the systems? – Are the current systems in use sufficient? How can they be improved? – Any particular systems that you have suggested to coordinate to improve RWS? – What do you see as barriers to using ICT solutions in Rural Communities?
• Challenges	– What information related challenges do you experience as rural water service providers?
• Suggestions for solutions	– What solutions have you considered RWS coordination? – What solutions have you considered or thought about to improve RWS service delivery?

Location	UWASNET (Umbrella Organization for all NGOs)
Theme Guide	**Questions (semi-structured interviews)**
• Organization Structure	– How is UWASNET structured? – What role do you play? (What exactly do you do) – What is your level of influence/involvement with policy formulation for RWS? – What external forces influence your policies or decisions?
• Workflow	– How do you coordinate all the NGOs in rural water supply? – How do you gather your information? And how is information used and managed? – Do you share information with other stakeholders? – Do you work with district local governments and community?
• Service delivery	– What services do you provide in relation NGOs coordination? – Any challenges faced? – What solutions do you have for the challenges
• Stakeholder coordination	– How do you engage with other stakeholders? – What platforms do you have available for engaging with other stakeholders? – How do you involve the local governments and community? – Who is involved in coordination? And what do they do?
• Current IT systems in use	– Do you use IT systems to collect the information and coordinate NGO's? What technologies do you use? – Do other stakeholders have access to the systems? – Any challenges with the systems? – How can it be improved? – Any particular systems that you have suggested to coordinate NGOs? – Are there any non-technical ways to coordinate?
• Challenges	– What challenges do you face while coordinating stakeholders? – What information related challenges do you experience as rural water service providers?
• Suggestions for solutions	– Would you suggest need for an ICT intervention? – What can work better? How can it work better?

Location	District and WASH Leaders (District Local Government)
Theme Guides	**Semi-structured interview Questions**
• District Structure	– How is the DWO organized? – What departments do you work with to deliver services to communities?
• Workflow	– How do you get information related to water supply? – What do you use the information for? Do you share it with other stakeholders? – How do you manage the information flow between the district and other stakeholders?
• Service delivery	– How do you get water supply services delivered to communities? – How do you monitor water supply services? – How are the complaints handled/ solved? – Does the community participate in problem solving?
• Stakeholder Coordination	– How do you coordinate with other stakeholders like NGOs? – What mechanisms have you initiated to coordinate stakeholders, communities or other service providers? – What coordination challenges do you face?
• Current IT systems in use	– What systems do you have in place to facilitate information sharing/ coordination with stakeholders? – Are these systems sufficient? How can they be improved? – Any challenges with the systems? – Do you think ICT can act as a solution to challenges in rural water sector? – What do you think are ICT barriers in the rural water sector?
• Challenges	– What challenges do you face when dealing with water supply delivery? Communities? NGOs? Ministry of water? Other stakeholders? – What solutions do you have for these challenges?
• Suggestions for solutions	– What other solutions do you think can improve sector coordination? – What solutions have you considered or thought about to improve RWS services?

Appendix A.14: Sample Activity Schedule

Illustrations show planned activity schedules. The dates shown where in the original proposal plan, but often changed due to interview cancellations, postponements and re-schedules through the research.

Planned Activity Schedule for the Research (field studies)

Time frame	Location	Participants	Activity/Objective	methods	Outcomes
Jan 9th – Jan 13th 2015	Kampala (Uganda)	- UWASNET (Umbrella Org. for NGOs in water)	- Find out coordination mechanisms used by UWASNET for NGO's - Find out how the NGOs Coordinate - Find out how UWASNET empowers NGOs to coordinate - Find out sector coordination Challenges - Find out what solutions used for Sector coordination - Find out any non-technical ways that Are used to coordinate - Find out if a need for intervention is required - Find out if IT systems are used - Find out challenges faced in delivering services to rural communities - Find out policy or Decision making in the sector	- Informal interviews. - brainstorming discussions	• Understanding sector Coordination challenges/ problems **[Objective 1 of research]** • Understanding sector Coordination needs that can be solved using ICTs **[Objective 2 of research]** • Understanding needs for any ICT or non ICT intervention for the Sector coordination problems
Jan 16th – Jan 20th 2015	Kampala (Uganda)	Ministry of water officials (Dept. of RWS)	- Investigate how ministry coordinates rural water supply providers and water consumers - Find out policies, structures and strategies developed for RWS - Find out key challenges in delivering services to rural communities	- Informal interviews. - brainstorming discussions	• Determining focus groups for the researcher to participate in the ICT intervention design
Jan 23rd – Jan 27th 2015	Kampala (Uganda)	- IT officials in Ministry of Water - MIS Unit for Water supply	- Find out IT systems used for the RWS - Find out which systems are used by All the stakeholders (shared) - find out accessibility of IT systems by other stakeholders - Find out how information is shared by numerous stakeholders - Find out how data is captured and Stored in the systems - Find out any challenges related to the use, management, maintenance and update of the systems	- Informal interviews. - brainstorming discussions	• Assessing whether collected data will aid development of a framework to support design of an ICT intervention that links WASH stakeholders, technology and governance
Jan 30th – Feb 4th 2015	Eastern Uganda (Kapchorwa and Kween Districts WASH leaders)	- District Water Engineers - Local WASH leaders	- Find out the local government structure and roles of various district leaders in service delivery for WASH - Find out how the stakeholders Coordinate in the districts - Find out challenges in delivering and accessing district water services. - identify key responsible persons.	- Informal interviews. - brainstorming discussions	• Information collected will serve as initial requirements for the design of the ICT plus its implementation to solve identified problem
Feb 7th – 11th 2015	Eastern Uganda (Kapchorwa and Kween Districts WASH leaders)	- District Water Engineers - Local WASH leaders	- provide feedback from sessions with district leaders - Determine research focus group	- Informal interviews. - brainstorming discussions - Focus group discussions	• Discussions pertaining support for the research • Discussion to define if an ICT intervention is required. • Discussions on issues that can be solved the research

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