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**Critical Success Factors for Enhanced Information Systems Capabilities in Water
Billing Processes: A Case Study of Buffalo City Metropolitan Municipality**

By

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2012109494

Dissertation



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Together in Excellence

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ABSTRACT

Water is a nation's most precious resource as humans depend upon it for their lives and livelihoods. Water resources, therefore, require efficient and strategic management by those entities tasked with such a responsibility. Municipalities manage the water distribution to local citizens, but experience challenges due to the numerous tasks involved in water management. A major challenge that municipalities face is inefficiencies in water management business processes due to immature information system capabilities. Many studies focus on the infrastructure-related challenges such as ageing pipes, but little emphasis is placed on the information system-based challenges in water management and their relationship to the local water consumer. Therefore, the focus of this research investigation was on the water billing process activities and the information systems involved in these activities.

The study collected primary data by conducting a focus group comprising seven respondents working in water billing-related processes and then conducted semi-structured interviews with two managers at the Buffalo City Metropolitan Municipality (BCMM). The Nvivo software tool was used to organise the collected data. Finally, the collected data was analysed using the principles of thematic analysis. Firstly, the primary evidence indicates that the water billing information systems that are used at BCMM are unintegrated. Secondly, that there are numerous manual processes in the water billing-related processes, which lead to mistakes in the capturing of consumer data. Thirdly, the analysis confirms that BCMM is faced with water management challenges. Fourthly, the analysis revealed that there is inadequate communication between various water billing information systems that are used, which results in delays in data capturing, errors and outdated information. The findings conclude that BCMM has immature water billing information system capabilities and that there are problems related to water processes.

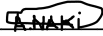
The research investigation derived several critical success factors (CSFs) for BCMM to action to ensure that their water billing information systems are enhanced. The CSFs were reviewed by the two managers used for the study in order to ascertain their relevance to the context and were considered relevant by the managers. Therefore, the recommendation is that BCMM, and other municipalities with similar contexts, should action the proposed CSFs to enhance their water billing-related information systems capabilities.

DECLARATION

I, **Avuyile Naki** hereby declare that:

- The work in this dissertation is my own work.
- All sources used or referred to have been documented and recognised.
- This dissertation has not previously been submitted in full or partial fulfilment of the requirements for an equivalent or higher qualification at any other recognised institution.

Ethics number **BOUO31SNAKO1** (*Refer to Appendix A*)

Signature  ~~Avuyile Naki~~

Date: 14 April 2019



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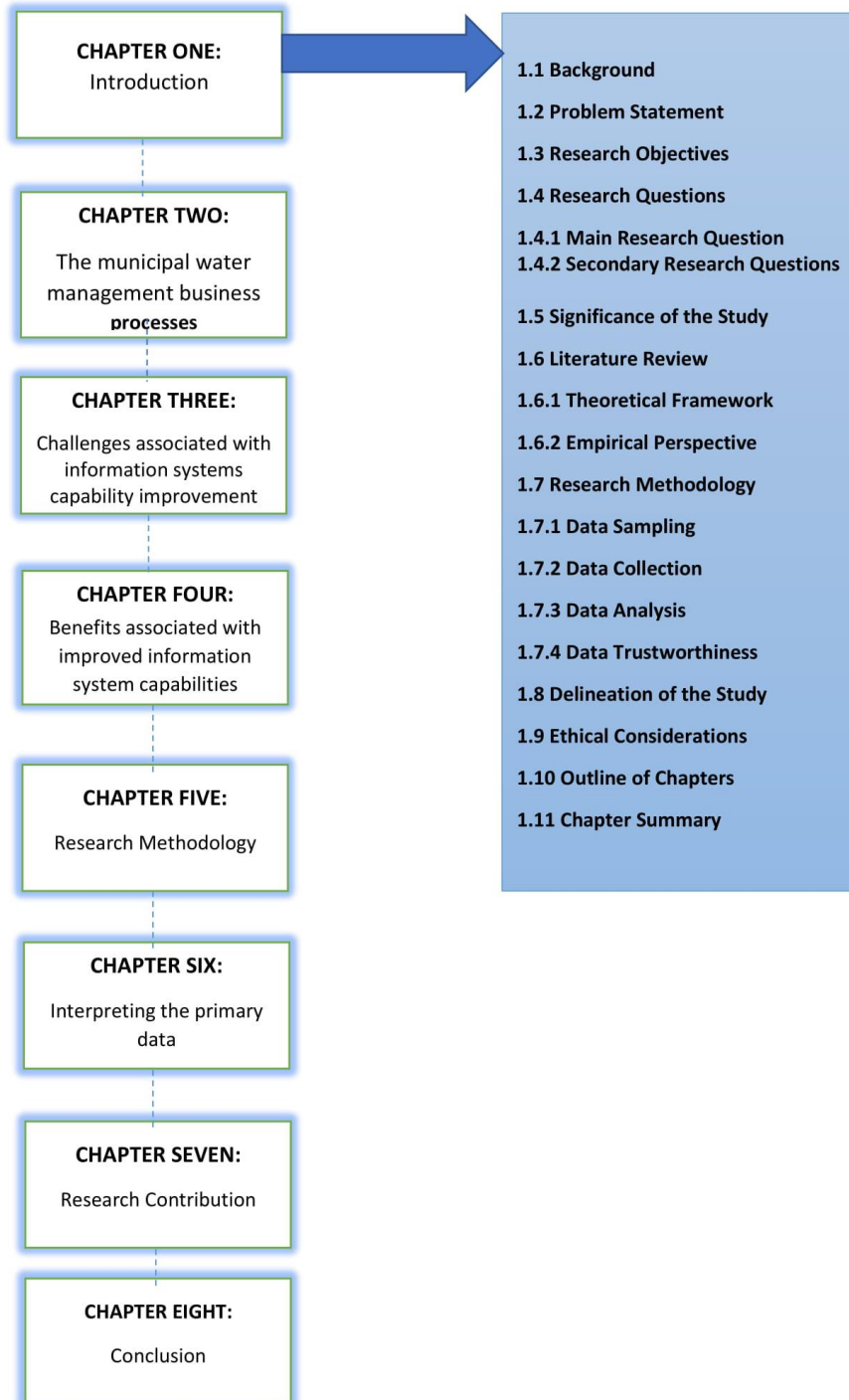
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LIST OF ACRONYMS

Acronym	Term	Description
IS	<u>I</u> nformation <u>S</u> ystem	a set of interrelated components that collect, manipulate, store and transport data and information and provide feedback to meet the objectives of the organisation
ERP	<u>E</u> nterprise <u>R</u> esource <u>P</u> lanning	system that integrates all organisation's primary business processes in order to enhance the efficiency of the organisation
BCMM	<u>B</u> uffalo <u>C</u> ity <u>M</u> etropolitan <u>M</u> unicipality	municipality that is used as case study in this research investigation
MIS	<u>M</u> obile phone – based <u>I</u> nformation <u>S</u> ystem	refers to the use of mobile phones to collect and transfer real-time information regarding water billing to the relevant stakeholders
SWM	<u>S</u> mart <u>W</u> ater <u>M</u> anagement	system and technologies that that monitor and manage water-related issues more effectively.
WST	<u>W</u> ork <u>S</u> ystem <u>T</u> heory	one of the theories that is used in this study,
DWF	<u>D</u> epartment of <u>W</u> ater and <u>F</u> orestry	a custodian of South Africa's water and forestry resources. It is primarily responsible for the formulation and implementation of policy governing these two sectors
NWA	<u>N</u> ational <u>W</u> ater <u>A</u> ct	a law that regulate the use and distribution of water resource.
BPM	B usiness P rocess M anagement	a discipline that focuses on using business processes to achieve an organisation's objectives through enhancement of the essential organisation's business process

Chapter One: Introduction



1.1 Background

Water is fundamental to human life and its management is critical. Therefore, South African citizens are not unique in that they need regular access to water for survival (Paul, 2012; Adeleye, Medayese, & Okelola, 2014). Enhanced water provision for the purposes of sanitation and drinking is imperative as it ensures the continued survival and health of South African citizens (Paul, 2012). In South Africa, municipalities are the sphere of government that is the touchpoint for citizen water management.

Water management can be defined as the municipality activity of planning, developing, distributing and managing the use of water resources (Russo, Alfredo and Fisher 2014). Furthermore, Russo, Alfredo and Fisher (2014) define water management as the process of meeting the current water demand for all citizens without impairing the future supply. Strict water management is important in South Africa as demographic studies reveal that by 2025 the water demand will exceed the available water supply in the country (Paul, 2012). Subsequently, this research study will focus on the critical success factors that need to be considered in order to overcome the challenges faced by municipalities when enhancing information systems capabilities that are associated with managing water resources.

Van der Mescht and van Jaarsveld (2013) state that the challenges facing municipal water management are significant because of the many tasks that are involved in the management of water. According to van der Mescht and van Jaarsveld (2013) these challenges can include budgetary constraints, institutional deficiencies and personnel problems. The various challenges experienced by municipalities have an impact on the efficacy of business processes associated with water management.

Tarhan, Turetken and Reijers (2016) define business processes as the tasks or activities that must be in place/performed to achieve a certain goal for a particular customer. Tarhan et al. (2016) point out that not all organisations¹ are on the same maturity level when it comes to their business processes, especially when it comes to their use of information systems.

¹ For the purpose of this research project the researcher is aware that the organisational structures and focus of municipalities are different from those of an organisation, but the concepts associated with organisations will be applied to municipalities where relevant.

Alter (2008) describes an information system as a work system whereby humans perform activities using information and technologies to produce a certain product or service. Zhao, Liu and Lin (2010) argue that many organisations seek to enhance their business processes using information systems. Information systems make business processes more efficient, effective and flexible when best practices are applied (Zhao et al., 2010).

In order to better understand the impact that information systems have on municipal water management business processes, a research project was conducted. This research project investigated the information systems capabilities maturity level of the water management processes at the BCMM in the Eastern Cape Province and identified the common challenges that need to be addressed when moving from one maturity level to the next. The BCMM, named after the Buffalo River, was established as the local municipality in 2000 and was later transformed into the metropolitan municipality it is today (Muller & Main, 2011). It was created through a combination of former East London and King William Town municipalities and has undergone minor changes in size over the years as wards associated with voting areas have been amended (Future Works, 2014). This research investigation focused on one aspect of water management at BCMM, namely the water billing business processes.

As previously noted, the task of providing water resources is delegated to the municipalities and, as water service providers, they need to ensure that there are minimal interruptions in supply, water tariffs are reasonable and water is of a good quality, for the benefit of customers (DWA, 2012). On the other hand, for benefit of the municipalities, they need to charge customers for the water they consume. Municipalities send invoices (bills) to customers as confirmation that they have been charged for water use. The water billing process involves multiple steps such as meter reading, the capturing of said reading on the financial system and the distribution of bills to customers.

The sections to follow will introduce the problem statement that leads to the main research question together with the three sub-questions that will assist in answering the main question. This will be followed by the objectives of the research study and a discussion of the significance of conducting this study. An introduction on the associated literature and the relevant theories for this study is then presented. The final sections describe the methodology that will be used to undertake this research, delimitations, and ethical considerations.

1.2 Problem Statement

Ramaswamy (2016) states that municipalities have differing levels of maturity when it comes to their information systems capabilities. For municipalities that have immature information systems capabilities the result is water management processes, such as water billing activities, that are not fully integrated, which in turn leads to delays in the provision of real time, accurate, quality information relating to the provision of water (Sivarajah, Irani, & Weerakkody, 2015).

The annual Auditor General Report (2013) findings state that BCMM (and other local municipalities in the Eastern Cape) still have inadequate processing and reconciling practices for information, due to the poor documentation and operationalising of policies and processes with regards to service delivery (such as water provision). This indicates that even though BCMM has information systems in place, their capabilities are immature. Immature information system capabilities can result in delays in communication between the municipality and its residents with respect to service delivery. Moving from immature to mature information capabilities is often impacted by numerous challenges encountered by municipalities. Identifying the challenges and providing mitigating actions for them can facilitate the need for enhanced information systems capabilities.

Therefore, the aim of this research was to propose critical success factors that must be met at BCMM in order to enhance the information system capabilities of their water billing processes.

1.3 Research Objectives

This research:

- explored and evaluated the existing water billing processes that are in place at BCMM;
- investigated the various levels of maturity in information system water billing capabilities at municipalities;
- determined the challenges municipalities encounter when expanding their information systems capabilities for water billing processes in municipal water management; and
- proposed critical success factors for enhancing the information systems capabilities of water billing processes for better service delivery.

1.4 Research Questions

1.4.1 Main Research Question

How can the information systems capabilities of water billing processes be enhanced for water management at Buffalo City Metropolitan Municipality?

1.4.2 Secondary Research Questions

SQ1: What business processes are associated with water management at municipalities?

This sub-question began by defining the nature of local government (municipality) and its transformation after apartheid. Furthermore, this question sought to explain in detail the business processes that are associated with water management at a municipality. Business processes are defined as a collection of related tasks or activities that produce a specific service or product for a particular customer (Gourbesville, 2013).

SQ2: What challenges do municipalities encounter when enhancing information systems capabilities?

Information systems capabilities are those elements that facilitate the interaction between people, information and technology with the intention to boost the performance of the organisation (Davidrajuh, 2009). This sub-question explored the different types of IS capabilities and the difficulties that are faced by municipalities in enhancing them.

SQ3: What benefits can municipalities realise from enhanced information systems capabilities?

Enhanced information systems capabilities refer to the municipality's ability to combine human skills, information technology and information needs to deliver Enhanced organisational business processes (Bi, Smyrniotis, & Kam, 2013). Enhancing IS capabilities will allow the municipality to perform its water management business processes in a coordinated manner (Bi, Smyrniotis, & Kam, 2013). This sub-question explained the benefits that municipalities can realise when enhancing their information systems capabilities.

1.5 Significance of the Study

According to the National State of Water Resources Quarterly Report (2014), South Africa is the 30th driest country in the world. Water is a scarce resource; therefore, it is necessary for local government municipalities in South Africa to manage their water supplies efficiently to reduce wastage. Wastage arises from the poor management of the existing infrastructure as well as the non-payment of citizens for services delivered (van der Mescht & van Jaarsveld,

2013). The main reason for the poor management of water infrastructure is identified as insufficient funding allocations for the replacement of the infrastructure components (van der Mescht & van Jaarsveld, 2013). Additionally, wastage is attributed to the inability of municipalities to collect payment from citizens for water service provision and for future infrastructure maintenance (Mavhungu, 2011). This is caused by the inability of water management information systems to fully reconcile the water supplied with the payments that are made by customers.

A Dispatch Live article states that residents owe the BCMM R17 million for water services rendered during 2016 – 2017 financial year (Goerge & Loewe, 2014). The critical success factors that are proposed in this research will play an important role in recommending how BCMM can use them to make sure that the information systems used for water management business process are Enhanced and matured, specifically in ensuring accurate and effective water billing.

1.6 Literature Review

This section will introduce the underlying theoretical framework that will be used to frame the literature discussion for this study. Thereafter, the empirical perspective introduces the secondary data that is relevant to this study.

1.6.1 Theoretical Framework

The researcher employed two theories, namely Work System Theory and the Capability Maturity Model, which includes business process maturity.

This research study utilised the Work Systems Theory (WST), which is the collective term for a combination of an analytical theory (which is the *work system framework*) and an explanatory theory (which is the *work systems life cycle model*) (Alter, 2013). Hamid, Rozan, Deris, and Ibrahim (2014) define Work Systems Theory as one that allows for the analysis and provision of conceptual frameworks to describe systems in an organisation.

The main premise behind WST is that a work system is a fundamental component of every organisation whether private or public. Alter (2013) defines a work system as a system in which people are utilising information, technology and other resources to develop a specific product or offer a service for/to relevant customers. In the context of this research study, BCMM will be viewed as an ‘organisation’ responsible for the delivery of services, such as water, to its

customers (residents) through the use of work systems. The service that has been provided to the customers is then analysed to determine the work system's performance by considering the efficacy of its processes (Alter, 2015). Figure 1 indicates the elements of WST.

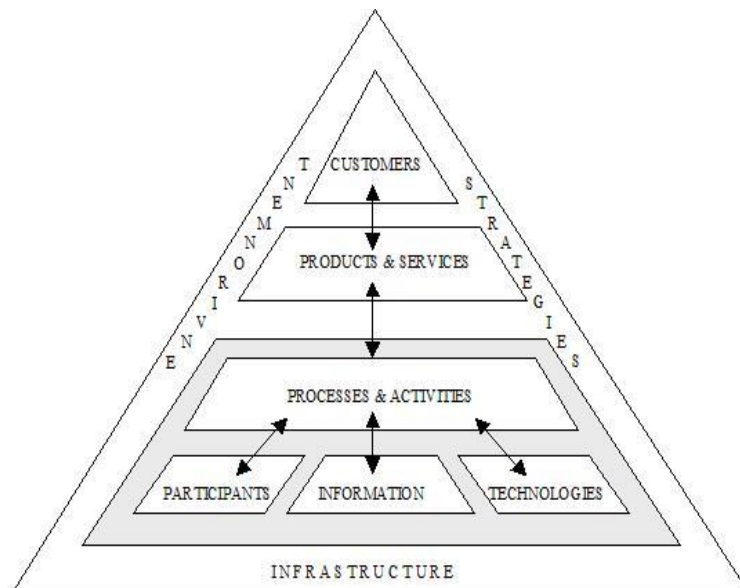


Figure 1: Work System Framework (Alter, 2013)

Figure 1 represents the nine elements of WSE: infrastructure, participants, information, technologies, processes and activities, products and services, customers, environment and strategies (Alter, 2013, p.78). Process and activities, participants, information and technologies are fully inside the work system. On the other hand, environment, infrastructure and strategies are completely outside the work system but have an integral impact on how it operates.

Moreover, this research investigation made use of Capability Maturity Models (CMM) (Marchewka, 2013) and Business Process Maturity Models (Van Looy, 2013). These have been used to determine the level of water management business processes maturity at BCMM. Marchewka (2013) states that one of the key ideas of CMM is to differentiate between mature and immature business processes.

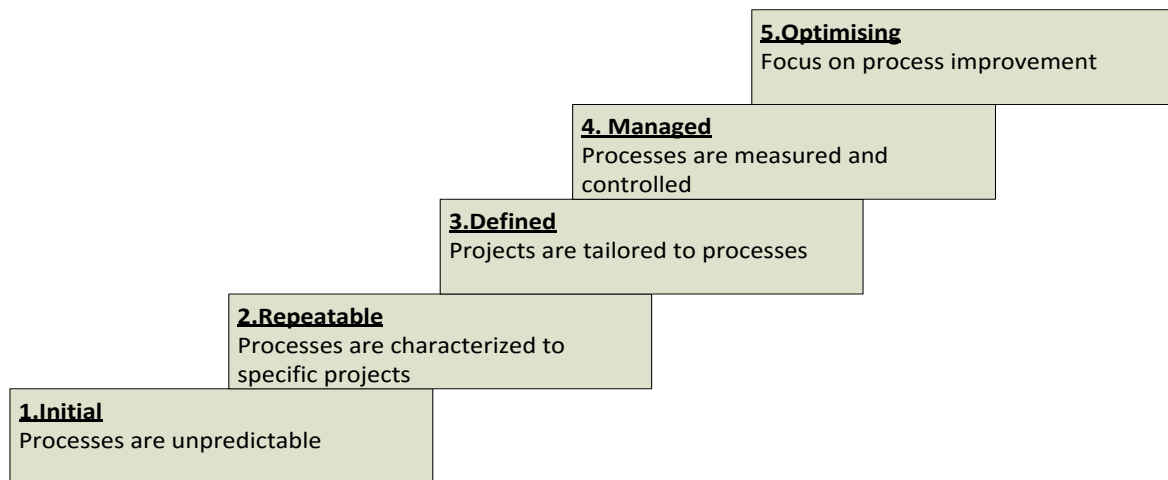


Figure 2: Characteristics of Process Maturity Levels (Röglinger et al., 2012)

Figure 2 shows the levels - or rather stages - that an organisation can use to evaluate its capabilities with regards to a certain problem area. Pöppelbuß and Röglinger (2011) argue that the maturity of the business processes is being defined by the level of their capabilities. Furthermore, Curtis and Alden (2007) mention the challenges that organisations face in determining level of maturity. Van Looy (2013) state that often an organisation chooses maturity models that don't fit their context. For example, small organisations need to use maturity models that are relevant to themselves. Another challenge is the lack of knowledge with regards to maturity levels (Andersen & Jessen, 2010). Other organisations do not have sufficient knowledge about the importance of determining the level of processes maturity. However, there are benefits that an organisation can obtain from determining their level of maturity such as having a place to start in order to enhance their business processes (Curtis & Alden, 2007).

1.6.2 Empirical Perspective

The Municipal Systems Act 32 of 2011 clearly states that government in South Africa is divided into three spheres, namely national, provincial and local government. These spheres have different roles and responsibilities. The sphere associated with local government is that body in direct contact with citizens (Municipal Systems Act 32, 2011; van Wyk, 2012). Local government refers to the elected government body in charge of providing municipal and public services to a local community (Karagel & Karagel, 2014). Karagel and Karagel (2014) further define local government as the administrative zone concerned with legal administrative autonomy. In layman's terms, local government is a structure responsible for governing a specific city or town.

As mentioned earlier, local government is a sphere that is responsible for the management of water resources. There are various business processes that need to be in place for municipalities to manage water effectively. These processes must be Enhanced - or rather optimised to ensure that water is delivered successfully and efficiently to citizens. Indeed, Groot (2013) and Rinaldi, Montanari and Bottani (2015) state that efficient water management is imperative for industry sustainability and depends on the optimisation of business processes.

Metropolitan municipalities in South Africa are optimising their business processes by using Enterprise Resource Planning (ERP) systems to perform these processes (Nomvalo, 2011). They also conduct reviews of business processes to ensure that they are properly mapped into the ERP system. Other systems that used by municipalities to optimise business processes include transaction processing system (TPS), enterprise information system (EIS) and e-Government. Additionally, Rinaldi, Montanari and Bottani (2015) argue that some municipalities enhance business processes that only focus on citizens, but must ensure that the systems are ultimately integrated throughout the municipality value chain. Integrated systems allow the citizens and municipal employees to get real-time data about municipal services due to Enhanced information systems capabilities.



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Enhanced information systems capabilities increase the effectiveness of business processes (Jung-Chi Pai, 2012). However, municipalities face challenges when enhancing their information systems capabilities, especial those who implement ERPs. Seo (2013) states that unlike other information systems, the primary challenges of ERP implementations are not technology-related issues such as standardisation or compatibility. The challenges with ERP implementation are mostly about organisation- and human-related issues such as resistance to change. Furthermore, the lack of senior management commitment would be another major ERP implementation obstacle (Seo, 2013; Lee, Zhang, Lee, & Au, 2009). Seo (2013) points out that ERP systems integrate all business functions and processes in the organisation therefore management dedication to the ERP is vital. Further Beikzad and Babaei (2013) state that challenges that municipalities face regarding IS capabilities enhancement can be categorised into humanistic, organisational and environment factors. The human factors involve making everyone in the organisation aware of what they want to do with the information that is produced by the information systems (Beikzad & Babaei, 2013). On the other hand, organisational factors are challenges that are less visible such as organisational culture, change and the behaviour of employees. Environmental factors refer to the lack of

methodology, procedures and rules that can be employed to ensure that information systems deliver positive results.

If municipalities overcome these challenges they can obtain various benefits when information systems capabilities are Enhanced. Schrenk and Popovich (2007) state that information systems provide transparency and quick capturing, processing and communication of information. Therefore, if the municipal information systems capabilities are enhanced they could result in efficient business processes whereby water-related information would be communicated properly to households. Municipalities in developed and developing countries are utilising innovative solutions to enhance water billing processes (Chaovalit & Surasvadi, 2015). These innovative solutions include: mobile phone-based information systems, water monitoring and assessment information systems and smart metering. Municipalities enjoy many benefits from employing innovative solutions. These benefits include availability of information concerning water billing, Enhanced decision-making and cost-effective water billing processes (Nowduri, 2012).

1.7 Research Methodology



The research onion model has been used to organise the research methodology in this research study. The interpretive paradigm was adopted in this research investigation as the underlying philosophy. Furthermore, an inductive approach was used in discussing the challenges that BCMM face concerning water management. Then, a case study strategy and qualitative research choice was used. The case study approach provides an opportunity to focus on a naturally occurring event within its natural setting. This approach gave the researcher an in-depth insight into the relevant issues that are being experienced by BCMM with regard to water billing.

Furthermore, focus group and semi-structured interviews have been used in this research investigation to elicit primary data. Moreover, measures such as triangulation were taken to ensure the credibility of the collected data. The data sampling, data collection and data analysis are discussed in detail in the following section.

1.7.1 Data Sampling

For the purposes of this study, purposive sampling was used to source the participants (Richie, Lewis, Nicholls, & Ormston, 2013). Tongco (2011) describes purposive sampling as a technique whereby the researcher makes a deliberate choice of informants due to qualities a

particular informant possesses or due to their relevance to the setting being investigated. The employees who deal with water billing processes and the associated information systems at the BCMM were used as the purposive sample for this research investigation.

1.7.2 Data Collection

A review of available literature on the topic of water management informed the interview guide development for the focus group discussion with employees who work with the water billing processes at BCMM. Subsequently, this study made use of a focus group and semi-structured interviews with BCMM employees as well as managers to collect the primary data. Furthermore, as the last step in the data collection process, the Critical Success Factors that were proposed in this study were submitted to managers at BCMM for them to provide feedback and comments.

Rennekamp and Nall (2011) define the focus group data collection method as a group interview of approximately 6 to 12 individuals who have similar traits. In the context of this study, similar traits would be that employees are working in the area of water provisioning and / or information systems. This type of method allows the researcher to get in-depth information, different perceptions, experiences and beliefs (Rennekamp & Nall, 2011). The study made use of 7 employees for the focus group.



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Deschambault (2011) states that when using the interview as a data collection method, the researcher must assume that the respondent's perspectives are meaningful. This study made use of semi-structured interviews with 2 managers in the revenue management department at BCMM, which provided a level of consistency as to how the data was collected. Yin (2014) warns that the researcher making use of interviews for data collection must be willing and able to adapt to the interview process and may have to conduct follow-ups interviews with previous respondents to seek clarity on an issue that was raised by later respondents. In this research study, interviewer asked follow up questions during interview sessions to get more information and clarity. Yin (2014) explains that this aids in the richness of the data being collected by gaining deeper insights into the setting being investigated.

The various data collection methods assisted in triangulating the data that was collected. Yin (2014) states that triangulation helps to strengthen the construct validity of the single case study. Moreover, the multiple data that is collected will provide multiple measures of the same case (Yin, 2014).

1.7.3 Data Analysis

Yin (2014) states that data analysis of the case study method is one of the least developed aspects of doing case study research. Yin (2014) cautions that many researchers start case study research without having an idea of how the data or evidence will be analysed, and subsequently struggle to extract relevant meaning from the data collected. To overcome this, Yin (2014) suggests that researchers need to analyse the question first and then the evidence that addresses the question. Yin (2014) further proposes that analytic strategies, such as computer-assisted tools, can be used to analyse case study research. Therefore, NVivo, a qualitative research analysis tools, has been used to analyse the primary data which was collected from the responses from the participants who attended the focus group and semi-structured interviews.

The literature was used to identify the themes that have been used for analysing the interview transcripts. Themes refer to the abstracts or constructs which investigators identify before, during or after data collection (Vaismorandi, Turenen, & Bondas, 2013). Themes can be used to analyse the qualitative data; this process is called thematic analysis. Vaismorandi et al. (2013) define thematic analysis as a method of identifying, analysing and reporting patterns (themes) within the data. This method is essential in reporting the participants' experiences, meaning and reality.



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1.7.4 Data Trustworthiness

Nilsson and Chron  r (2015) argue that data trustworthiness is a concept that is regarded as important in the whole research process. The level of data trustworthiness in a qualitative study can be measured by using the four components, namely credibility, transferability, dependability and conformability (Nilsson & Chron  r, 2015; Elo, Kaarianen, Kanste, Polkki, Utriainen, & Kyng  s, 2014).

Credibility

Eileen, Magilvy and Faan (2011) state that ensuring credibility is imperative when establishing trustworthiness. Therefore, the researcher has conducted the data analysis, which has ensured the credibility of this research study, by triangulating (collecting data from different sources using different methods). Furthermore, this has resulted in an in-depth understanding of the research setting (i.e. municipalities). Finally, the researcher provided respondents the opportunity to provide feedback to ensure that the interviewer's interpretations were accurate.

Transferability

Elo, Kaarianen, Kanste, Polkki, Utriainen and Kyngas (2014) define transferability as the ability to transfer research findings from one group or context to another. It is concerned with whether the findings of the study can be applied to other situations (Elo et al., 2014).

Dependability

Dependability refers to the strength or stability of data over a period of time and under different conditions (Nilsson & Chron  r, 2015). In this research study the dependability has been achieved by including peers that assisted the researcher in the analysis process. Additionally, dependability has been attained by providing a detailed description of the research methods.

Confirmability

This occurs when credibility, transferability and dependability have been established and achieved in a research study (Cope, 2015). The researcher performed a follow-up analysis on each individual and focus group interview and documented any instances of biases, personal feelings and novel insights. The researcher asked the participants for clarification on definitions, acronyms, and municipality specific terms during the interview process.



1.8 Delineation of the Study

This research study focused on the challenges associated with the information systems capabilities of the water billing processes and how information systems can be enhanced at local government level. Furthermore, this study focused on local government municipality category A (metropolitan municipalities) designations, specifically the Buffalo City Metropolitan Municipality, in the Eastern Cape. The study focused on one aspect of water management, which is water billing. The workings of other category A municipalities have been used for comparison purposes only. Furthermore, this research did not focus on the mechanical/engineering infrastructure associated with water management, but rather the business processes associated with information systems. Finally, from a supply chain management perspective, the research study focused on the point at which the municipality takes ownership of the water from Amatola Water until such time as it is transferred to the resident.

1.9 Ethical Considerations

Ethics consideration in research is vital, therefore, a researcher needs to understand the basic implications of the ethicality of the research and how it might affect the research study (National Statement on Ethical Conduct in Human Research, 2014). The National Statement on Ethical Conduct in Human Research (2014) notes that this is especially the case if the study that is conducted involves organisations (private or public) or members of the community who will serve as the participants in the research.

The researcher has ensured the confidentiality and anonymity of the information gathered from respondents. The participants of the study received full disclosure with regards to the nature of the study, its risks and benefits. The researcher made every effort to avoid the respondents being harmed emotionally and physically during the course of the study.

Ethical clearance has been received from the University of Fort Hare Research Ethics Committee (UREC), such that this research study complies with the rules and regulations of this committee. This study forms part of a larger NRF research project, which has received ethical clearance from the UREC, but individual ethical clearance was also sought for this specific study.



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1.10 Outline Chapters

The research thesis comprises seven chapters that will be structured as follows:

Chapter 1 will introduce the research study and provide an overview of the research problem, the main objective of the research, its significance, the overall objective, the delineations, ethical considerations, theoretical foundations and the contribution of the research.

Chapter 2 will discuss the nature of local government within the South African context, the categories of municipalities and districts (Category A, B and C), and the role of the local government in supplying water and sanitation. This chapter will also provide details about the nature of the case study context (i.e. BCMM) to be investigated.

Chapter 3 will focus on the challenges that municipalities encounter when enhancing their information systems capabilities.

Chapter 4 will describe the benefits that a municipality can obtain by enhancing water management business processes and information systems capabilities.

Chapter 5 will provide detailed discussion about the research approach, paradigm used, population and sample selected and data collection methods used.

Chapter 6 will lead the reader through the analysis and interpretation of the collected data from the various data collection instruments, so that the contribution can be clearly established from the case study.

Chapter 7 provides the contribution of the research, namely Critical Success Factors that must be met at BCMM to enhance IS capabilities in water billing processes.

Chapter 8 provides a summative conclusion of the research study and indicates how the research problem has been addressed and proposes future research arising from this study.

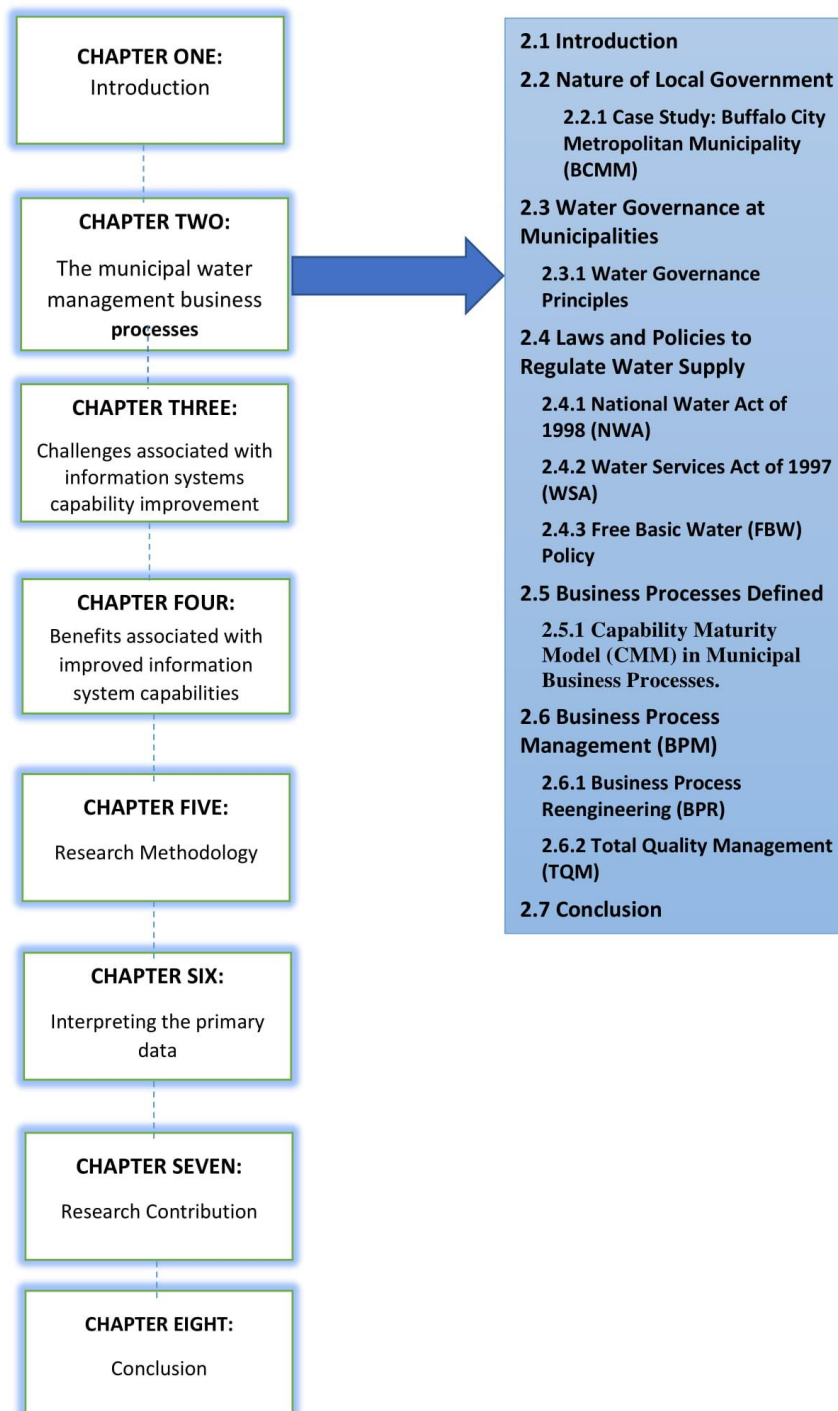
1.11 Chapter Summary

This chapter has introduced the overview of this research study and how it was conducted. This chapter has explained, *inter alia*, the research problem that was investigated, the objectives of the research as well as the methodology that was adopted in this research investigation. The last section of this chapter detailed the outline of this research investigation. Thus, the following chapter focuses on municipal business processes with regards to water management.



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Chapter Two: The Municipal Water Management Business Processes



2.1 Introduction

Since 2002, local government authorities (municipalities) were assigned the responsibility of providing water-related services to their community (Haigh, Fox, & Coleman, 2010). Behind the provision of these water resource services resides key business processes that need to be present (Kunene, 2016). The term business process refers to the set of interrelated tasks performed to achieve business outcomes (Kunene, 2016). Additionally, Gourbesville (2013) defines business processes as the collection of related and structured tasks that produce an expected output for specific customers. In the context of local government institutions, customers would be the residents of the community who require water provision. The water provision business processes include activities that the municipality operationalises to ensure that residential consumers have access to clean water for their specific needs.

Jain (2012) states that ensuring effective access to water services requires proper management that involves a systematic approach that requires multiple stakeholders to formulate and implement policies to control and regulate the use of water. Water management involves planning for water re-use and facilitating and financing the water provision to ensure the sustainability of the water resource (Carlson, 2012). Water management at the municipal level can be achieved through the implementation of water conservation (WC), water demand management (WDM), and through effective water billing (Masia & Erasmus, 2013). WC and WDM involve direct interaction with the infrastructure and involve many manual processes. This study will focus on the available information systems processes associated with water billing.

The chapter seeks to explain the business processes that are associated with water resource management at a municipal level. In doing so, this chapter will begin by describing the nature of local government and its role in ensuring the equitable access to water services. The chapter discussion will further include the laws, policies and principles adopted in South Africa to regulate, manage, monitor and govern water resource management.

2.2 Nature of Local Government

In South Africa, there are three spheres of government, namely national, provisional and local (Koma, 2010). Local government (which is the focus of this research) is a sphere of government that is responsible for ensuring that public services such as water, sanitation, electricity, and infrastructure are being delivered to residents (Koma, 2010). Mthembu (2012) asserts that the local sphere of government is the most important sphere because it is the closest

touchpoint for service delivery to residents. The primary goal of local government is characterised as the pursuit of Enhanced living conditions for residents in its sphere of influence. According to Nyalunga (2006) the primary goal can be achieved by local government if it maintains the objectives stipulated in the South African Constitution (Section 152(1) of the Constitution of the Republic of South Africa, 1996). These objectives include:

- providing democratic and accountable government for local communities;
- promoting social and economic development;
- promoting a safe and healthy environment; and
- encouraging the involvement of communities in the matters of local government.

Thornhil (2008) and Alexander and Berman (2014) state that local government is a entity that is close to the people. The residents of the community approach local government for information and service delivery requirements, such as water. Therefore, local government, through various municipal services, has an obligation to provide service delivery such as water services to its residents.

The municipality can act as a Water Services Authority (WSA) and/or Water Service Provider (WSP) (Algotsson & Murombo, 2009). When a municipality is a WSA, it ensures that the water resource infrastructure is protected and maintained. Furthermore, it ensures the affordable and sustainable access to water resources by regulating water in an equitable manner. On the other hand, a municipality can be considered a WSP when it provides water-related services as required by the contract they have with the WSA. For the purpose of this research, Buffalo City Metropolitan Municipality (BCMM) is identified as a WSA and has contracts with Amatola Water (a WSP) to perform water provision related projects on its behalf (Amatola Water Annual Report, 2009).

Khwela (2013) indicates that it is very important to note that local government is a sphere of government, not a single municipality. Khwela (2013) goes on to state that all single municipalities in South Africa make up local government. Therefore, a single municipality such as BCMM is a form of local government. Selaelo (2012) states that local government is a sphere of government which consists of various municipalities which must be established in every province in South Africa. Thus, a municipality has a constitutional obligation to govern local government affairs in a given community or area of jurisdiction (Selaelo 2012; Koma 2010). Municipalities play an important role in local government such as ensuring the

provision of services (e.g. water) to a community in a suitable (e.g. affordable, efficiently and effective) manner (Selaelo, 2012).

In South Africa, municipalities are divided into three main categories: Metropolitan (Category A), Local (Category B) and District Municipalities (Category C) (Nyalunga, 2006). Nyalunga (2006) further defines a metropolitan municipality as a municipality that has an executive municipal authority in its area. In order to be classified as a metropolitan, a municipality is required to have a residential population in excess of 500 000 citizens (Alexander & Berman, 2014). There are currently eight metropolitan municipalities in South Africa. Table 1 indicates the metropolitan municipalities, their location, and populations.

Table 1: Municipal Metropolitans (adapted from Alexander & Berman, 2014)

Municipality	Location	Population
Buffalo City Metropolitan Municipality	East London	755,200
City of Cape Town	Cape Town	3,740,026
City of eThekweni	Durban	3,442,361
City of Johannesburg	Johannesburg	4,434,827
City of Tshwane	Pretoria	2,921,488
Ekurhuleni Metropolitan Municipality	East Rand	3,178,470
Mangaung Municipality	Bloemfontein	747,431
Nelson Mandela Metropolitan Municipality	Port Elizabeth	1,152,115

District municipalities are different from metropolitan municipalities in that they are made up of a number of municipalities that fall into one district (Alexander & Berman, 2014). There are 44 district municipalities in South Africa. Alexander and Berman (2014) state that there are usually about four to six local municipalities that make up one district municipality. The areas that fall outside of the eight metropolitan municipalities are divided into local municipalities; there are 266 local municipalities and each municipality is further broken down into wards (Alexander & Berman, 2014). The focus of this research is Buffalo City Metropolitan Municipality (BCMM), which is described below.

2.2.1 Case Study: Buffalo City Metropolitan Municipality (BCMM)

BCMM has administrative offices located in the city centre of East London, Eastern Cape Province, South Africa. It was formed through the merger of two former transitional local councils, namely East London and King Williams Town (BCMM, 2011). The Buffalo City

local municipality was originally established in 2000 (BCMM, 2011). In 2011, the Buffalo City local municipality was separated from the Amathole District Municipality and converted into a metropolitan municipality. As the shaded area illustrates in Figure 3 below, BCMM includes towns of varying sizes, such as East London, Zwelitsha, Dimbaza as well as the second largest township (Mdantsane) in South Africa. The city of East London is the primary node of administrative control of the municipality while King William Town is the secondary (BCMM, 2011).

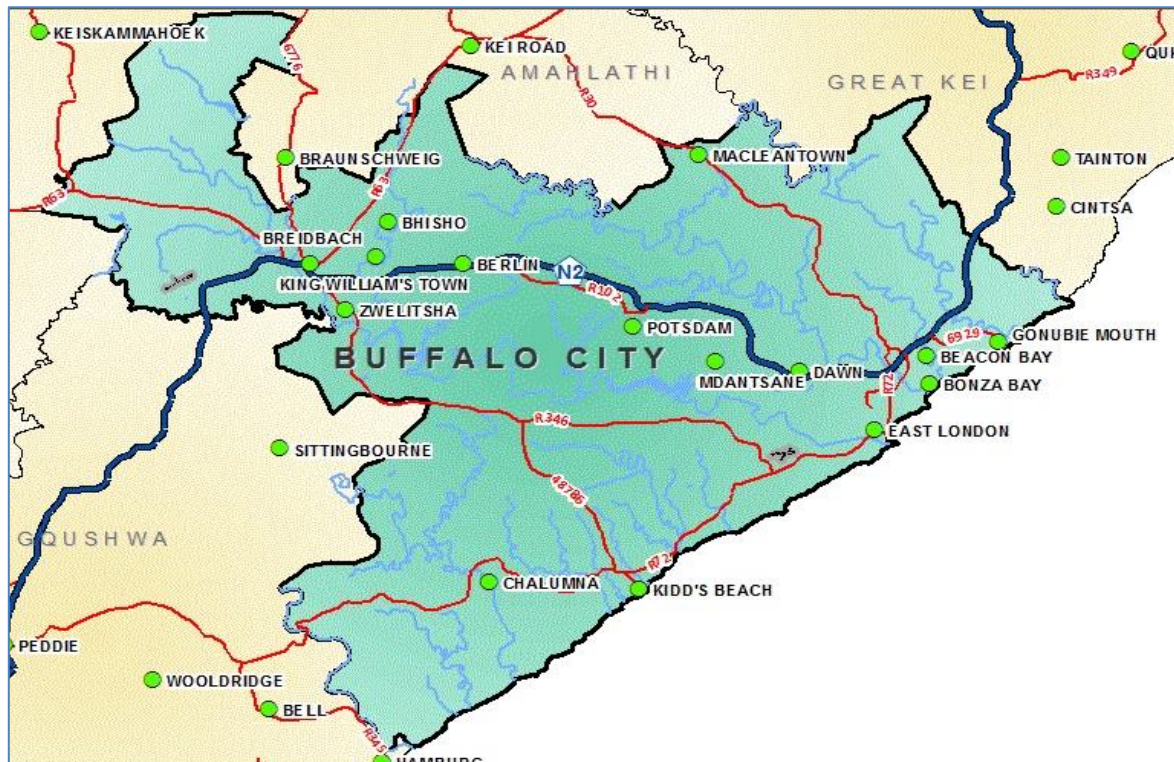


Figure 3: BCMM Map (BCMM, 2011)

BCMM depends on the various river catchments to supply water to its inhabitants. These catchment areas include: Kwelerha, Gqunube, Buffalo, Nahoon, Gxulu, Tylomnqa and Keiskamma River (Future Works, 2014). The Buffalo and Nahoon rivers combine to form a water transfer scheme called the Amatole Water Supply System (AWSS), which is the primary supply of water for the whole municipality (Future Works, 2014). In essence, AWSS is responsible for the treatment and transportation of quality water to households. However, a 2012 Eastern Cape Development Report concluded that only 24% of residents in the metropole are receiving piped water (Buffalo City Metropolitan Municipality: Development Indicators, 2012).

Having discussed the case of the research the next section examines how water can be governed at a municipal level. This process is called water governance. Water governance concerns the establishment of policies, rules and legislations to ensure that there is a balance between water demand and water conservation.

2.3 Water Governance at Municipalities

Fukuyama (2013) defines governance in the public sector as the government's ability to make and enforce rules and to deliver services in a democratic manner. Governance rests upon two values: inclusiveness (treat everyone equally) and accountability (individuals need to be responsible for their actions). Furthermore, Kaufmann and Kraay (2010) describe governance as the manner in which public officials or government institutions exercise their power and authority to shape public policy and provide public services. McGarry, Mugisha, Hoang-Gia and Myles (2012) argue that the definition of governance applies at both macro (i.e. national) level as well as micro (i.e. sector or institution) level. Thus, the definition of governance depends on the context in which it is used (McGarry et al., 2012). In the context of local government and this research, governance associated with service delivery is explained as the constitutional obligation of the local entity to supply water services to residents and to ensure that the political and administrative systems are present to develop and manage water resources and the delivery of water services (Bakker, Kooy, Shofiani & Martijn, 2008). Within the context of this research, the governance under discussion is referred to as water governance.

Water governance covers the full range of actions through which local government and other relevant stakeholders work together to manage water provision. McGranahan and Satterthwaite (2006) state that local government institutions such as municipalities must support water governance at all levels. According to McGarry et al. (2012), this will be achieved when municipalities are practising good leadership such as being transparent with regards to water governance processes. Valukonyt and Saparniene (2012) state that municipalities must not just support water governance but need to adhere to existing water governance principles.

2.3.1 Water Governance Principles

The Organisation for Economic Cooperation and Development's (OECD) Principles on Water Governance Report that was conducted in 2015 includes 12 water governance principles that government institutions need to take into account. Figure 4 depicts these water governance principles. The principles remind stakeholders in local government that good governance of

water requires solving water-related challenges in a fair and inclusive manner (OECD, 2015). Water governance principles promote and encourage all levels of stakeholder participation as they enable sustainable water policies and effective management practices.



Figure 4: Overview of Water Governance Principles (OECD, 2015)

Akhmouch (2016) states that the principles are formulated in order to achieve the goals of water governance which at its core focuses on effectiveness, efficiency and trust and engagement in water management. At local government level, the efficiency and effectiveness of service provision is imperative in order to obtain the trust of residents. Table 2 below provides an overview of the water governance principles in the context of local government. The water governance principles are explained in the context of municipal water billing processes.

Table 2: Water governance principles applied to local government municipal water billing (adapted from OECD, 2015)

Categories	Principle	Description	Application at Local Government - Municipal Water Billing
Effectiveness	Clear roles & responsibilities	Clearly allocate roles and responsibilities for water policy-making, management and the implementation of policies.	The stakeholders at local government (i.e. municipal managers and general employees) must clearly know their tasks and duties when it comes to water billing.
	Appropriate scales within basin systems	Manage water at the appropriate scale within integrated basic governance systems to foster co-ordination between different scales.	The water billing tools should promote or encourage multi-level co-operation among users and stakeholders.
	Policy coherence	Encourage policy coherence through effective cross-sectorial co-ordination.	Municipality must use mechanisms that will allow consistent and logical policies with regard to water billing.
	Capacity	Adapt the level of capacity of responsible authorities to the complexity of water challenges to be met.	This can be done by matching the level of technical, financial and institutional capacity in water governance to address the problems.
Efficiency	Data & Information	Produce, update and share timely, consistent policy related data and information.	A municipality can use various information systems to ensure that water billing related information is accurately shared with and between stakeholders.
	Financing	Ensure that governance arrangements help mobilise water finance and allocate financial resources in a transparent manner.	Local government (such as BCMM) need to promote governance that will aid the municipality in generating revenue through effective water billing.
	Regulatory Frameworks	Ensure that sound water management regulatory frameworks are effectively implemented.	Achieved when a municipality is adopting consistent legal and institutional frameworks that set out rules and standards for achieving effective water resource billing.
	Innovative governance	Promote the adoption and implementation of innovative water governance practices.	Information and Communication Technologies (ICT) can be used as the innovative element for water

			billing at local government level
Trust & Engagement	Integrity & transparency	Mainstream integrity and transparency across water policies and water governance frameworks.	Government institutions need to establish clear accountability for transparent water policy making.
	Stakeholder engagement	Promote stakeholders' engagement for informed contributions to water policies.	All stakeholders such as residents and management must be involved when water billing-related decisions are taken.
	Trade-off across users, rural and urban areas, and generations	Encourage water governance frameworks that help manage water distribution among citizens of different communities	Local government sectors must promote non-discriminatory involvement in decision making, such that there is an equitable distribution of water to all.
	Monitoring & evaluation	Promote regular monitoring and evaluation of water policies and governance.	The municipality must often check or assess to what extent the water billing policies and processes address water challenges.

The identified water governance principles are holistic, with the understanding that there is no 'one-size fits all' approach when it comes to addressing water related challenges (OECD, 2015). Valukonyte and Saparniene (2012) previously articulated this view by noting that the principles of water governance are established from broader good governance principles that include accountability, legitimacy, rule of law and transparency.

This research will focus primarily on two of the identified water governance categories namely, efficiency and effectiveness. Efficiency is concerned with the frameworks and measures that are in place to manage information and data at local government. Effectiveness is concerned with whether the municipal employees adhere to the policies and procedures for water management.

Water governance and water resource management are often considered as the same concept (Sojamo, 2015; Harris & Morinville, 2013; Iribarnegaray & Seghezze, 2012). However, water resource management is the operational component of water governance (Wostl & Knieper, 2016). Fisher, Alfredo and Russo (2014) state that water resource management is concerned with meeting the current water demands for all customers without negatively impacting the future water supply requirements.

2.4 Laws and Policies to Regulate Water Supply

Molobela and Sinha (2011) argue that the challenges of water resource management do not only depend on the availability of water but also on the implementation of a given legal framework. Magwaza (2011) emphasizes the critical nature of water by stating that it is a basic requirement for human survival as well as the survival of animals and plants. However, in South Africa there are still large areas that do not have access to piped water because of the inequalities in infrastructure provision experienced during the apartheid era (Nnadozie, 2013). Chapter 2, entitled the Bill of Rights (Section 27.1), of the Constitution of the Republic of South Africa (Act 108 of 1996) stipulates that the government has a duty to ensure that every citizen in South Africa has equal access to clean drinking water (Algotsson & Murombo, 2009). In support of this constitutional requirement two Acts that regulate water resources were then introduced, namely, the National Water Act 36 of 1998 and the Water Service Act of 1997 (Algotsson & Murombo, 2009).

2.4.1 National Water Act of 1998 (NWA)

In 1997, the South African Cabinet adopted the National Water Policy (NWP). This policy was tabled to achieve three fundamental objectives: (1) equitable access to water (2) sustainable use of water resources, and (3) effective water use (National Water Policy Review, 2013). In August 1998, the National Water Act (NWA), which was based on the NWP, was signed into law. The main purpose of the NWA is to ensure that the nation's water resources are protected, used, conserved and managed effectively (Gualtieri, 2007; Van der Schyff & Pienaar, 2010). Gualtieri (2007) further points out that the NWA takes four factors into account, namely:

- (1) promoting equitable access to water resources;
- (2) meeting the basic human needs of present and future generations;
- (3) promoting efficient use of water for the benefits of public interest; and
- (4) facilitating social and economic development.

The motive behind the formulation of this law was to ensure equitable water distribution in South Africa and to emphasise the aim of water resource management which is to achieve sustainable water resource use (Haigh, Fox, & Coleman, 2010). The NWA constructs a comprehensive legal framework for the national government to manage water resources including rivers, streams and ground water.

The NWA has been praised by the international water community as the most progressive water legislation in the world (Rüesekgsong, 2014). However, the NWA has proven difficult to implement successfully in South Africa (Schreiner, 2013). One of the key challenges outlined by Schreiner (2013) and Quesne, Kendy and Weston (2010) is the issue of leadership, transformation and power. The restructuring of the South African water legislation post-apartheid resulted in difficulties in overcoming the historical disparities for the initial successful implement of the NWA (Schreiner, 2013). Furthermore, the NWA prompted changes to the Department of Water and Forestry (DWF) that resulted in the implementation of a vast number of new functions. One of these functions is the regulation of the water pricing strategy.

The water pricing strategy provides a framework for the pricing of the use of water resources by residents in municipalities. The pricing strategy covers the use of raw (untreated) water that is supplied by government institutions as well as treated water. Otieno and Dzwaïro (2012) state that the water pricing strategy for raw water charges allows DWF to sell the raw water to water boards at fixed prices. The water boards treat the water against a specified standard. Thereafter, the water is distributed to local authorities that supply customers. The water users (customers) are charged based on the volume of water they consume. DWS (2015) outlines the main objectives of this pricing strategy developed under NWA. These include:

- ensuring that water resource management information systems are cost effective and do not become an unnecessary financial burden on the water users;
- ensuring that there is adequate funding for the effective operation, maintainance and development of waterworks;
- providing an enabling framework for the provision of financial assistance and the use of water pricing to support the redress of racial and gender imbalances in access to water;
- facilitating financial stability of water management;
- promoting water use efficiency; and
- establishing a platform for an independent regulator for Enhanced economic regulation across the entire water value chain.

Futhermore, this water price strategy seeks to ensure that economic development is achieved. According to this strategy the catalyst for economic development is consistent and sustainable water availability for everyone.

2.4.2 Water Services Act of 1997 (WSA)

The South African government introduced acts and laws to regulate water supply at local as well as national level. The National Water Act (NWA) and Water Service Act (WSA) are interdependent and complementary to each other. The NWA provides the legal framework that governs the nation's water resources while the WSA provides the framework that guides the provision of water to the nation (Magwaza, 2011). The WSA is the instrument that regulates the accessibility of water resources to domestic customers. The WSA stipulates that the Water Service Authorities (i.e. municipalities) have a duty to ensure efficient, affordable and economical access to water services by residents within their jurisdiction (Gualtieri, 2007). The duty of the municipality is to ensure that there are equitable allocations of water resources provided for the community, and in turn, the residents within the community have a responsibility to pay reasonable charges for water services. As a practical example, BCMM cannot withhold access to water services from a community, however, the municipality has the ability to impose reasonable limitations on water use as long as there are instruments for equitable water distribution to all communities. In order to achieve equitable water access to communities, the South African government introduced a Free Basic Water (FBW) policy for poorer households.



2.4.3 Free Basic Water (FBW) Policy

The FBW policy was introduced in 2001, by then minister of Water Affairs and Forestry, Mr Ronnie Kasrils. The primary target of this policy is the impoverished and those who do not have access to portable water (Hjortenholt, 2013). This policy allocated 6000 litres of water per household per month of free basic water, on the condition that if the household consumed more than 6000 litres, they would have to pay for the additional water usage based on the standard set tariff of the municipality. Many municipalities did not agree on whether this free basic water should be for everyone or only for poor water users. In 2002, the Department of Water Affairs and Forestry (DWF) confirmed that the free basic water service would only apply to households defined as poor (Calfucoy, Cibulka, Davison, Hinds, & Park, 2009).

The implementation of this policy has been delegated to local government authorities but they can choose which approach to use to apply the policy. There are two approaches that a municipality can choose, namely the universal coverage approach or the service-level targeting approach (Magwaza, 2011; Calfucoy et al. 2009). Metropolitan municipalities where there is a high volume of water users mainly use the *universal coverage approach*, which sets out a basic provision of six kilolitres per household. The *service-level targeting approach* is targeted

at rural areas where water is provided through boreholes and standpipes (Calfucoy et al. 2009). This approach restricts the amount of water provided to the basic service levels. Furthermore, those municipalities that have low water capacity and/or a high proportion of poor customers implement this approach to ensure equitable access to water. In essence, the FBW policy is there to ensure that poor families who cannot afford to pay for water services have access to clean water.

These policies, rules and acts are implemented at local government level to ensure that municipalities manage water effectively. However, municipalities cannot rely on the laws to achieve effective water management, but must ensure the implementation of sound business processes to ensure the efficient operational management of their water resources.

2.5 Business Processes Defined

Gourbesville (2013) defines a process as the collection of tasks or actions that convert input to output in order to add value to an entity. Remoreras (2009) describes four elements of a process:

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- *Processes definition* – processes must be well designed and documented.
 - *Process and activity roles* – the roles must be clearly assigned in the organisation as to who is responsible for certain processes.
 - *Available tools* – the tools to accomplish a particular process must be available in the organisation.
 - *Training* – people, such as employees, should be trained to avoid the inconsistencies in processes execution.

Rouse (2016) defined a business process as the set of activities that are put in place to accomplish a certain organisational goal. Business processes are also defined as the various processes that are conducted within an organisation to create outputs that will benefit customers (Damij & Damij, 2014). Burattin (2015) defines a business process as a structured and measured set of activities that are designed to make or provide a certain output for a particular customer. Business processes can be related to various functions such as product manufacturing, service provisioning, goods procurement and inventory management (Ordoñez, Ordoñez, Corrales, Cobos, Wives, & Thom, 2016). Thus, a business process is the series of steps that an organisation should follow to achieve a specific goal.

The focus of this study are the business processes related to water service provisioning at municipal level and the associated tasks. Based on the definition of business processes provided, water service business processes would be the tasks or activities that are put in place by municipalities to ensure effective and efficient water resource management. These activities include effective water billing that will result in efficient water management and Enhanced revenues. Effective water billing is achieved through the following tasks:

- application for water resource;
- meter reading;
- transfer of readings to billing system;
- billing of customers; and
- sending invoices.

The primary goal of the business processes as it has been explained by Burattin (2015) and Damij and Damij (2014) is to create an output that will benefit the customers. In the case of water management through effective billing, the output would be transparent and accurate water billing. Another important element in business processes is the people who are going to execute those processes to create the output. The people executing business processes related to water billing are the municipal employees, from meter readers to water billing officers. Ler (2016) identifies water management business process categories together with their explanations/functions. These categories include: Customer, Asset Management, Management of Networks, Geographic Information, Measurements and Transverse Business Processes. The focus of this research study is on the first category – the customers. The customer business processes includes billing, customer care and communication with water service users. These elements are the focus of this research, with respect to assessing and evaluating the efficiency and effectiveness of water billing at BCMM. In order for these elements to be assessed and Enhanced properly, they need to be standardised.

Moreover, Ordoñez et al. (2016) state that organisations standardise their business processes, and these are normally documented and/or stored in specific repositories. The foremost goal of business process enhancement is to increase organisational performance that will result in service delivery enhancement. Lodhi, Koppen and Saake (2011) point out that before making enhancements to the existing business processes it is vital to understand how processes are executed in an organisation. When viewing a municipality as a government organisation we can argue that enhancing business processes can result in better water service provision. In

essence, process enhancement increases the organisational capability with regards to service provision. Valdez, Buttles, Svolou and Valdez (2008) state that in order to increase organisational capability, an organisation should focus on three elements, which include processes, people and technology (*cf.* Figure 5). The intended goal of any business process is to enhance the interaction between these three elements where a computer-based information system is being utilised, in order to achieve optimal efficiency and output.

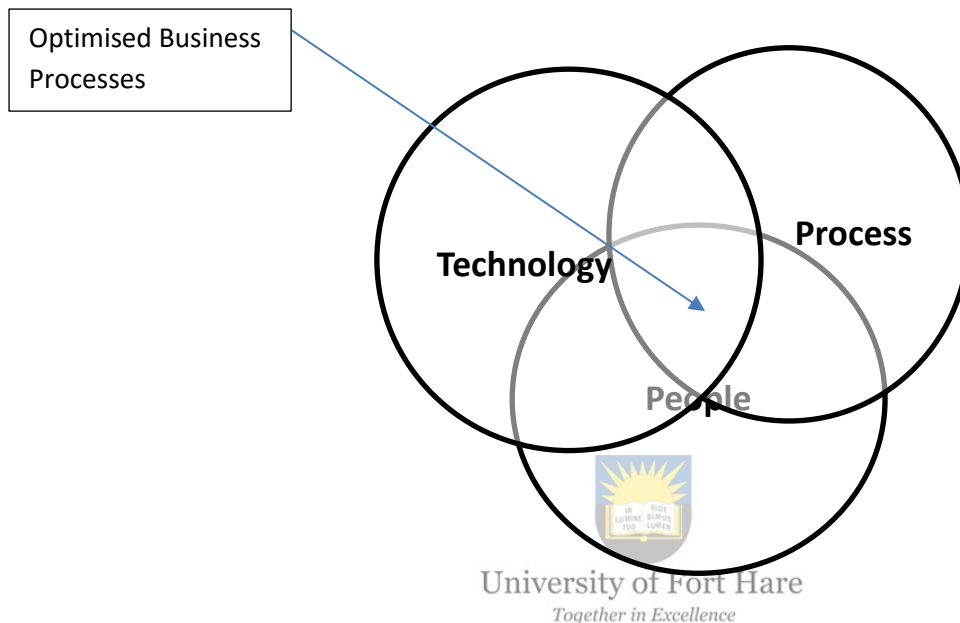


Figure 5: Focus of Process Enhancement (Valdez et al. 2008)

These elements are presented in the Work Systems Theory (WST), which is one of the underlying theories of this research study. In WST, the elements people, technology and processes are viewed as completely in the work system. Certainly, when an organisation seeks to enhance its business processes they should focus on these three elements. Alter (2013) states that the failure to include these three elements in business process enhancement/enhancement leads to a negative impact on the overall results of the activity undertaken.

However, Lodhi, Koppen and Saake (2011) state that organisations find it difficult to enhance their business processes because they do not know where to start. Organisations seeking a starting point or guideline on how to start can make use of the Capability Maturity Model (CMM). The CMM can serve as the starting point for evaluating the existing capabilities of the organisation's business processes (Crowston & Qin, 2010).

2.5.1 Capability Maturity Model (CMM) in Municipal Business Processes

The Capability Maturity Model (CMM) was developed in 1991 at the Software Engineering Institute to support enhancement in the software development processes (Titov, Bubnov, Guseva, Lyalin, & Brikoshina, 2016). It was developed to help organisations select process enhancement methods by determining their current process maturity and identifying the critical problems that hinder the process enhancement. CMM, therefore, is a tool that is used to assess the ability of the organisation to perform a given task or activity (GIS Capability Maturity Model, 2013).

The CMM comprises three elements, which include key practices, processes and maturity stages/levels or capability maturity. Literature reveals that the CMM is often criticised for its complexities and difficulties in implementation (Spruit & Sacu, 2015). Therefore, this research study only focuses on the maturity levels from a holistic perspective in order to simplify its relevance to the study. By adopting a holistic perspective, it simply means that the research study will look at the bigger picture which is the enhancement of water billing related business processes. The maturity stages are initial, repeatable, defined, managed, and optimising (*cf.* Figure 6). Over the years, the CMM has been applied to different fields, which include information technology (IT), commerce, and government to enhance business processes (Vitoriano & Neto, 2015; Crowston & Qin, 2011). In this research study this model will be applied in the public sector as a background theory for the enhancement of the processes that are associated with the provision of water resources.

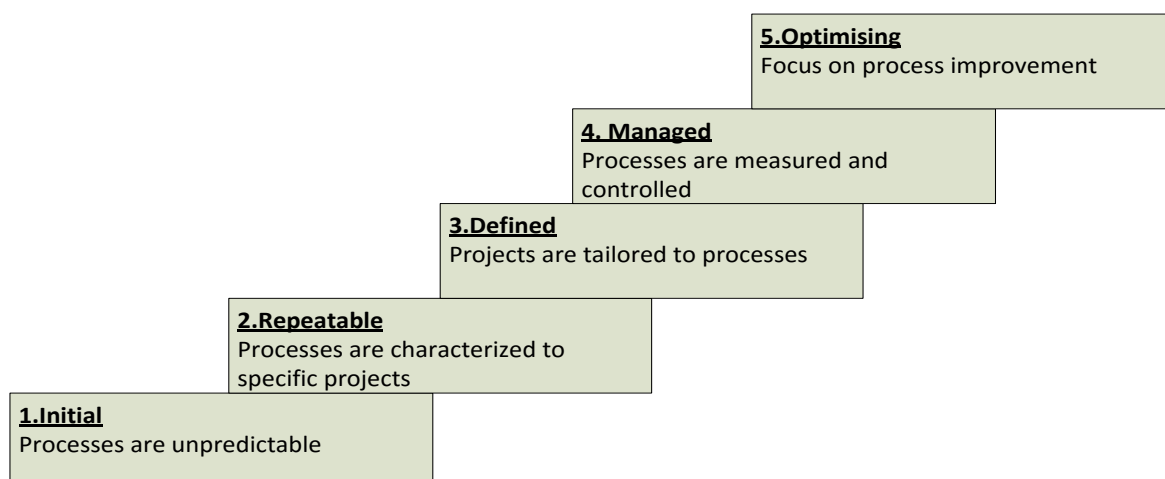


Figure 6: Capability Maturity Model (Titov, Bubnov, Guseva, Lyalin, & Brikoshina, 2016)

Titov et al. (2016) state that the lowest stage of maturity means that the business processes are very poor while the highest level represents best practices and Enhanced processes. The description will start from the lowest stage, initial, and then explain each level in relation to water resource management processes and use.

The **initial stage** represents processes that are ad hoc (i.e. not adaptable), chaotic and poorly controlled (Crowston & Qin, 2011). There are no standardised or consistent ways of performing tasks and there is no ownership of processes at this level of maturity. As a practical example, if municipalities fail to monitor and control their water management processes that means they are at the lowest level of maturity. If a municipality is represented on this level it indicates that their processes with regards to water billing are undisciplined and immature and, as a result, they will experience some delays in information communication, which impact decision-making. Furthermore, their water billing business processes are not clearly defined, which results in errors and inconsistencies. The affected municipality would need to examine these chaotic and unstructured processes properly to determine whether they are relevant to the overall goal of the municipality. For organisations at this level the remedial action is typically to investigate the availability of information systems and technologies to standardise their processes (Tanrikulu & Ozcer, 2011). The information systems involvement in processes design enables the organisations' processes to demonstrate consistency, which leads to easy updates.

Unlike in the initial stage, the **repeatable stage**, is concerned with processes that are consistent, planned and whether the basic controls to perform those processes are in place. Furthermore, procedures and policies exist in the organisation. The only problem at this level of maturity is that processes are not defined and understood. Moreover, at this level of maturity there are standards to regulate processes but when these are not well documented it becomes difficult to replicate the tasks. As an example, in a given municipality, the processes, policies and procedures for the effective water billing may exist, but there is no clear understanding of how to action them consistently. If the employees at the municipality do not understand the processes for water billing processes, then it is going to be difficult for them to monitor and enhance on them. Human involvement is critical at this stage; organisations should ensure that their employees understand the business processes that are required to accomplish a certain task (Haron, Sahibuddin, Harun, Zakaria, & Mahrin, 2013).

At the **defined stage** business processes for certain activities are fully understood by the whole organisation. At this level of maturity processes need to be communicated to everyone and skills that are required to perform a given process must be clearly identified. When the processes are understood by every employee in the organisation it will result in consistent outputs. For example, in order for the water billing processes to be understood by everyone at a municipality, the municipality's management should promote and offer personnel training to enhance the knowledge of personnel regarding particular processes.

For the **managed stage** to be realised, processes must have been properly defined and they must be analysed quantitatively to enhance the quality of the business processes. Enhancing the quality of the processes will lead to effectiveness in performing a particular process. Furthermore, a characteristic at this level of maturity is that processes are performed identically every time they are being implemented. The processes at this level are then further divided into sub-processes, if needed, so that they can be managed effectively. For example, to be at this level of maturity a municipality needs to perform regular business process audits and to check whether employees are following the standards and norms when performing various activities.



The **optimised stage** is representative of business processes that are well defined and continuously Enhanced. At this level innovative solutions such as business process reengineering (BPR) are introduced to optimise processes further (Balajiware, 2016). For example, municipalities at this level of maturity would be focused on continually enhancing process performance by implementing innovative technologies.

The CMM has been used to explore the maturity of the business processes related to water management (solely focusing on water billing) at the BCMM, which is the identified case study for this research. The CMM is to be used to determine BCMMs current maturity level concerning water resource management business processes and to identify what challenges need to be addressed for maturity enhancements.

Tarhan, Turetken and Reijers (2015) have identified the characteristics of mature business processes. These include:

- the processes that are *documented and communicated* to existing staff and new employees;
- processes that are *carried out according to documented procedures*;

- the processes that are *defined and consistent*;
- the *defined processes that are updated* when necessary;
- *roles and responsibilities are very clear* in organisational processes;
- *processes are being monitored* as well as the employees responsible for them; and
- the disciplined *processes are understood and followed* because everyone understands them and their benefits.

These characteristics are applied in this study for evaluating and assessing the water billing business processes. Furthermore, these traits and those expected at each stage of the CMM will assist in determining the maturity stage of the BCMM water billing process. Business Process Management (BPM) is another concept that plays an important role in ensuring that organisations' processes are mature and the overall organisational performance is optimised.

2.6 Business Process Management (BPM)

Jeston and Nelis (2014) define BPM as the discipline that focuses on using business processes to achieve an organisation's objectives through enhancement, management and the governance of the essential organisation's business processes. The definition of BPM that is going to be used for this research study states that BPM is a disciplined approach to identify, design, execute, document, and manage both automated and non-automated business processes to achieve consistent increased capabilities of business processes (Von Rosing, Scheer, & Von Scheel, 2015).

BPM is not a new concept in the process enhancement world (Song & Zhu, 2011). Rosemann and De Bruin (2010) reveal that the definition of BPM ranges from a focus on information technology (IT)/information systems (IS) views to holistic management practice. Furthermore, Rosemann and De Bruin (2010) argue that the IT/IS view of the BPM definition focuses on business process automation. In supporting Rosemann and De Bruin's (2010) statement, Sinnl (2011) formulated a technical definition of BPM, stating that it is the method which supports critical business process design through information systems. Song and Zhu (2011) point out that even though BPM is associated with process automation it is not a technology but rather a process-oriented management discipline. Song and Zhu (2011) subsequently identify five key elements or themes of BPM, namely:

- process strategy – requires that business processes must be carefully planned to contribute to organisational overall success;

- process ownership – involves assigning process owners e.g. organisational employees;
- process measurement – is concerned with evaluating and assessing process performance;
- process enhancement – requires organisations that have systematic measures such as IT in place to enhance business processes; and
- process architecture – includes those systems in place to design processes.

These business process elements can play a critical role in enhancing water billing business processes at a municipality. As an example, when a municipality has systematic measures in place to enhance their water billing processes, they will not only enhance the processes, but it will standardise them and allow execution in a consistent manner.

Additionally, BPM can be seen as a holistic management practice that requires support and involvement from organisational top-level management for the monitoring of important business processes (Rosemann & De Bruin, 2010). In essence, BPM can be viewed as the approach to analyse, enhance, control and manage the business processes in order to help the organisation to deliver enhanced services (Song & Zhu, 2011). BPM seeks to evaluate the important business processes of the organisation and enhance them on a regular basis. Jeston and Nelis (2014) further point out that in order for an organisation to implement BPM, they need to understand clearly that the processes are fundamental elements of organisational success. Dabaghkashani, Hajiheydari, and Haghighinasab (2012) state that BPM provides organisational benefits such as automation of procedures and processes, trouble-shooting business processes and monitoring processes. Corradini, Falcioni, Polzonetti and Re (2011) describe the steps that an organisation needs to go through when implementing BPM for the purposes of process optimisation, namely:

- documenting the processes to obtain an understanding of how that process works;
- assigning the processes to individuals in order to establish managerial accountability;
- managing the process to enhance some measures of process performance; and
- enhancing the process to enhance the process performance.

It is important to analyse and prioritise the business processes before the organisation can undergo the stages/life cycle of BPM for continuous enhancement so that it is clear which processes are more important in comparison to others. These stages include design, modelling

execution, monitoring and optimisation (Dabaghkashani, Hajiheydari and Haghhighinasab, 2012, p. 726).:

- Design - the process design includes the identification of existing business processes as well as the design of “to be” processes;
- Modelling – this is the theoretical design of the processes and determines how the processes might operate when they are Enhanced;
- Execution – the organisation can develop or rather purchase software that will execute the required steps of the process;
- Monitoring – the process performance is being measured; and
- Optimisation – involves retrieving processes performance information from the modelling and monitoring stages.

The most important aspect of the adoption of BPM is the continuous enhancement of business processes. Organisations need to be aware that the environment changes, technology changes, therefore business processes must change (Dabaghkashani, Hajiheydari, & Haghhighinasab, 2012). Enhancing business processes on a continuous basis can lead to many advantages. Thus, Corradini et al. (2011) state that public institutions can obtain various benefits from BPM, such as the increased effectiveness and efficiency achieved through restructuring the organisation along cross-functional processes.

Some municipalities fail to enhance their water provision business processes on regular basis. As a result, these municipalities face significant challenges in supplying high quality water that meets the needs of the community (Gayialis, Papadopoulos, Ponis et al., 2015). Ler (2016) believes that these challenges are caused by lack of business process enhancement, rapid urbanisation and climate change, which puts pressure on water resource management. Ler (2016) further states that according to an environmental outlook baseline report conducted in South Africa, water demand has increased by 55 % between 2000-2015. This calls for the development of new technologies that will support water processes management so that water can be conserved for future generations. As a result, many government institutions have introduced computer-based support tools for water resource process enhancement (Gayialis et al., 2015). Government institutions such as municipalities employ the Business Process Management System (BPMS). This management system plays an important role in modelling, monitoring and reengineering water business processes to allow for continual enhancement.

However, even though computer-based technologies are being implemented, there is still a lack of standardisation when it comes to these technologies and business processes (Ler, 2016). Gourbesville (2016) points out that in order for a municipality to achieve higher maturity levels there must be standardisation and added value to business processes and computer-based tools. Other government institutions in developed countries employ methodologies such as business process reengineering and total quality management, which are briefly explained.

2.6.1 Business Process Reengineering (BPR)

Business process re-engineering originated in the United States in the 1990s. It is still a relevant management resource and has been a frequently used tool for business process enhancement by both private and government institutions (Fragoso, 2015). Wanjiku (2015) defines BPR as the process of rethinking, redesigning and restructuring business processes to achieve enhancement in the processes and overall organisational performance enhancement. Khakata (2014) affirms that BPR involves the combining of business processes and information technology to come up with new Enhanced business processes. Nzewi, Nzewi and Moneme (2014) highlight that business process management re-engineering is not merely the restructuring, reorganising, and automation of business process but rather involves dramatic changes in overall organisational processes, structures and employees' responsibilities.

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BPR involves redesigning systems that support the processes to optimise organisational performance. It is also referred to as the process rebuild and does not always involve changing business processes directly; it also includes changing the policies and rules that regulate business processes. Kock and McQueen (2010) state that BPR is being used successfully mostly by the private sector. However, Fragoso (2015) states that many government authorities are still struggling to understand process re-engineering and its use for their own service delivery business processes. In this regard over 70 percent of government authorities fail to implement business process re-engineering successfully (Kock & McQueen, 2010).

The factors that result in the failure of BPR in government institutions include a lack of participation and involvement of staff in business processes and the lack of clear communication among stakeholders (Kock & McQueen, 2010). Weerakkody, Janssen and Dwivedi (2011) state that the success of BPR in the public sector depends on the BPR techniques and tools which include technology, management, business processes, structures and people. Weerakkody et al. (2011) further reveal that BPR is often criticised for making revolutionary changes in organisations' business processes, hence many organisations prefer the Total

Quality Management approach, which focuses on small scale incremental business process enhancement.

2.6.2 Total Quality Management (TQM)

Vuori and Kujala (2012) define TQM by initially explaining quality management. Quality management can be defined as the process of employing quality management systems in managing business processes to maximise customer satisfaction while continuing to enhance processes. TQM is a long-term approach to organisational success through Enhanced business processes and customer satisfaction (Vuori & Kujala, 2012). Oakland (2014) and Gharakhani, Rahmati, Farrokkhi, and Farahmandian (2013) view TQM as the systematic activities being performed by the whole organisation to achieve the organisation's objectives effectively and efficiently through continual business process enhancement.

Benito and Lorente (2016) argue that TQM does not have a generic definition as various authors have their own definition that suits their own beliefs and academic experiences. However, there are some elements that are similar through the various definitions, that is, customer satisfaction, continuous business process enhancement and employee involvement (Benito & Lorente, 2016). This study adopts a definition of TQM which states that it involves processes and actions accomplished at a municipality to achieve effective water management through effective water billing.



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The basic principle of TQM is based on promoting and encouraging every member in the organisation to participate in enhancing business processes (Gharakhani et al., 2013). It involves a bottom-up implementation approach by utilising continuous process enhancement activities (Pereira & Aspinwall, 2010). This process enhancement technique believes that continuous enhancement does not only increase the business process capabilities, but also the organisational performance (Gharakhani, Rahmati, Farrokkhi, & Farahmandian, 2013). TQM could play an important role in municipal water management as it would encourage all the employees to contribute to enhancing water management processes. Furthermore, it can lead to positive results in the whole water provision process.

TQM supports teamwork and its principles are based on the continuous enhancement of customer satisfaction and process orientation (Rashid & Ahmad, 2011). Martonova (2013) states that TQM has two approaches, the soft approach and the hard approach. The *soft approach* includes elements such as total employee involvement, continuous enhancement, quality planning, continuous training, customer satisfaction and information and analysis

(Martonova, 2013). In contrast, the *hard approach* incorporates elements such as the ISO 9000 series, Kaizen Approach, Six Sigma, and benchmarking (Martonova, 2013). However, these approaches can be implemented concurrently in an organisation to achieve much Enhanced results.

Martonova (2013) states that even though the TQM and BPR concepts have the same goal of enhancing an organisation's business processes they have differences. The main difference between these two concepts is in the area of focus. TQM focuses on the continuous enhancement of an organisation's business processes with the aim of satisfying the customers by delivering services that will meet their expectations and needs (Pereira and Aspinwall, 2010). This process enhancement methodology introduces methods and activities such as training that will lead to Enhanced and ongoing customer satisfaction. In contrast, BPR focuses on the radical redesign and change of the core business processes to achieve dramatic enhancements such as high organisational performance. Based on these differences, it is evident that TQM puts customers first while BPR is only concerned with dramatic enhancements in organisational business processes.

A further difference that is identified by Pereira and Aspinwall (2010) is related to participation. BPR is an intensive top-down effort therefore it requires top management support whereas TQM is built on the culture of the organisation and can work effectively with the intervention or daily support from organisation's leaders. In TQM, everyone in the organisation has a huge role and responsibility to provide Enhanced services and customer satisfaction (Kumar & Tyagi, 2014). The TQM approach can play a vital role in enhancing water billing process as this methodology involves the training of employees so that they can be proficient in performing water billing processes, such as entering customer information.

2.7 Conclusion

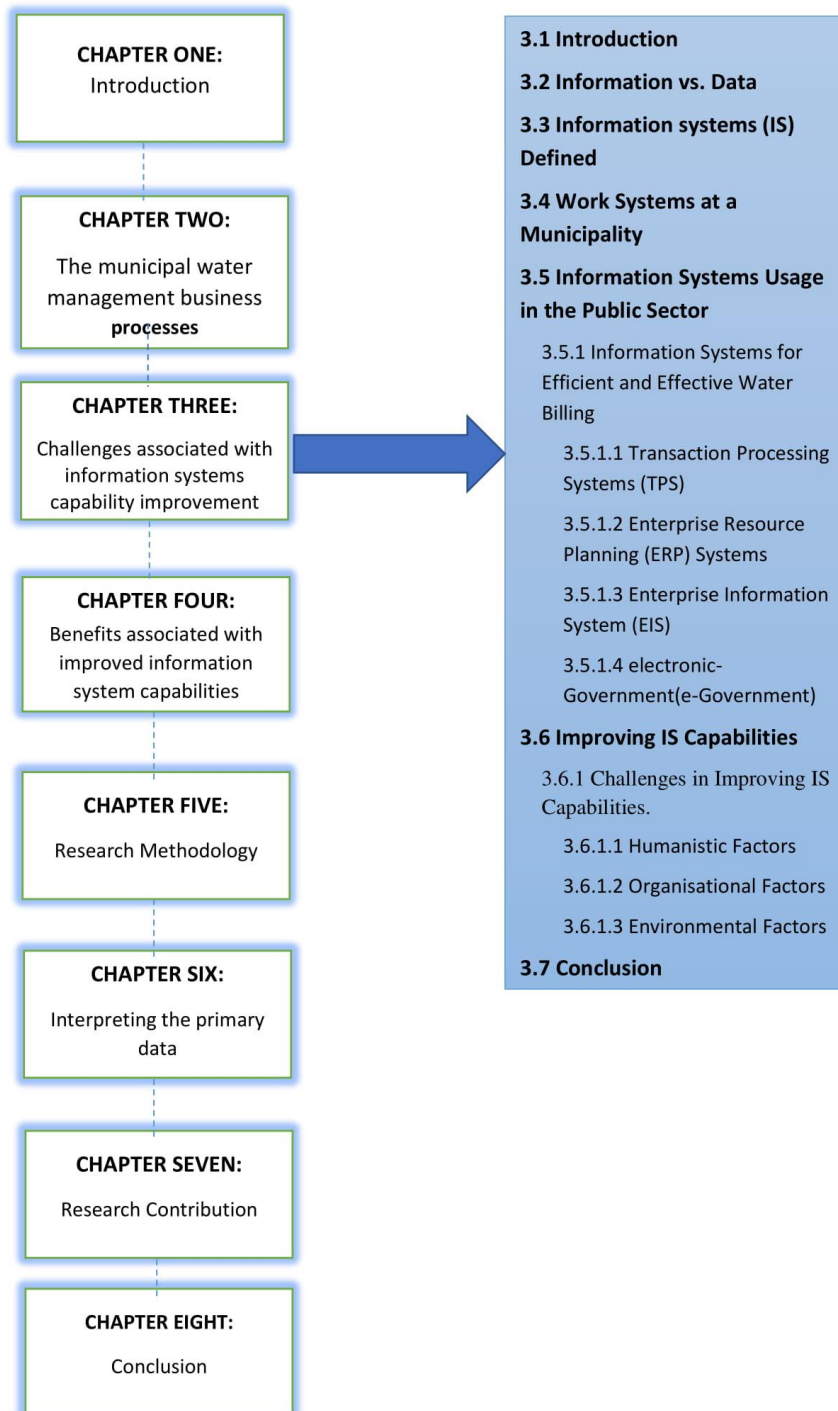
This chapter sought to address sub-question one: *what business processes are associated with water management at municipalities?* In answering this question, business processes were defined first. Then this chapter went on to describe processes that are involved in water management, which include application for water resource, meter reading, transfer of meter readings to the billing system, billing of customers and sending invoices.

Business processes are defined as the structured set of actions or tasks that are performed by the organisation with the intent of delivering services that will satisfy the needs of the

organisation's customers. Enhancing business processes is vital to ensure that municipalities are providing water in an efficient manner. Municipalities can be divided into three main categories, namely metropolitans (Category A), local municipality (Category B), and district municipality (Category C). These are different from one another as metropolitan municipalities are municipalities that have 500 000 or more voters and district municipalities are made up of six to eight local municipalities. However, they have a similar goal of providing water resources to every citizen of South Africa in an equitable manner. To ensure that water is being delivered to every citizen there are laws and policies in place to regulate that. These laws include the National Water Act, the Water Service Act and the Free Basic Water Policy.

Apart from the laws that are enforced by government to monitor water services, there are a number of methodologies or techniques that government authorities can utilize for business process enhancement. Business process management is one of these techniques which has been defined above as the systematic approach in identifying, monitoring, managing, executing and documenting business processes for the enhancement of the entire organisation's performance. Other process enhancement techniques that have been noted include business processes re-engineering (BPR) and total quality management (TQM). Although these two concepts are related to enhancing efficiency in the organisation, they are different from each other. TQM is concerned with long-term customer satisfaction through business process enhancement, while BPR is concerned with radical business process changes to obtain enhanced organisational performance. Even though these techniques are being implemented, municipalities still face various challenges in enhancing their information systems capabilities, which are explored in the next chapter.

Chapter Three: Challenges Associated With Information Systems Capabilities Enhancement



3.1 Introduction

There is growing consensus amongst the global public sector community regarding the need for the stimulation and revitalization of public services processes in order to enhance service delivery to citizens (Ziemba & Obłąk, 2014). In pursuit of this goal, government institutions are introducing innovative ways to manage government service processes, such as the utilization of information systems to support service delivery (Ziemba and Obłąk, 2014). This reflects the focus of the private sector, which considers information systems as a vital measure for their realised benefits for organisational growth.

Karim (2011) defines information systems as an arrangement of people, data, processes and information technology that interact with one another to collect, process and distribute information that is needed to support organisational goals and objectives. The adoption and implementation of information systems within government institutions such as municipalities plays an important role in enhancing their business processes by making them efficient, effective, convenient and reliable (Frost, Kenyo, Pike, & Pels, 2012).

Fan (2013) reveals that information systems provide municipalities with the flexibility to re-design their business processes. This flexibility, according to Fan (2013), results from information processing capabilities that are enabled by the information technologies. Frost et al. (2012) argue that organisations can only obtain the benefits from information systems if they constantly enhance the capabilities of these information systems. Unfortunately, organisations encounter challenges when enhancing their information systems capabilities, which range from humanistic to environmental factors (Beikzad & Babaei, 2013).

This chapter seeks to describe the challenges that are faced by municipalities in order to enhance their information system capabilities for water management processes. To this end, this chapter will begin by defining information and how is it different from data. Secondly, the definition of information systems together with the types of systems that are used by municipalities in developing countries to manage water resources will be covered. Thirdly, this chapter will explain how municipalities are taking advantage of information system to achieve effective water billing in order to enhance the entire water management process.

3.2 Information vs Data

Before defining 'information systems' it is important to understand the nature of 'information' as it stands and how it differs from data. Stair and Reynolds (2014) define information as the collection of organised and processed facts that add value to the organisation goals and objectives. Ranisavljević, Spasić and Ranisavljević (2012) define information as a set of classified and interpreted data used to make relevant decisions. Therefore, information is made up of data that is analysed, interpreted and processed.

Stair and Reynolds (2014) claims that many people fail to understand the difference between information and data. Doyle (2014) reveals that these concepts are different from one another: data is raw and it has not been processed, shaped or interpreted. Data includes the collection of unprocessed items such as text, numbers, images, audios and videos. In contrast, once the data is analysed and processed it becomes information. Doyle (2014) further makes the distinction between information and data much simpler by stating that computers need data while information is required by humans to make an informed decision.

The information needs to be valuable and useful to managers and government officials. In order for information to be valuable, it must have certain characteristics such as accessibility, accuracy, completeness, flexibility, reliability, relevance, security and timeliness (Stair and Reynolds, 2014 p. 16).

- *Accessibility* – Information should be easy to obtain or access. It must be kept in a place where all authorised individuals can access it in the right format and at the right time to meet their personal as well as organisational needs (Souka, 2011). For example, the information regarding the water management processes must be available to anyone who deals with water management.
- *Accuracy* – This is the user's perception that the information is correct (Top, 2015). Information must be error-free. In order to ensure that information is error-free the data that is captured for processing must be accurate. For example, municipalities must have an information system in place that will be responsible for ensuring that information is accurate.
- *Completeness* – Good information should contain all the relevant details that will be required by the person who is going to use it. For example, the water-related information must include all the important facts so that the municipal employees will not be lost or confused when they are trying to work with that information. Furthermore,

organisations need to conduct assessments frequently to check the completeness of information (Kupferberg & Protus, 2011).

- *Flexibility* – Flexible information can be used for different purposes in the organisation and by different people to perform different tasks. In addition, the system that is used needs to adapt quickly to changing user demands. Moreover, Furukawa, Hirobayashi and Misawa (2014) state that in order for information to be effective these systems need to be flexible and be able to accommodate an amount of variation regarding the requirements of the supported business process.
- *Reliability* – Deals with the truth and the trustworthy of information. Users must trust the information. Colepicolo (2015) believes that reliability of the information depends on the user evaluation. For example, the municipal customers will assess the reliability of the water billing information.
- *Relevance* – Information should be relevant to the purpose for which it is required. The relevant information helps decision makers to make accurate and relevant decisions. Alcamí and Carañana (2012) state that relevant information also increases knowledge and mitigates uncertainty in the problem under consideration.
- *Security* – In non-technical language, the information should be kept safe from unauthorised users, especially information that contains sensitive details of individuals (Nass, Levit, & Gostin, 2009).
- *Timely* – The information must be delivered in a timely manner because information received too late may be irrelevant. Boell and Kecmanovic (2015) point out that something might only be valuable information at a particular point in time, while being irrelevant at another time.

Information is considered valuable if it helps the employees, managers, relevant stakeholders and decision makers to achieve an organisation's objectives (Top, 2015; Butterfield, 2016). In preparation to measure the value of the information, it is quite critical to identify and understand the goals of the organisation (Top, 2015). Van der Heijden (2009) reveals that as much as information is important for the organisation, it needs to be stored, processed and disseminated to stakeholders and that is where information system have a role to play.

3.3 Information Systems (IS) Defined

Abualloush, Bataineh and Aladwan (2017) state that public, as well as private organisations, are living in the information society; they no longer depend only on human resources or labour.

Instead, they rely more on knowledge and information systems. Baron (2017) reveals that before an information system can be understood fully, it is imperative to know what a system is. Baron (2017), Lunenburg (2010) and Gharajedaghi (2011) define a system as a set of items that are related to one another in an orderly manner to contribute to a specific purpose.

Based on the definitions of a system provided above, it can be concluded that a system is made up of separate elements that are being connected and/or combined to achieve a certain goal. Systems are categorised as open or closed (Anderson, 2011). Open systems refer to the systems that interact with other systems or the external environment (i.e. influences that can affect the organisation such as political, ecological and technological) (Lunenburg, 2010). In contrast, closed systems are systems that have little interaction with another system (Lunenburg, 2010; Zakus & Bhattacharyya, 2007; Groff & Jones, 2014). Open systems possess a number of benefits compared to closed systems. Since open systems are interacting with other systems, they are more flexible and agile when compared with closed system which are rigid (Groff & Jones, 2014). The open systems approach allows organisational managers to analyse problems by examining the internal structure of the organisation and considers the external environment (Groff & Jones, 2014).



Stair and Reynolds (2016); Mohamed (2013) and Bourgeois (2014) describe information systems as a set of interrelated components that collect, manipulate, store and transport data and information and provide feedback to meet the objectives of the organisation. Figure 7 illustrates the overview of the functions of information systems with examples. In essence, the information system can be viewed as the mechanism that accepts input from the users and transforms it to output that will be of value to customers and the organisation.

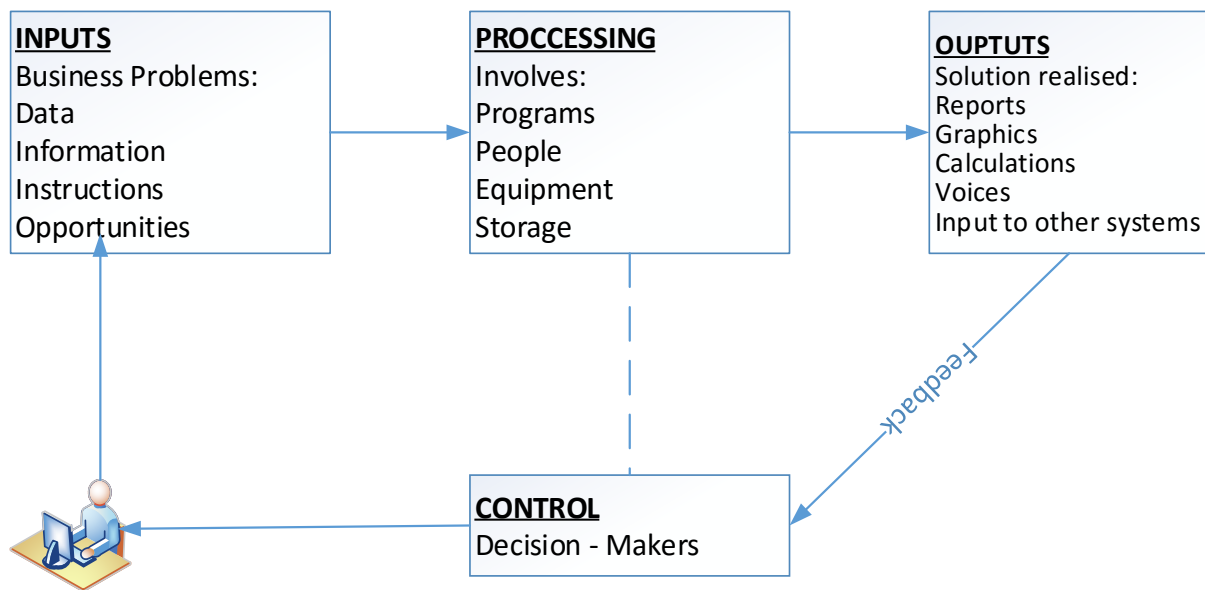


Figure 7: Functions of Information Systems (Mohamed, 2013)

Abualloush, Bataineh and Aladwan (2017) further define an information systems as a system that is based on a computer which makes information available to users in the organisation according to their needs. Information systems is further described by Davidavičienė (2014) as the combination of human resources and information technology that use technology to perform an action in support of business processes. Since information systems include computers, people often confuse information systems (IS) with information technology (IT). Kornkaew (2012) reveals that the definition of IS and IT are closely related, however, the difference is in their functions. IT includes the products, methods, inventions and standards that are used for the purposes of producing information. In contrast, IS consists of IT infrastructure, application systems and personnel who employ information technology to deliver information and communication services (Kornkaew, 2012). IS is able to supply an organisation with previous, current and future predictive information that will assist in decision-making processes (Bourgeois, 2014).

The inputs to IS can be data that is entered by the user e.g. a municipal worker. Then the data will be properly processed to be meaningful information that will be useful to the user. The output is returned to the user as a form of feedback to help the user make a correction if it is necessary (Mohamed, 2013).

According to Boell and Kecmanovic (2015), IS can be defined using four views, namely technology, social, socio-technical and process views. The *technical* view of the IS focuses on the technical influences and the functionality of the system (Baxter & Sommerville, 2011). In

the *social view*, IS is described as a social system, which is embedded in IT (Boell & Kecmanovic, 2015). The *socio-technical view* argues that IS is neither technical nor socially determined. Instead, the technology and social system interact with each other to produce a desired result (Boell & Cecez-Kecmanovic, 2010; Ghaffarian, 2011). In the *process view*, IS is defined as a work system devoted to processing information, which entails capturing, storing, retrieving, manipulating and displaying information (Boell & Kecmanovic, 2015). Alter (2013) takes a process view to define IS, stating that it is a work system in which human participants perform work (processes and activities) using information, and technology to produce products/services for internal or external customers. This research study will adopt the process view of IS proposed by Alter (2013), where the employees of BCMM are the participants who perform processes and activities (i.e. water billing processes) for municipal customers. The next section discusses work system theory in the local government context.

3.4 Work Systems at a Municipality

Buffalo City Metropolitan Municipality (BCMM) contains work systems that enhance the provision of water services to customers, coordinate work across departments and perform other support functions. Furthermore, within BCMM there are work systems in place to support effective water billing. BCMM can be thought of as a set of work systems.

The Work Systems Theory was developed by Alter (1999). The WST is an understandable and useful theory in IS, as it provides a basis for deep analysis (Recker & Alter, 2012; Niederman & March, 2014). The key element is the work system (Alter, 2013). The focus in WST is not the IS, but rather the participants who take part in the work system to produce products and services for the customers. When using IS as a work system the municipality employees are utilising information, technology and other resources to produce services/products for the people of the community. Furthermore, the municipalities can be regarded as a work system in which their IS processes are devoted to processing information. According to Alter (2013), the WST is made up of nine elements that need to work in harmony to produce products and/or services for the customers. Table 3 summarises these elements, using BCMM as the context.

Table 3: Work Systems Theory (adapted from Alter, 1999)

Components	Description	BCMM (example)
Process and Activities	These are inside the work system and they must occur so that the work systems can produce a service/product for a customer.	In the case of BCMM, these include the operational procedures that become the processes that the municipality uses to deliver water to its customers. Furthermore, these can include activities that are in place at BCMM to ensure that customers are being billed correctly.
Participants	The individuals who perform the work within the work systems which include IT and non-IT users.	These are the BCMM employees who action the water-billing processes and activities associated with water provisioning.
Information	Generated as an output by work systems and also an input to the work system.	Relates to all data collected by BCMM to produce information used for such things as water volume management, water costing, and decision-making.
Technologies	These are the technologies that work systems depend on to work effectively and efficiently.	These are the computer hardware and software that the municipality uses for the entire water management ecosystem.
Product/services	By nature, work systems are there to produce products/services for external customers.	These are the water services that BCMM provide to its customers.
Customers	These are the individuals who are going to benefit from the products/services that are created by the systems.	The customers include the residents (residential and commercial) who make use of BCMM services.
Environment	This is the local government municipality where the work system is in operation, as well as any applicable government regulations.	For the purposes of this research study, the environment will be BCMM, together with the regulations regarding water management.
Infrastructure	Includes human, information, and technical resources that work systems use to create products/services.	Infrastructure includes the employees at BCMM and resources that are involved in the water management ecosystem.
Strategies	The strategies that are relevant to the work system include enterprise, department and system strategy.	These include the various strategies that BCMM are pursuing in order to integrate information systems into the service delivery processes and activities.

The elements of the WST were developed to help organisational managers and executives to recognise and understand the IT-reliant systems in the entire organisation. The elements can be grouped into two categories, ones that form the actual work system and those that are indirectly part of the work system. The elements that form the actual work system are: processes and activities, participants, information and technologies while the other five

elements are indirectly part of the work system. Furthermore, these elements can be utilized to assess whether public sector organisations are operating as a work system - do they involve people, processes and technologies utilising IS.

3.5 Information Systems Usage in the Public Sector

The use of IS in the public sector is considered to be an important approach to increase the efficiency of service delivery and to enhance internal administration and management capabilities (Arduini, Denni, Lucchese, Nurra, & Zanfei, 2013). Municipalities increasingly rely on computer-based systems and information management. The information that was traditionally exchanged through human communication can be exchanged electronically through the use of IS (Zeb, Froese, & Vanier, 2012). There are various types of IS that are implemented by public sector organisations as tools to support the delivery of services such as water resources. Some of these include the Work Flow Management System, Enterprise Information Systems, Business Process Management System, Geographical Information Systems (GIS) and Business Intelligence Systems (Ziemba & Obłąk, 2014).

- Work Flow Management System - This is a system that is partially or fully automated and manages government institutional work procedures. One of the objectives of this system is to include the already existing applications as well as new applications into a system and provide an integrated execution among them (Mayer, Proell, & Rauber, 2012).
- Enterprise Information Systems – This type of system supports the integration and use of other systems such as Enterprise Resource Planning, Transaction Processing System and the Customer Relationship System. These systems promise enhancement of the processes that are used by government to deliver services to citizens (Karim, 2012).
- Business Process Management System – This system is developed to manage the processes within the organisation. It is responsible for defining, organising, planning and monitoring business processes (Grau & Moormann, 2014).
- Business Intelligence Systems – This system offers analytical capabilities that enable the government institution to come up with informed decisions. Hartley and Seymou (2011) point out that business intelligence systems provide government institutions with benefits such as the ability to obtain comprehensive information without the need to use sophisticated tools. These will be more crucial in the drive for better management of Big Data.

- Geographical Information Systems (GIS) – Pandey, Shukla and Shukla (2013) define GIS as the set of tools that captures, store, analyse and presents data that are linked to locations, which play an important aspect in the geo-spatial management of the municipalities' physical resources.

The application of these above-mentioned systems can play an important role in enhancing the management of water in municipalities. For example, the adoption of Enterprise Integration System in municipal water billing, can enhance the entire water billing process as it will ensure that all tasks involved are integrated. Enhancing water billing using IS will have a positive impact on the revenue streams of the municipality (Rao, 2012). Municipalities understand that water billing is a critical component of the overall performance of the municipality (Rao, 2012). Ziemba and Obłąk (2014) argue that municipalities take advantage of IS to enhance their water billing process by enhancing the effectiveness of the information flow and communication among stakeholders.

3.5.1 Information Systems for Efficient and Effective Water Billing

The ineffectiveness in water billing does not solely affect the financial stability of the municipality. It can also have a negative impact on customer accountability because ineffective billing will lead to inaccuracies resulting in the incorrect billing of water use, such as billing being delivered to wrong addresses (Gupta, 2012). These types of errors will result in customers losing faith in municipal water billing. The section above (*cf.* Section 3.2) discussed good information characteristics such as accessibility, accuracy and completeness to name a few. The ineffective water billing in a municipality will result in water-related information that is incomplete and inaccurate. Thus, the municipality will not be able to meet the good information characteristics. Figure 8 summarises the municipal water billing processes.

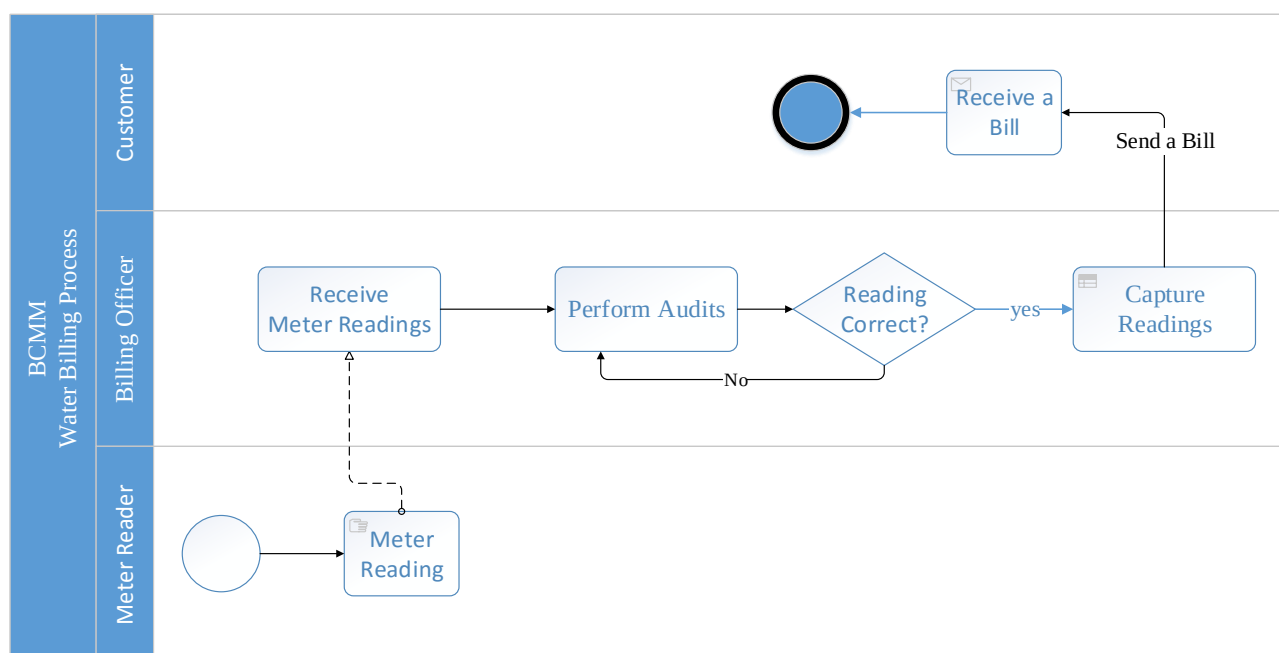


Figure 8: BCMM High Level Water Billing Processes

Furthermore, Molobela (2016) indicates that recent findings reveal that municipal revenue planning is problematic in South Africa and is caused by the inability of municipalities to bill customers effectively for municipal services such as water consumption. The cause may lie in municipalities not having updated, accurate and complete computerised listings of the customers they are serving. In addressing this issue, the *Back to Basics* report that was compiled in 2017 suggests that municipalities need to recruit competent and experienced water managers as well as install good water billing IS (Back to Basics, 2017). Furthermore, municipalities should use Enhanced technology in water payment collection so that effective water billing can be realised (Hope, et al., 2011).

In order for a municipality to achieve effective water billing, they need to enhance the current water billing process through robust recordkeeping and billing procedures and by introducing IS that will update customer databases (Gupta, 2012; Rao, 2012). Moreover, IS will ensure that water billing related information is complete and error-free (Rao, 2012). Misra and Kingdom (2012) state that human handling should be minimised in billing processes by putting in place system measures (controls and audits) that will prevent fraud and billing errors. Enhancing water-billing processes through IS use can yield several benefits. These benefits include the elimination of delays in sending out invoices to customers (making customers more willing to pay for water services), consistency and accuracy in water billing, and reducing non-revenue water occurrence from water leaks (Ambre, 2016).

Even though IS usage leads to positive results in the public sector (specifically through effective water billing), it has not been sufficiently investigated, presented and utilised (Pushpakumara, Wanniarachchige, Peiris, & Samantha, 2014). Furthermore, existing IS in government institutions are primarily focused on financial management auditing. However, government institutions are implementing IS such as transaction processing systems (TPS), enterprise resource planning (ERP), enterprise information systems (EIS) and e-Government to enhance the delivery of water services to residents.

3.5.1.1 Transaction Processing Systems (TPS)

Mahar (2013) reveals that earlier transaction processes were manual systems in which clerks would record transactions in a journal. These transactions would later be transferred manually to the central system or file folder representing different customers. However, the advances in IS as well as IT assisted in digitalising TPS in order to minimise the manual processes (Mahar, 2013). Bernstein and Newcomer (2009) define TPS as the system that accepts the transaction request from users, executes these requests to the database system and forwards the result to the users. TPS keep the organisation running smoothly by automating the processing of a large amount of paperwork that must be handled daily (Makabongo, 2015). Furthermore, TPS provide an environment that ensures good information characteristics such as the integrity, availability and security of data (Amin, Alauddin, & Azad, 2012). The main goal of the TPS is to automate the repetitive business processes with an organisation to increase the speed and accuracy while lowering the cost of processing each transaction. Furthermore, it makes the organisation more efficient by reducing the people impact from the process, which will automatically reduce the likelihood of data entry errors.

In the case of municipal water billing (the research study focus), the adoption and implementation of TPS will play an important role in automating the whole process of water billing. Municipalities are faced with challenges with regard to water billing. These challenges include incorrect billing, mistakes in data capturing, errors in meter reading, lack of integration in water billing business processes and incorrect invoices (Mosha, 2010; Raftelis, 2015; Weaver, Keefe, Hamer, & Palmer, 2017). These errors affect the financial sustainability of the municipality. Moreover, the manual processes that exist in water billing often cause ineffective water billing (Weaver et al., 2017). The implementation of this system will eliminate the manual processes, therefore mistakes and errors in water billing will be minimised. TPS will result in Enhanced interaction between the municipality and its customers, through access to water billing related information as well as increased transparency in billing processes.

As much as TPS provide municipalities with a variety of benefits, there are associated limitations with this information system (Bernstein & Newcomer, 2009). These challenges include a lack of computer literacy skills among employees, high bandwidth costs, limited public access to the Internet and a resistance to change (Makabongo, 2015; Bernstein & Newcomer, 2009). However, municipalities can address these challenges by allocating a budget for the implementation of TPS and its associated costs. Alternatively, municipalities can adopt enterprise resource planning as a tool to integrate the municipal processes so that water-related challenges, such as errors in data capturing, can be mitigated.

3.5.1.2 Enterprise Resource Planning (ERP) Systems

ERP systems enable the organisation to integrate all of its primary business processes in order to enhance the efficiency of the organisation. Chandiwana and Pather (2016) define an ERP system as one that offers an organisation a comprehensive and integrated solution for managing services on a single integrated software system. ERP systems are concerned with two foci: firstly, unifying an organisation's primary business processes and secondly, enhancing the efficiency in an entire organisation. Furthermore, ERP seeks to assist organisations with the integration all business functions in the organisation into a single accessible database to present a holistic view of the business and its data.



Fernandez, Zainol and Ahmad (2017) point out that the initial implementation of ERP systems was to serve manufacturing companies. However, due to the vast benefits that this tool provides, public sector organisations have taken a step to implement ERP systems (Fernandez, Zainol and Ahmad, 2017). The benefits of ERP systems include facilitation of communication and data transfer of critical information, which allows all stakeholders to have real-time information (Tombovcevs & Tombovcevs, 2013). Sadrzadehrafiei, Chofreh, Hosseini and Sulaiman (2013) point out that ERP systems benefits can be divided into tangible and intangible benefits. The *tangible benefits* include reduction of lead time, Enhanced customer services, IT reduction costs, Enhanced organisational performance, continuous enhancement and reduced paperwork. On the other hand, *intangible benefits* include the integration of business processes, Enhanced information visibility, standardisation, greater flexibility and Enhanced decision-making (Lipaj & Davidavičienė, 2013; Sadrzadehrafiei et al., 2013). The tangible and intangible benefits of ERP systems do not focus on any one particular industry but are applicable to all types of industries. However, this research investigation specifically focuses on the benefits that public organisations gain from ERP implementation. The benefits include:

enhancement in service delivery to citizens, smooth workflows and the provision of better governance and transparency (Fernandez, Zainol & Ahmad, 2017).

Literature reveals that public organisations are often struggling to implement ERP systems successfully due to their complexity (Ziemba & Obłąk, 2014). Additionally, there is a lack of proven scientific theories and experiences on the implementation of ERP systems in the public sector (Mukti & Rawani, 2016). Implementing ERP systems requires a combination of knowledge of the process approach, specific organisation business process, IT architecture and the unique environment of a given sector of the economy, such as the public sector (Ziemba & Obłąk, 2014).

Previous studies have revealed the critical success factors (CSFs) need to be in place at government institutions in order to implement an ERP system successfully (Hairul, Nasir & Sahibuddin, 2011; Alaskari, Ahmad, Dhafr, & Pinedo-Cuenca, 2012; Chandiwana & Pather, 2016; Ziemba & Obłąk, 2014). These CSFs are broadly categorised into three main factors, namely people-related factors, process-related factors and technical-related factors, with examples of each shown in Table 4.

Table 4: CSFs for ERP Adoption in Government (Ziemba & Oblak, 2014)

People-related factors	Process-related factors	Technical-related factors
Top management support	Clear vision, objectives, goals and scope	Familiarity with technology
User/Client involvement	Effective communication and feedback	Supporting tools and good infrastructure
User training and education	Up-to-date progress report	
Committed and motivated team	Realistic budget	
Skilled and sufficient staff	Effective monitoring and control	
Effective project management skills and methodologies	Clear assignment of role and responsibilities	
	Realistic schedule	
	Education on new business processes	

In pursuit of enhancing the water billing process through the adoption of ERP systems, municipalities need to ensure that they carefully consider these CSFs for ERP adoption (*cf.* Table 4). For example, municipal managers need to provide training and education to their employees on how to use the water billing systems effectively. Furthermore, top management

needs to provide support in water management processes by ensuring that they design clear policies and procedures for water billing. Top management needs to ensure that all employees adhere to these policies and procedures. Having discussed ERP systems, their benefits and challenges, we can now consider the impact of ERP systems on municipal water billing.

The aim of the ERP system is to integrate the main functions of the organisation (i.e. the municipality) into a single database so that various departments can easily share information (Fernandez, Zainol & Ahmad, 2017). Therefore, ERP adoption can assist in addressing the challenges that are faced by municipalities, which include a lack of integration in business processes and organisational functions and inadequate systems to process water billing related information (Favour, 2014). Cape Town City Metropolitan Municipality (CTCM) has successfully implemented an ERP SAP system to enhance effectiveness and efficiency in their system and processes used for planning, reporting and service delivery (State of Cape Town Report, 2016). The implementation of SAP in CTCM has enabled the residents of the city to provide input to the municipality on service delivery concerns.

The successful implementation of an ERP system can ensure that human handling is minimised in water the billing processes. However, ERP packages are typically huge and complex software and municipal systems will need customisation. Usman, Crispin and Neil (2012) define ERP customisation as the process that involves the alteration of an ERP system to match the organisation's existing business processes. Apart from implementing an ERP system, an Enterprise Information System (EIS) can assist a municipality in ensuring that water resource delivery is effective and efficient.

3.5.1.3 Enterprise Information System (EIS)

The implementation of EIS could be the solution to effective water supply and water billing for municipalities. An EIS is defined as any kind of IS that enhances the functions of the enterprise or organisational business processes through integration (Kuna, 2014). The EIS provides a technological platform that allows an organisation to integrate and coordinate their business processes (Kuna, 2014). Concerning water billing, the implementation of EIS could play an important role in integrating the entire water billing process. EIS can enable a municipality to have a single system that will be central within the municipality. It will ensure that water-related information is shared across all functional areas. The integration of the water billing processes makes real-time water-related data available to all relevant stakeholders.

Furthermore, the implementation of an EIS leads to realised benefits such processes efficacy and effectiveness (Anaya, 2013). The efficiency in water billing processes will reduce municipal costs because it will consume fewer resources (Ambre, 2016). In addition, this process efficiency will provide standardised water billing processes. The process effectiveness will be achieved by ensuring that municipal customers are satisfied with the water billing related services. If water billing processes are effective, then customers will begin to trust the municipality which could result in changes to customer attitudes towards paying for water consumption (Ambre, 2016).

Nonetheless, many public organisations in developing countries (such as Sri Lanka) seek to obtain effective and efficient water management through the implementation of IS such as e-government to enhance the delivery of their water services (Van der Vyve & Rajapakse, 2012). This has afforded local government organisations the opportunity to provide services in a self-service manner to citizens. In addition, the succesful implementation and use of EIS make options such as e-government possible because of system integration. However, this e-government initiative is still in its infancy in other developing countries because of lack of computer literacy skills among communities (Van der Vyve & Rajapakse, 2012).

3.5.1.4 Electronic Government (e-Government)

The large volume of information that is produced by government institutions makes it a necessity to find enhanced ways to have this information available to citizens (Latre et al., 2013). As a result, governments across the globe are actively looking at implementing e-government services to ensure that citizens have access to government information at any given time (Latre et al., 2013).

Jafari and Ali (2014) define e-Government as the broad-based transformation initiative that is enabled by leveraging the capabilities of information and communication technologies in order to deliver high-quality services to support the goals of the citizens. Furthermore, e-government can be viewed as the use of information technologies (such as the Internet) by government institutions that have an ability to transform relations with community members (Mahajan, 2015; Qader and Kheder, 2016). The common theme behind the definitions of e-Government is that it includes the automation of existing paper-based procedures to enhance the delivery of public services to the community. e-Government doesn't only provide information but also enables transparency in government processes, saves time due to the provision of services through a single portal and simplifies procedures (Nkwe, 2012).

Many government institutions implement e-Government to obtain benefits such as the reduction of costs and enhancement in the effectiveness of public services (Qader & Kheder, 2016). In theoretical terms, e-Government has the potential to increase government effectiveness and transform the nature of public governance through electronic governance (Cloete, 2012; Qader & Kheder, 2016).

However, in practice, many developing countries such as South Africa face challenges and complexities in implementing this initiative. Mostert (2010) states that one of the challenges that are faced by South African government institutions with regards to e-Government implementation is the shortage of ICT skills. Mostert (2010) goes on to argue that skilled South African IS professionals are leaving the country to work in developed countries, while others move from public organisations to the more lucrative private sector.

Apart from the shortage of ICT skills to implement e-Government, Cloete (2012) believes that the main obstacle that hinders the implementation of e-Government is weak leadership and inconsistency in policies with regard to the implementation of e-Government. Another challenge when it comes to the implementation of e-Government is the lack of trust in information sharing and cybercrime. Even though security features are advanced when it comes to e-Government, many government institutions are still concerned about security, with the fear that the personal information of citizens can be exposed or stolen (Solinthone & Rumyantseva, 2016). Liang, Wang and Long (2011) reveal that e-Government requires the intergration of internal systems, however, municipal systems are seldom linked and integrated which hinders the successful implementation of e-Government initiatives. Despite the challenges that are faced by South African government institutions, e-Government offers the community an opportunity to participate and engage in public services such as water management.

e-Government implementation can lead to effective water management in a municipality as it will allow every municipal stakeholder to participate in the management of water (Asabere & Torgby, 2014). Municipalities use this platform to make important information available online, computerize the water management procedures and interact with residents through online services. In the case of water billing process, e-Government will allow citizens to get access to the current information without having to spend much time and energy to get it (Asabere & Torgby, 2014; Ahmad, Nasr, Safwat, Gaber, Sayed, & Ahmed, 2014). This in turn

would eliminate the need for residents to travel to municipal offices when they want to query their water accounts.

Furthermore, citizens can take advantage of the flexibility of this platform to pay for their water consumption, through the Internet or by cell phone. Pillay (2012) points out that e-Government is an enabler of e-democracy in water management as it allows citizens to perform interactions with government institutions and enhance the residents' democratic abilities. In addition, e-Government allows citizens to voice their opinions regarding the provision of water from the municipality. The municipality will then be able to address the challenges that residents might have through electronic channels.

In implementing e-Government for water management in Australia, an Australian National Auditing Office Model (ANAO) Model was developed (Mohammed and Steven, 2011). The model is made up of four stages: publishing information, interaction, transaction of secure information and sharing of information with other agencies.

- *Stage 1: Publishing Information* – This involves publishing the information that is visible on the web. Citizens can search for information regarding meter-reading dates, account-related information and other water billing information.
- *Stage 2: Interaction* – Citizens should be able to interact with the available information. For example, they must be able to perform calculations of their municipal debts with the tools provided.
- *Stage 3: Transaction of Secure Information* – This stage ensures that security and safety on the web is maintained.
- *Stage 4: Sharing Information With Other Agencies* – This stage is concerned with the sharing of common data with other municipalities.

Even in South Africa, metropolitan municipalities such as of the City of Johannesburg embrace the e-Government initiative. They have an online website that enables communication between citizens and the municipality (Pillay, 2012). This is not just an ordinary website; the people of Johannesburg can also use this platform to pay their water bills. With e-Government services in place people do not have to wait in long queues to pay water bills or to check their balance (Pillay, 2012). This has led to positive results because citizens increasingly trust the municipality due to its transparency. Literature reveals that even though e-Government has some benefits, there are challenges too. The challenges include insufficient IT/ICT

infrastructure, shortage of skills necessary to use the Internet and the high cost of access, security issues, lack of top management commitment, as well as a lack of integrated systems in municipalities (Asabere & Torgby, 2014; Ahmad et al., 2014; Naidoo, 2012). This means that having IS in place doesn't solve all the problems. Therefore, municipalities need to enhance the capabilities of their IS.

3.6 Enhancing IS Capabilities

It is widely acknowledged that the investment in IS and IT leads to positive organisational outcomes (Smirnov, Shilov, Oroszi, Sinko, & Krebs, 2016; Bi, Smyrniotis, & Kam, 2011). However, the power of IS in enhancing the business processes of an organisation relies on its ability to provide visibility, traceability and real-time information (Krishnan & Teo, 2011). The ability of IS to enhance organisational operation is called IS capabilities.

Bi et al. (2011 p.604) define IS capabilities as the ability to leverage the appropriate IT skills and expertise to develop an effective and efficient work engine that will integrate organisational information in order to create valuable outcomes (such as offering products, services and information to customers). Enhancements in IS capabilities can include, but are not limited to, enabling efficient operations; supporting effective management; enhancing decision-making processes and producing real-time information. Bi et al. (2011) and Mohammed and Hu (2015) further reveal that IS capabilities are made up of IT infrastructure and IT human resources. *IT infrastructure* refers to the hardware, software as well as the management of IT. In contrast, *IT human resources* includes employee IT skills and knowledge. Peppard and Ward (2014) further indicate that it can be tacit and difficult to describe and identify IS capabilities. They claim that IS capabilities can only be defined its core elements or its objectives (i.e. IT skills and expertise and IT infrastructure).

IS capabilities will be Enhanced if employees in an organisation possess IT skills and appropriate IT infrastructure is in place. Once the IS capabilities are enhanced in an organisation, it can lead to the enhancement of organisational business processes. For example, if government institutions such as municipalities are able to enhance their IS capabilities of the water management processes, this will result in flexible, visible and traceable business processes. Furthermore, the communication and decision-making processes will be Enhanced.

McLaren, Head and Yuan (2012) provide a simplistic organisational perspective of IS capabilities by stating that it is the organisational capabilities that are enabled by IS. Roldán,

Rodríguez and Felipe (2015) also propose an organisational view of IS capabilities by stating that it is an organisation's ability to mobilise and deploy IT-based resources together with other resources. McLaren et al. (2012) state that people confuse IS capabilities with the functional attributes of IS. McLaren et al. (2012) make it clear that the functional attributes of IS describe the functions that will be used by the information systems (marketing, production, human resources and finances) while IS capabilities involve implementing IS that support the organisation's processes. Moreover, Davidrajuh (2009) identifies three core IS capability elements in any organisation, which are information technology practices, information management practices and information behaviours and values. Table 5 outlines these IS capabilities within the context of a municipality and illustrates how a municipality can use them to enhance water billing processes.

Table 5: IS Capabilities Core Elements (adapted from Davidrajuh, 2009)

IS capability element	Definition specific to the municipality	Application in water billing process
Information Technology Practices	The capability of the municipality to manage appropriate IT applications effectively (including hardware) to support the decision-making and communication processes.	The available IT in the municipality must support the billing process from meter reading to the billing of a customer for water consumption.
Information Management Practices	The capability of the municipality to manage good quality information effectively.	The water billing-related information must be organised so that it is accessible when it is needed.
Information Behaviours and Values	The ability of the municipality to promote ethical IS behaviour amongst employees for the effective use of information.	Water billing employees must understand the importance of information sharing during the water billing processes.

Municipalities can enhance their IS capabilities for water management processes by ensuring that they effectively manage IT assets which are associated with water billing. Stefanovic et al. (2015) argue that the first step in enhancing IS capabilities in water management is to enhance the collection, processing and storage of water-related information.

IS capabilities enhancement is primarily concerned with three elements, namely people, technology and information (Bi, Smyrnios & Kam, 2011; Mohamed, 2013; Roldán, Rodríguez & Felipe, 2015). Apart from focusing only on core IS enhancement elements (indicated in Table 4), the elements of a Work System can be used in enhancing IS capabilities in

municipalities. WST is the theory that was created by Alter (1991) (cf. Section 3.4). The premise behind this theory is that a work system is a fundamental component of every organisation (cf. Section 1.7.1.). The nine elements of WST are identified below, together with ways in which municipalities can enhance these elements to enhance IS capabilities.

Process and Activities – Steps that are involved in ensuring that the work system produces service/products for customers. In enhancing processes and activities, municipalities need to standardise and integrate all the processes to avoid delays in performing these processes.

Participants – Individuals who perform the work within the work system. For example, participants can be organisational employees who utilise IS to deliver customer services. Therefore, in enhancing IS capabilities these employees need to be made aware of the importance of consistent and error-free information. As such, municipalities need to conduct trainings and workshops to educate their employees about using IS effectively.

Information – Is the input and output of the work system. Municipalities should do away with using manual processes when checking errors in information. They must consider putting systematic measures in place to ensure that the information that is delivered to customers is error-free.



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Technologies – A work system depends on technologies to work efficiently and effectively. Municipalities should frequently introduce new technologies and IS to make it easier for their employees to deliver information and other services to customers.

Product/services – Are produced by a work system for external customers. Services that municipalities provide must be of a good quality. For example, the municipality should use technologies to ensure that water services are provided to all residents equally.

Customers – These are individuals who benefit from the output of the work system. Municipalities should introduce innovative solutions such as e-Government to ensure that municipal customers receive real-time information without having to go to municipal offices.

Environment – Rules, procedures and regulations to govern and manage IS and IT use must be developed and followed at municipalities. These rules will ensure that IS capabilities are enhanced and that IS add value to the organisation.

Infrastructure – Includes human, information and technical resources used by a work system to create products. In order to enhance IS capabilities, municipalities should focus on delivering

error-free information to customers. Furthermore, as it has been noted under “participants”, employees must be trained and educated about the importance of IS.

Strategies – Strategies such as information system integration can play a vital role in enhancing IS capabilities in municipalities.

Therefore, municipalities need to ensure that IS capabilities are Enhanced by enhancing these elements of WST at all times in order to have enhanced business processes. However, organisations experience difficulties in enhancing IS capabilities (Bi, Smyrnios & Kam, 2011; Mohamed, 2013).

3.6.1 Challenges in Enhancing IS Capabilities

Peppard and Ward (2014) argue that enhancing IS capabilities is a challenge on its own as it requires a deep understanding of how IT influences the existing operations, how to manage IS projects, how to ensure that employees possess the right behaviour and what values are needed to work with information. This proves that enhancing IS capabilities is not something that can be done overnight; it requires thorough planning (Peppard & Ward, 2014). Beikzad and Babaei (2013) categorise the challenges of enhancing IS capabilities into humanistic, organisational and environmental factors. The following section explains these factors, and discusses them in relation to Work System Theory (WST) (cf. Section 3.4).



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3.6.1.1 Humanistic Factors

Beikzad and Babaei (2013) state that municipal managers, as well as employees, do not know what they want and know their information needs. In order to properly enhance IS capabilities, everyone in the organisation should be aware of what they want to do with the information that will be produced by IS. Furthermore, Beikzad and Babaei (2013) point out that top local government officials are not participating in IS management initiatives. Additionally, Kornkaew (2012) states that support and commitment from top management is very important in IS capabilities enhancement. The municipal top management needs to motivate and encourage employees regarding the importance of IS by communicating the vision and role of IS effectively.

Another important issue when it comes to IS capabilities enhancement is the mistake of overlooking the importance of people (Platiša & Balaban, 2011). Many public organisations believe that IS capabilities enhancement depends only on the availability of IS components (such as hardware, software, procedures and data). An organisation can have a good IS in place

to manage water processes but if employees do not understand it, it will be a waste of time and money (Beikzad & Babaei, 2013).

A further challenge includes the resistance to change. The resistance to change in municipal employees is caused by fear, such as the fear of technology and the fear of being displaced by IS and IT (Kornkaew, 2012). Employees believe that its always a challenge when an organisation replaces an old system with a new system because they have to learn how to use the new system.

If government institutions want to enhance the capabilities of their IS they need to train and educate their staff about the critical role of IS in achieving organisational goals (Bafo & Heyes, 2011). Almalki, Al-fiet and Zafar (2017) state that government institutions may lack the resources to engage in user education, have an inability to recruit appropriate staff and an inability to employ IT experts in municipalities. Bafo and Heyes (2011) warn that the success of training and education depends on the correct execution of all the relevant steps such as the compilation of training needs, the implementation of training programmes and the evaluation of the effectiveness of training. The training will equip the municipal employee with the necessary skills and knowledge to help them to think outside the box in terms of how IS can solve water management issues (Bafo & Heyes, 2011).



The theory that is being adopted in this research study (WST) (*cf.* Section 3.4) features humans (participants) as one of the elements. This theory argues that humans need to be included in the IS implementation plans for IS adoption to be successful in the organisation due to the fact that it is the humans/participants who manipulate and interact with the IS on a regular basis. Furthermore, WST advocates that the IS must accommodate both the participants who don't have IT expertise and those who possess IT skills. The second factor that was mentioned by Beikzad and Babaei (2013) as an obstacle in enhancing IS capabilities is the organisational factor.

3.6.1.2 Organisational Factors

Organisational factors are defined by Almalki, Al-fiet and Zafar (2017) as the challenges that are less visible such as organisational culture, change, behaviour of employees, inadequate capabilities, poor co-ordination and distribution of responsibilities. Other barriers include existing political fights and middle and senior management attitudes in municipalities. Furthermore, this factor is concerned with the lack of consistency and complexity of the existing IS that are being used by an organisation to manage its processes. The complexity of

existing the IT infrastructure and/or IS that is used by the municipality to deliver water-related information can hinder the enhancement of information system capabilities (Beikzad & Babaei, 2013). Moreover, municipalities face difficulties in transforming business processes to be in line with their IS systems (Almalki, Al-fiet, & Zafar, 2017). The IS and IT used by government institutions are often not standardised and are unintegrated (Kornkaew, 2012).

Organisational factors can be addressed by ensuring that institutions consider and analyse their information, human and technical infrastructure, as stipulated by Alter (2013) in Work System Theory (*cf.* Section 3.4). For organisations to enhance their IS system capabilities, they need to make sure that technologies that are responsible for information sharing support the organisation's objectives and goals. The environmental factor is another challenge that could hinder the enhancement of IS capabilities.

3.6.1.3 Environmental Factors

These factors refer to the lack of methodology, procedures and rules that can be employed to ensure that IS delivers positive results (Beikzad & Babaei, 2013). Other challenges to IS capabilities include limited budgets that government institutions put aside for IS development. Furthermore, Sirbu, Banica and Rosca (2010) state that some environmental factors result from high labour costs and changes in government regulations, making it difficult for organisations to enhance their IS capabilities. Table 6 provides a summary of the information system enhancement for each factor.

Alter (2013) describes the environmental factors, including the relevant technical, regulatory and demographic environment, within which the work systems operates. WST stipulates that environmental factors may have direct or indirect impacts on IS capabilities. For that reason, organisations should put measures in place to ensure that they can address and manage environmental factors.

Table 6: Information System Capabilities Enhancement Challenges

Humanistic Factors	Organisational Factors	Environmental Factors
Lack of IS awareness among organisations' employees	Poor coordination in IS management	Lack of procedures, rules and methodology to enhance IS
Senior municipal managers do not participate in IS activities	Employees' behaviour towards information system usage	Limited budget
Lack of top management support and commitment	Existing internal and external political conflict	Changes in government rules

Overlooking the importance of people in IS	Middle and Senior management attitudes	
Resistance to change	Complexity of existing IS used by organisations	
Lack of training and education	Difficulties in transforming organisations' business processes to suit IS	
	Lack of IS standardisation and integration	

Based on the challenges provided above, it can be concluded that human factors are the major challenge facing government institution with regards to information system capabilities enhancement. The success in IS capabilities enhancement depends on the employees of a given organisation, whether or not they are adequately equipped with IS/IT skills (Bafo & Heyes, 2011). As it has been mentioned in the above section humanistic factors are often overlooked in government institutions; they tend to focus more on technical challenges. For example, when employees of BCMH possess the necessary skills, they will be aware of the importance of IS in the water billing process. Organisations need to ensure that their employees understand the business process, as well as the IS in place.



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3.7 Conclusion

The utilisation of information systems in government institutions such as municipalities is growing at an accelerating rate in developing countries like South Africa. These municipalities are employing information systems as a tool to redesign their business processes to become effective, efficient, traceable, flexible and visible. There are a number of information tools that are used by municipalities to manage their water resources. These include Enterprise Resource Planning, Enterprise Information Systems, e-Government and Geographic Information Systems, even though South African municipalities are facing some challenges in successfully implementing these tools.

It has been noted above that in order for municipalities to acquire benefits that are associated with information systems they must enhance their information systems capabilities. Municipalities need to focus on three core elements when enhancing information systems capabilities and these include Information Technology Practices, Information Management Practices and Information Behaviours and Values. However, municipalities are facing challenges in enhancing their information system capabilities. Moreover, this chapter sought

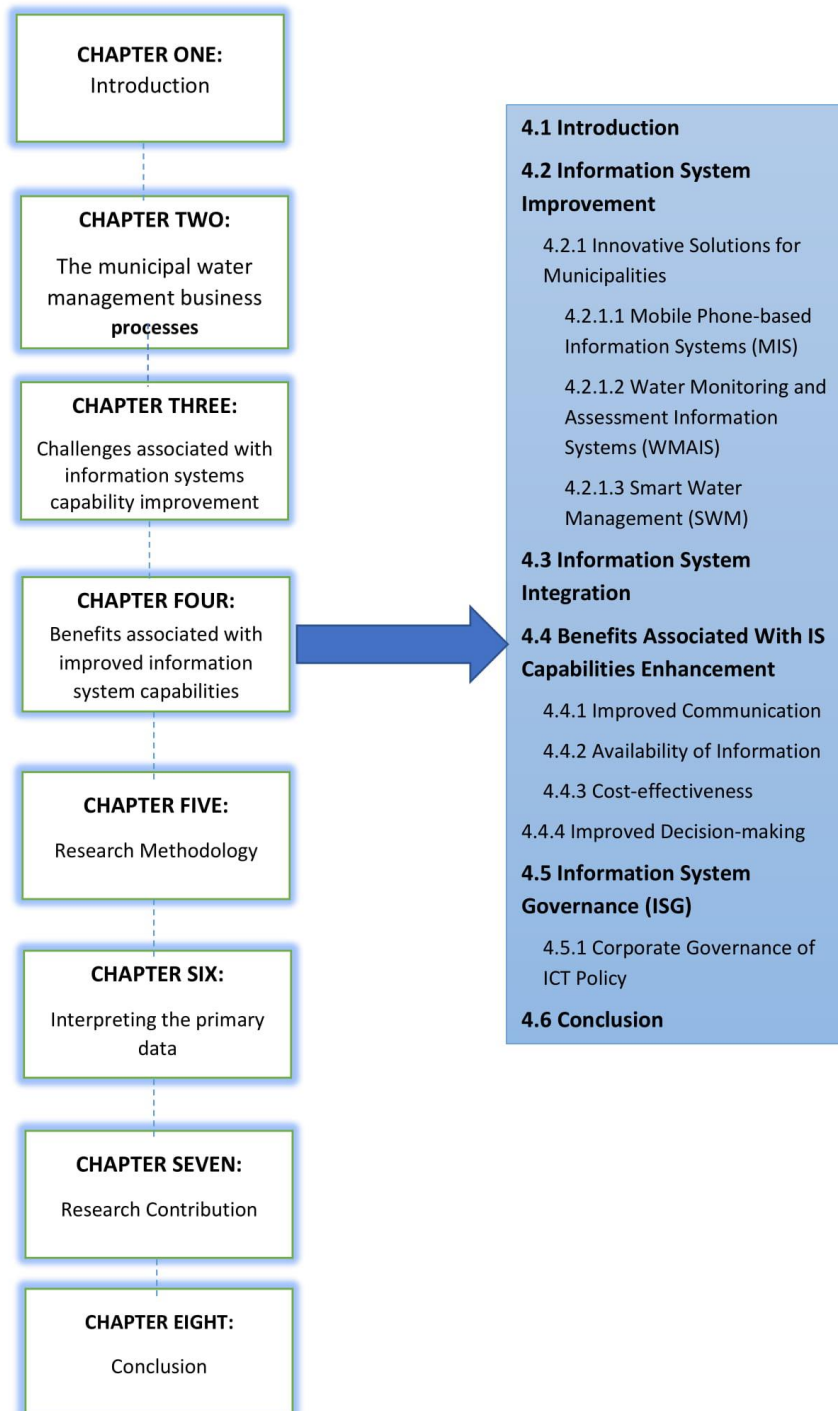
to answer the second sub-question of this research question, namely: *What are challenges do municipalities encounter when enhancing information systems capabilities?*

The chapter answered this sub-question by categorising the challenges of IS capabilities into three factors, namely humanistic, organisational and environmental factors. The humanistic factors include lack of IS awareness among the organisation's employees, lack of top management support and commitment, lack of training and education and resistance to change. On the hand, organisational factors involve less visible challenges such as organisational culture, change and the behaviour of employees to mention a few. Environmental factors refer to the lack of methodology, procedures and rules that can be employed to ensure that IS delivers favourable results. Having discussed the challenges that are associated with enhancing the information system capabilities, the next section focuses on the benefits of the enhanced information system capabilities.



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Chapter Four: Benefits Associated With Enhanced Information Systems Capabilities



4.1 Introduction

This chapter identifies the benefits that municipalities obtain from enhancing their IS capabilities. As detailed in the previous chapter, IS capabilities refers to the ability to use the appropriate IT skills, technologies and expertise to develop an IS that will integrate the organisation's information to create valuable outcomes (Bi et al., 2011). Furthermore, the previous chapter briefly identified benefits that are associated with Enhanced information systems capabilities. However, in this chapter these benefits will be discussed in greater detail.

The chapter will begin by describing the technologies that are used by municipalities (local and international) to enhance their IS capabilities in order to enhance the management of information related to water management. Karanasios and Allen (2014) assert that many municipalities are increasingly using mobile technology to enhance their IS capabilities and the management of water resources.

Furthermore, this chapter discusses the role of IS in enhancing business processes. Business processes was defined in chapter two as the set of activities that are put in place to accomplish organisational objectives (Rouse 2016). There is a positive relationship between IS and business processes as IS play an important role in re-organising and redesigning business processes. In addition, enhancing business processes in an organisation through IS can result in organisations obtaining higher maturity levels (Boulos, Wheeler, Tavares and Jones 2011). Lastly, IS Governance is explained. The Information Systems Governance (ISG) ensures that IT investment adds value to the organisation. Moreover, it is essential to implement corporate governance of ICT policy in order for municipalities to govern their IS and ensure that IT will enhance the organisational business processes.

4.2 Information Systems Enhancement

As highlighted in the previous chapter, IS play a strategic role in an organisation. IS assists the organisations to conduct their day-to-day activities efficiently with the help of software and IT technologies and support decision-making (Altameem, Aldrees, & Alsaeed, 2014). Furthermore, in the case of the public service sector, IS can enhance the delivery of water services to the community through transparent and effective water billing. As a result, it offers diverse benefits, ranging from transparency in water billing administration and Enhanced customer participation in water-related matters (Reyes, Garcia, & Romero, 2012). However, this does not mean IS works magically to achieve all of these benefits; an organisation's IS capabilities must be enhanced (Altameem, Aldrees & Alsaeed, 2014). Gourbesville (2016)

concurr, stating that IS are implemented within an organisation for the purpose of enhancing effectiveness and efficiency within that organisation.

Gourbesville (2016) further indicates that Enhanced IS capabilities, work systems, people and implementation methodologies determine whether the organisation will achieve effectiveness or not. Urbanczyk and Wojczyk (2013) argue that IS in local government should ensure an adequate flow of information to ensure the municipality's efficient management of water. Urbanczyk and Wojczyk (2013) further suggest that this objective (an adequate flow of information) can only be achieved through continuous assessment of the functioning of IS to identify actions for its enhancement so that the system can effectively support municipal goals. Therefore, the question is how municipalities can enhance and use their IS capabilities to enhance the management of water resources.

4.2.1 Innovative Solution for Municipalities

The national government reveals that municipalities experience shortcomings when it comes to providing accurate and up-to-date information when it comes to water billing process (Rivett, 2013; Brown, Marsden, & Rivett, 2012) and that enhancements are needed. The next section will present three innovations that are currently available to municipalities. These innovations include mobile phone-based information systems (MIS), water monitoring and assessment information systems (WMAIS) and smart water managements (SWM). These will be briefly discussed.

4.2.1.1 Mobile Phone-based Information Systems (MIS)

Enhancing IS capabilities in municipalities is concerned with enhancing the abilities of IS and technologies in municipalities by introducing technologies such as mobile phone-based IS. Pongnumkul, Chaovalit and Surasvadi (2015) point out that the mobile phone has gained a large market share because of its usefulness, ease-of-use and affordability. A mobile phone-based IS is responsible for data collection and can transfer real-time information regarding water billing to the relevant stakeholders (Jones & Rivett, 2011).

Rathnayaka et al. (2013) state that water billing is a critical function of any municipality and that the process involves meter reading. Rathnayaka et al. (2013) further reveal that meter reading looks straightforward but it is far from simple since it involves processes that can cause various problems. These problems include calculation errors, delays in system updating information and fault tracking issues. Municipalities and water utilities are taking advantage of the functionalities of mobile phone-information systems to enhance water billing processes.

Some of the capabilities of this system are that it collects, processes and notifies municipal customers about their water consumption.

In addition, MIS allows the involvement or the participation of individuals of the community in the management of water (Brown, Marsden, & Rivett 2012; Rathnayaka et al., 2013). The MIS-IS eliminates prone manual calculations and manual data entering as it increases the interaction between the municipality and its customers so that residents have access to water service information 24/7 (Brown, Marsden, & Rivett, 2012).

The MIS has gained much attention in African countries such as Senegal and Uganda (Ball, Rahman, Champanis, Rivett, & Khush, 2013). For example, municipalities in Senegal are utilizing mWater applications to maintain and manage water resources. On the other hand, the Ugandan government has collaborated with various mobile networks providers to implement ePayment, which is a tool that community residents use to pay water bills with their cell phones (Ball et al., 2013). Notwithstanding that MIS were implemented successfully in these countries, the implementation was not without challenges, which included technical and management challenges: *Technical challenges* – MIS requires extensive network coverage for it to work efficiently, therefore in places where a network is very weak it cannot function properly (Ball et al., 2013). *Management challenges* – the municipal management lack the necessary skills to integrate and adopt solutions without difficulties (Quin, 2012).

Many municipalities in South Africa face various challenges when it comes to water-related information management (Quin, 2012; Knappe, 2011). These challenges include difficulties in assessing and integrating information that is related to water resource management due to the shortage of skills required for information management (Quin, 2012). Furthermore, Harris, Howman, Grobler, Kuhn and Ntsaba (2011) indicate that recent changes in legislation have resulted in changes in water management and have led to new information requirements for water resource management decision making.

4.2.1.2 Water Monitoring and Assessment Information Systems (WMAIS)

In order to increase or enhance the information systems capabilities for water management processes, the Department of Water Affairs and Forestry (DWAF) introduced a tool called Water Monitoring and Assessment Information Systems (WMAIS). The main goal of this IS tool is to deliver water-related information that can be used effectively for decision-making by municipalities (Harris et al., 2011). The primary concerns that this IS tool is aiming to address include the:

- difficulty in accessing data and information available on IT platforms;
- shortage of skills required for adequate information management and the support for capacity building; and
- lack of an overall framework for information that is required from all water management institutions.

According to Rossouw, Botha and Dlamini (2012), this WMAIS is made up of three functional components, namely data acquisition, data storage and management, and information generation and dissemination. Based on the literature, it is evident that many municipalities enhance their IS to ensure that they provide quality, clean drinking water to its people (Quin, 2012; Harris et al., 2011). Furthermore, municipalities ensure that information related to water resource management is stored and distributed in an effective manner (Levidow et al., 2014). Enhancing water management processes facilitates the ease of transfer of information to various stakeholders as is vital in municipalities (Levidow et al., 2014). Moreover, the management of water resources in a smart fashion is also being employed as a tool to enhance municipal information systems associated with water management processes.

4.2.1.3 Smart Water Management (SWM)



Hamdy (2015) defines Smart Water Management as the future-orientated water management strategy that manages the entire water management processes from purification and distribution to the eventual recycling of the water resource. However, for this research study, the focus is on how SMW is used to enhance the information that is related to the distribution of the municipal water resource. SWM seeks to reduce the water information management challenges through the integration of IS and Information and Communication Technologies (ICTs) solutions (Shahanas & Sivakumar, 2016; Hope & Thomas, 2012). Hamdy (2015) asserts that SWM has become a key solution to the number of factors that affect the provision of water services to people by providing real-time data using various systems. The SWM systems and technologies are adapted to monitor and manage water-related issues more effectively and collect all the necessary data needed to enhance water management. Shahanas and Sivakumar (2016) describe the SWM system and technologies as systems with a high degree of automation, rapid response times and the ability to process and transmit data between locations. Figure 9 indicates the components of SWM.

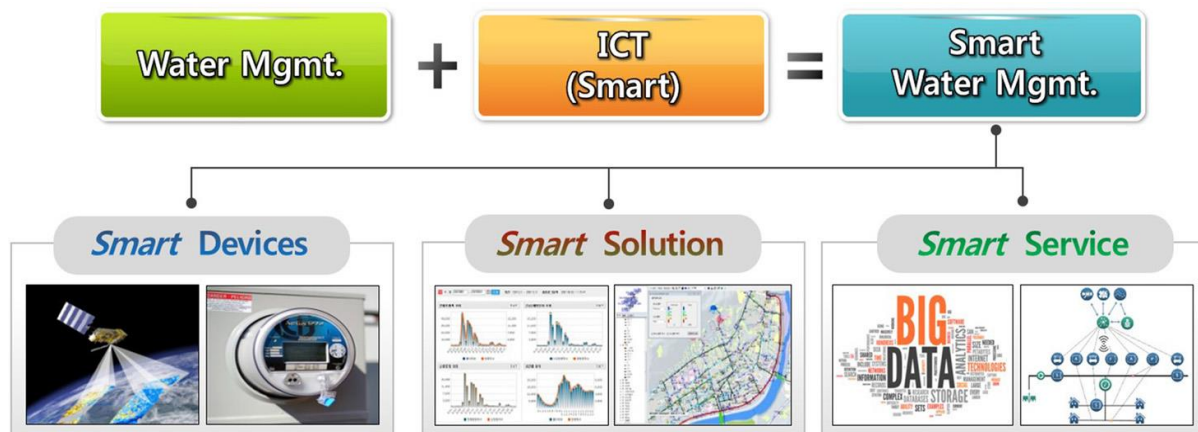


Figure 9: SWM Components (Gourbesville, 2016)

SWM integrates information technologies (i.e. sensors) to monitor water resources, diagnose problems and enhance efficiency in water management processes in order to provide citizens with a sustainable water supply. This IS makes use of smart devices (i.e. smart meters) that allows meter readers to be captured automatically. Hope et al. (2011) define smart metering as the system that measures water consumption and communicates the information in an automated fashion for monitoring and water billing purposes. Smart meters are different from standard meters as they measure water consumption in detail and deliver that information to the municipality without the need for manual readings. The smart meter reading offers various benefits, such as faster and more effective meter reading, theft and leak detection, water billing accuracy and increased reading frequency that leads to Enhanced debt collection (Hope, et al., 2011). It has been mentioned in the previous sections (*cf.* Chapter 2, Section 3.5.1) that ineffective water billing results in a decrease in municipal revenue. However, implementing these three components of SWM (smart devices, smart solutions and smart services) can play a pivotal role in ensuring that customers are billed correctly.

SWM in municipalities aims to achieve two goals, namely co-ordinated water resource management and distribution, and sustainable provision of public services (Gemma, Sang, Intosh, & Ospina, 2014). Mohamed et al. (2011) further indicate that a municipality can achieve the IS enhancement through the water billing/water management information systems integration.

4.3 Information Systems Integration

An organisation usually develops or purchases IS to replace or enhance manual ways of performing particular processes (Wallace, 2017). At times, it happens that an organisation

acquires multiple IS to be used in accomplishing these processes (Wallace, 2017). This leads to challenges, such as duplication of tasks, delays in processing, the inaccuracy of information and data redundancy. Therefore, in order to harmonise these multiple IS so that they communicate with each other, there must be integration (Sekgweleo, Billawer & Hamunyela, 2016). Mohamed et al. (2011) state that integration in the IS field has been viewed from two perspectives, namely a technological standpoint perspective as well as an organisational perspective. The former suggests that integration is the mechanism that represents the interconnection of the different systems within the organisation and are capable of communicating with each other. In contrast, the latter views the integration as a degree to which two or more independent organisations have standardised business processes. However, in this research study, the technological standpoint perspective will be adopted in defining IS integration.

Palmer (2012) describes IS integration as the process of melding existing and new technologies to form one capable system that is intended to take on additional tasks in order to enhance the performance of the existing system. Furthermore, Sekgweleo, Billawer and Hamunyela (2016) point out that the term system integration reflects the capability to combine a variety of IS. System integration implies that all relevant information or particular business processes are processed in the same software application (Gulledge, 2011). Guetat and Dakhli (2013) define IS integration as linking applications that were developed independently so that they function as a coordinated application. For this research investigation system integration is defined as the ability of the municipality to consolidate independent IS that are used to process information in water billing processes. IS integration in this research study context requires all system, data and communication to be integrated in order to provide real-time and consistent water billing-related information. Mohamed et al. (2011 p. 71) identify forms of information system integration that include Strategic, Horizontal, Vertical, Ergonomic and Data Integration. Table 7 explains these forms of integration within the context of municipality water billing processes.

Table 7: Information Systems Integration Form (adapted from Mohamed et al., 2011)

Information Systems Integration Form	Description	Municipality context
Strategic Integration	This type of system integration is about whether the different integrated IS supports the core objectives of the organisation.	Before this municipality can implement an integration approach for a water billing information system, they need to understand the goals and objectives of the municipality.
Horizontal Integration	This is concerned with how easy the decisions and data are processed by the integrated system.	The decision-making process is very important in the municipal water billing process. Horizontal integration will ensure that data in municipality is processed properly so that municipal managers can make informed decisions.
Vertical Integration	This form of information system integration enables access to information at various levels in the organisation.	Through the information system integration, all of the relevant stakeholders of the municipality must have an access to real-time water billing information. The vertical integration will allow water-related information to be shared by all department at a given municipality.
Ergonomic Integration	It is concerned with the users' comfort with using the graphical interface to access data from various systems on a single interface.	The integrated system should be user-friendly so that municipal system users are comfortable when using the system.
Data Integration	It focuses on the degree to which different departments within the organisation are coordinated through sharing of a number of common databases.	The municipal departments should use a database where they keep all customers water-related information, such as their meter numbers.

The system integration methods that are mentioned in Table 7 can play a huge role in harmonising the multiple water billing IS in municipalities. Municipalities need to choose and implement the system integration form/method that is appropriate for their systems carefully. Furthermore, the various system integration approaches can be used by government institutions to enhance the capabilities of their existing IS that support water billing. Enhancing IS capabilities can result in numerous benefits for a municipality, such as reduction in cost,

flexibility, effectiveness and efficiency in customers' information and timely responses to customers' queries. The next section will explore some of these benefits.

4.4 Benefits Associated with IS Capabilities Enhancement

Public organisations such as municipalities aim to enhance the quality and performance of public service delivery by finding effective and efficient ways of delivering services to people through Enhanced IS capabilities (Bertucci, 2012). Unlike businesses, municipalities are not profit-driven; therefore, Enhanced service delivery is their main objective (Bertucci, 2012). The enhancement of IS capabilities provides municipalities with enormous benefits (Chandiwana & Pather, 2016). The Enhanced IS capabilities result in Enhanced service delivery by ensuring better communication, availability of information, cost effectiveness and Enhanced decision making. Each of these benefits is discussed briefly.

4.4.1 Enhanced Communication

Zeb, Froese and Vanier (2012) argue that traditionally, information in municipalities was exchanged through human-to-human content, however, with the intervention of IS, it is currently exchanged electronically through computer-to-computer interaction. The IS capabilities enhancement allows more error-free information and data to be exchanged among relevant stakeholders (Zeb, Froese, & Vanier, 2012). As a practical example, Swellendam Municipality, located in the Western Cape, had communication problems such as ineffectiveness of internal communication mechanisms. They Enhanced their communication flow with the public and stakeholders by putting in place communication management systems that are updated regularly (Swellendam Municipality, 2013). With regards to water billing, when a municipality decides to enhance their IS capabilities through system integration, the water billing information will be shared among stakeholders easily.

4.4.2 Availability of Information

IS capabilities enhancement makes it possible for municipalities to have water-related information available 24/7 (Muhsinzoda, 2015). The availability of real-time information will allow municipal customers to obtain information regarding their accounts easily (Martinez, Escolar, Martinez, Pulido, & Lopez, 2014). For example, customers can view the information concerning their debts. This will assist customers to have water consumption plans. Furthermore, customer won't have to go to municipal offices to inquire about water billing because information will be available to them. Additionally, when IS capabilities are enhanced

the municipality is able to provide the necessary information virtually and without any delays while reducing mistakes that can occur in manually processed IS.

4.4.3 Cost-effectiveness

It has been noted that ineffective water billing results in a decline in municipal revenue. One of the triggers of ineffective billing is immature water billing IS capabilities. However, when the IS capabilities are enhanced, the effectiveness in collecting and processing water tariffs is increased. Since municipalities collect revenue from water service bills, Enhanced information systems can result in stable financial control within the municipality (Chandiwana and Pather, 2016). Furthermore, because of ineffective billing processes municipalities are experiencing non-payment of water consumption bills. Thus, municipalities increase water rates in order to generate more revenue, therefore, some customers cannot afford to pay for water services. However, enhanced IS capabilities would reduce irregularities in water billing and ensure that non-payment of services is mitigated so that the municipality could decrease water charges.

4.4.4 Enhanced Decision-making

IS play an important role in water management by ensuring that water managers can make informed decisions with the help of information technologies. Enhanced IS capabilities allow municipalities to have real-time water management information that assists stakeholders to make timely and effective decisions for planning and controlling activities (Nowduri, 2012). Furthermore, Nowduri (2012) points out that decisions are an integral part of management in any organisation. In order for decisions to be accurate they must be based on accurate information.

Apart from enhancing decision-making, Enhanced IS capabilities can assist municipalities in mitigating errors when billing their residents for water services (Chandiwana & Pather, 2016). Furthermore, enhancing IS capabilities in municipal water management would result in water billing processes that are fully integrated to allow for easier information sharing among relevant stakeholders (Martinez, Escolar, Martinez, Pulido, & Lopez, 2014).

In conclusion, Chandiwana and Pather (2016) state that municipalities can obtain indirect benefits from enhancing IS capabilities such as Enhanced internal water billing processes. Enhanced IS capabilities allow municipal billing business processes to be executed in a disciplined manner. If business processes are executed in a disciplined manner that means the processes of that particular municipality can be regarded as mature (Frost, Pike, Kenyo, & Pels,

2012). Simply put, enhancing information system capabilities has a positive impact on the maturity of the water management processes.

The enhanced IS capabilities play an important role in business process management as it converts the ‘*as in*’ processes of the water management into ‘*to be*’ business processes. ‘*As in*’ processes refer to the current state of a business process at a municipality before the intervention or redesign. In contrast, ‘*to be*’ processes refer to the way processes function after they have been redesigned. Basahel and Irani (2010) point out that for an organisation to enjoy the full benefits of enhanced IS capabilities, they need to have system integration. IS integration supports the coordination of work associated with different parts of the organisation (Basahel & Irani, 2010). Moreover, organisations need to have IS applications that fit the goals and objectives of the organisation. Sa Couto, Lopes and Sousa (2015) warn that public organisations must not just enhance their IS capabilities, they should also govern their IS to ensure that it creates value in the organisation.

4.5 Information System Governance (ISG)

Tounsi, Medromi, Faris and Sayouti (2013) state that the development of Information System Governance (ISG) has become a major requirement for both private and public sector organisations for the purpose of the smooth running of IS through prescribed standards and norms. Additionally, Rubino and Vitolla (2014) assert that in order for IS to provide a continuous flow of information, a set of rules, procedures and human resources must be defined. ISG can be thought of as a set of rules that allows executives and stakeholders to determine how they will manage IS to ensure that it adds value to the organisation (Abderrezak, Morley, & Soulier, 2015).

Additionally, Tounsi et al. (2013) define the ISG as the structure of relations and processes aimed at controlling the organisation in order to achieve its objectives by finding a good balance between the risks and advantages of ICT use. Furthermore, Ali and Green (2014) define ISG as the set of decisions, rights and the guiding frameworks that are designed to ensure that ICT resources are utilized appropriately in the organisation. Moreover, there is IT governance, which is a component of ISG. IT Governance in an organisation is concerned with two aspects, namely IT risk governance and IT value governance (Ali & Green, 2014). The former is concerned with decisions for minimizing threats, while the latter is concerned with value IT investment and the ability of the organisation to leverage its IS resources.

In case of the water sector at municipalities, ISG would be applied to the rules and regulations within the municipality to which management adheres when deciding on water management information systems. Leignel, Ungaro and Staar (2016) point out that if IS are properly controlled or their capabilities are being Enhanced, it can bring advantages such as Enhanced communication flow (*cf.* Section 4.4.1.). However, if it is not controlled properly then it can be seen as a burden or an obstacle to achieving an organisation's objectives (Leignel, Ungaro, & Staar, 2016). The GIS ensures that IS are controlled by enforcing regulations. According to Leignel et al. (2016) GIS assists the organisation in ensuring the following elements:

- efficiency and effectiveness of operations;
- reliability of information; and
- conformity with applicable laws and regulations.

Rubino and Vitolla (2014) give a systematic view of a ISG definition by stating that it is a system in which Information Technology in the organisation is managed and controlled. It specifies the distribution of rights and responsibilities among different participants and states the rules and procedures for making decisions. Based on the ISG definitions that are provided in literature, it is clear that ISG is about the management of IS and IT in the organisation through the enforcement of rules, procedures and regulations (Tounsi, Medromi, Faris, & Sayouti, 2013; Rubino & Vitolla, 2014).

Kaselowski, Von Solms and Von Solms, (2010) state that IS and IT use is increasing in municipalities for the management of their information resources. Furthermore, municipal service delivery depends on accurate information (*cf.* Section 4.4.2.) as well as the IT infrastructure that stores, captures and transmits information. Therefore, it is imperative to ensure that IS/IT are adequately governed. Kaselowski et al. (2010) indicate that this will ensure that the correct information is always available for decision-making which in turn will result in Enhanced service delivery (*cf.* Section 4.4.4.). Alternatively, a corporate governance ICT policy is used by organisations to govern and regulate the use of IS and IT resources.

4.5.1 Corporate Governance of ICT policy

The governance of ICT is defined as the effective and efficient management of ICT resources in order to achieve the goals and objectives of the municipality (Rubino & Vitolla, 2014). Furthermore, it is defined as the system by which the current and future use of IT/IS is directed, monitored and controlled (Swellendam Municipality, 2014). Corporate governance of ICT includes policies and strategies for using IT/IS within an organisation. There are standards and

practices that are implemented to ensure that ICT is governed at all levels within the organisation. These standards include King Code 4 of Good Governance, ISO 38500 Standard for the Corporate Governance of ICT and COBIT. However, within the operating municipal environment, there is corporate governance of ICT, which gives management within the specific municipality an opportunity to ensure that decision-making, ICT investment and the efficiency of the municipality remain transparent (Swellendam Municipality, 2014). With the assistance of the governance of ICT policy, management should be able to provide strategies, plans, policies, structures, procedures, processes, controls and culture, which comply with the best practices of ICT Governance Frameworks.

There are benefits that a municipality as a whole can obtain from adopting corporate governance of ICT policy (Odendaal, 2013). ICT, together with its sub-components in information systems and information technology, becomes an integral part of performing municipal day-to-day operations as it supports municipal sustainability and growth (Odendaal, 2013). Even though ICT is a great asset for municipalities, it also presents significant risks. Adopting the governance of ICT policy minimises the risks that are posed by ICT and IS resources. Other benefits that were mentioned in the report published on the Swellendam Municipality in 2014 focused on Municipal Corporate Governance of Information and Communication Technology and include:

- Enhanced stakeholder communication;
- Enhanced effective service delivery through ICT-enabled access to municipal information and services;
- Enhanced trust between the municipality and the community through the use of ICT;
- Enhanced return on ICT investment; and
- Enhanced management of information within the municipality.

The corporate governance of ICT policy will ensure that municipalities utilise IT resources and IS properly. Furthermore, it will ensure that municipalities realise benefits from using IS/IT resources, such as Enhanced communication and increase in revenues (cf. Sections 4.4.1. and 4.4.3.).

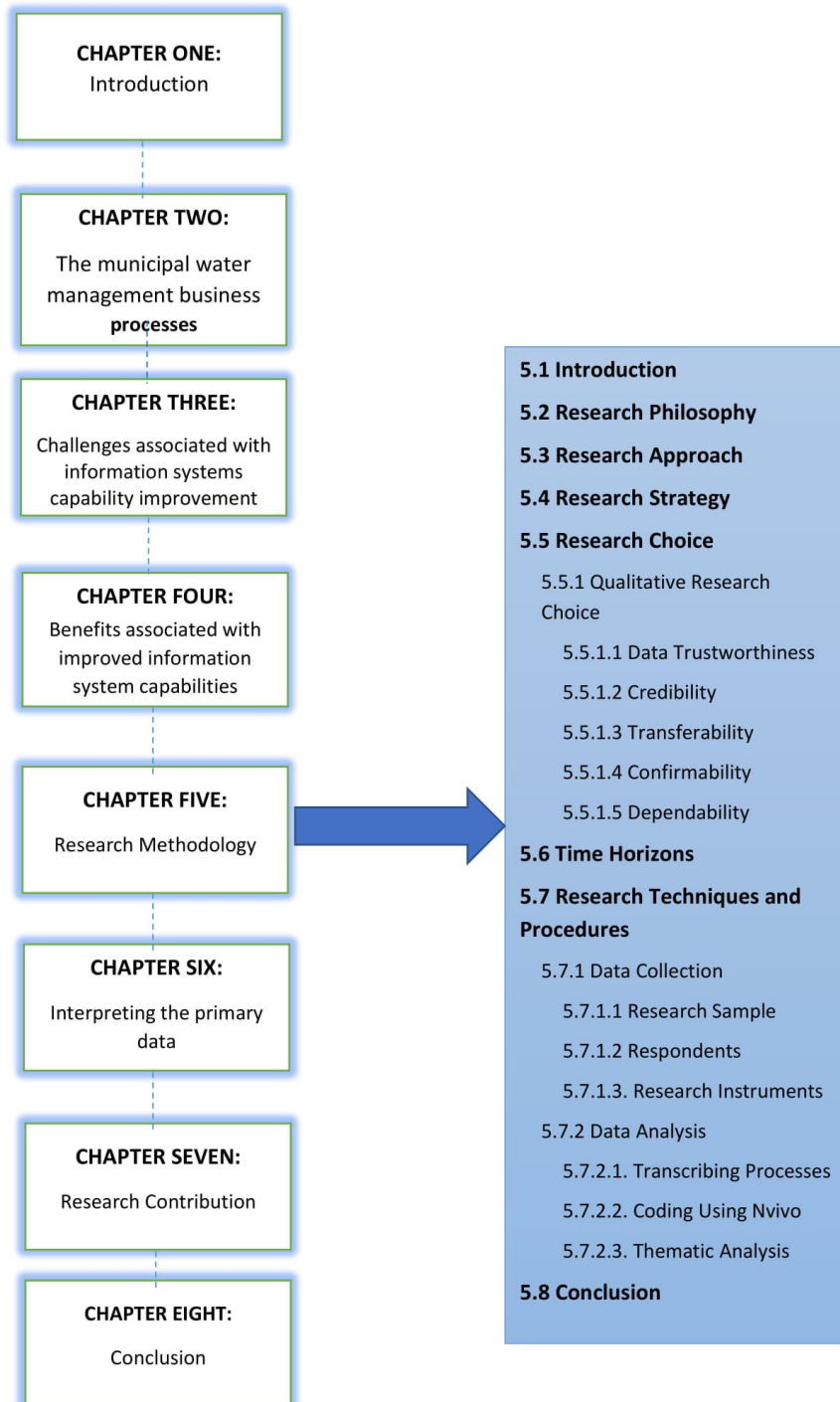
4.6 Conclusion

The objective of this chapter was to address the third and final sub-question which read as: *What are the benefits municipalities can realise from Enhanced information system*

capabilities? In addressing this sub-question, we started by discussing the IS enhancement and the importance of IS enhancement in municipalities. This chapter went on to discuss three innovative solutions that are currently used by municipalities to enhance their water billing processes. These innovative solutions include, mobile-phone-based information systems, water monitoring and assessment information systems and smart water management. Furthermore, IS integration was also defined in chapter four as a process of melding existing and new technologies to form one capable system that will enhance the performance of the existing system. This chapter viewed IS integration as an important process in water billing as it ensures that the systems that are used allow communication and the sharing of information.

The benefits of Enhanced IS capabilities were then identified and explained. These benefits include Enhanced communication, availability of information, cost-effectiveness and Enhanced decision-making. Enhanced IS capabilities allow the error-free water-related information to be shared among relevant stakeholders. Furthermore, IS capabilities enhancement affords senior management an opportunity to make informed decisions. Other benefits of Enhanced IS capabilities that were mentioned include the enhancement of water management business processes and the mitigation of errors in water billing. Lastly, this chapter pointed out that for municipalities to obtain these benefits, they should govern their IS to ensure that it creates value in the organisation. In pursuit of IS governance, organisations can use two methods, namely information system governance (ISG) and corporate governance of ICT policy. The ISG is concerned with controlling the organisation in order to achieve its objectives by finding a good balance between the risks and benefits of ICT use. On the other hand, the corporate governance of ICT policy was defined as the system that monitors and controls the current and future IT/IS of the organisation. The next section discusses the methodology and techniques that were used to elicit and analyse the primary data of the research study.

Chapter Five: Research Methodology



5.1 Introduction

Kathari (2014) defines research methodology as the way to solve a research problem systematically. It includes the steps that the researcher adopted in understanding the research problem. Kathari (2014) further explains research methodology as the study of methods by which knowledge is gained. Williams (2010) views research methodology as the general approach that a researcher takes in carrying out a research project. Cohen, Manion and Morrison (2013) argue that many people confuse research methodology with research methods; however, these are different from one another.

Research methods include the techniques, tools and processes that the researcher uses in conducting a research study. These include structured/semi-structured interviews, questionnaires, focus groups and surveys (Cohen et al., 2013). In contrast, research methodology is about how the research is being done by explaining why the researcher is using a certain method. Research methodology is concerned with answering questions such as why a research study has been undertaken, what data has been collected and what particular method is adopted (Kathari, 2014; Cohen et al., 2013).

The objective of this chapter is to explain how this research study was undertaken. The layers of the research onion (cf. Figure 10) are utilised to provide a logical order to the discussion in the chapter. The research onion is read from the outer layer to the core, where researchers will typically reach the point of presenting their findings. Subsequently, the chapter begins by examining and explaining the research paradigm of this research study. This will be followed by presenting the research design and the research strategy that was used which is a case study. Then the second last section of this chapter presents research sample and data collection and analysis techniques. Lastly, a summary of this chapter is provided in the final section of the chapter.

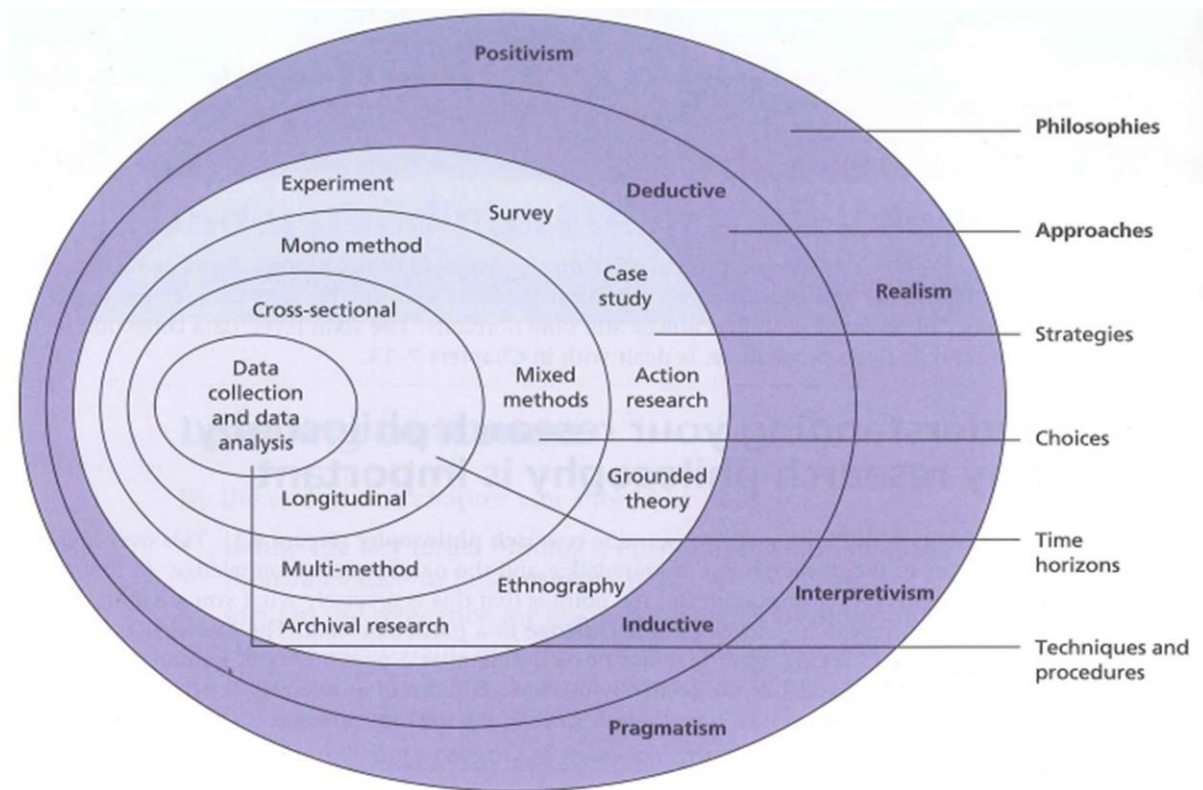


Figure 10: Research Onion (Saunders, Lewis, & Thornhill, 2009)



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The outer layer of the research onion, which is the research philosophy, is critical, as it will influence the way in which a research study is undertaken. The research paradigm needs to be clearly stated as it helps the researcher to present their perception of the world, that is, what the researcher believes constitutes reality and how that reality is understood (Saunders, Lewis & Thornhill, 2009). Furthermore, the research paradigm can be described as the development of knowledge and the nature of knowledge and how it is being obtained (Saunders, Lewis, & Thornhill, 2009).

A research paradigm can also be thought of as a research culture with a set of beliefs, values and assumptions that a community of researchers has in common regarding the nature and conduct of research (Antwi & Hamza, 2015; Williams, 2010). Thanh and Thanh (2015) argue that the term ‘research paradigm’ has been understood differently by various researchers with some stating that it comprises three elements which are a belief about the nature of knowledge, a methodology and criteria for validity. While other researchers such as Creswell (2014) refer to research paradigm in terms of epistemology (a relationship between the researcher and the

reality or the nature of knowledge) or ontology (the nature of reality) and research methodology (Thanh & Thanh, 2015; Edirisingha, 2012; Scotland, 2012).

The four research paradigms that exist, namely positivism, realism, interpretive and pragmatic, are shown in the outer layer of research onion (*cf.* Figure 10) and each of these views ontology and epistemology differently. Table 8 shows three different research paradigms that exist in social research: interpretive, positivism, pragmatic and realism, each with their ontology epistemology assumptions. This table also includes the methodology and methods associated with each of these research paradigms.

Table 8: Research Paradigms in Social Research (adapted from Antwi & Hamza, 2015)

Paradigm	Ontology (What is reality?)	Epistemology (Nature of Knowledge)	Methodology (How do you go about finding out)	Method (What techniques do you use to find out)
Interpretive	Reality is created by individuals in group	Discover the underlying meaning of events and activities	Case study Grounded theory Action research Ethnography	Qualitative: Include: Observations Focus groups Participant interviews
Positivism	Hidden rules govern teaching and learning process	Focus on reliable and valid tools to uncover rules	Experimental research Survey research	Quantitative: Include: Questionnaire Statistical analysis
Pragmatic	Truth is what is useful	The best method is one that solves problems	Action research Design-based research	Mixed-methods: Combination of the above-mentioned techniques
Realism	Reality is created from the empirical observations	Models of such mechanism which constitutes hypothetical description	Case studies	Mainly qualitative methods such as convergent interviews

However, we will only focus on the interpretive research paradigm as it was the underlying paradigm used in this research study. Thanh and Thanh (2015) reveal that the interpretivism paradigm allows the researcher to view the world through the perceptions and experiences of participants. Interpretivists believe that an understanding of the research context in which a particular research is conducted is critical to the interpretation of data gathered (Thanh & Thanh, 2015).

Edirisingha (2012) states that the position of interpretivism in relation to ontology and epistemology is that interpretivist researchers believe that reality is multiple and relative. Moreover, the knowledge acquired in the interpretivism paradigm is socially constructed rather than objectively determined (Edirisingha, 2012). Scotland (2012) views the ontological assumption of the interpretive research paradigm as relativism. This means that reality in interpretive research design is subjective and differs from person to person (Scotland, 2012).

Edirisingha (2012) states that in the interpretivism paradigm access to knowledge is through social constructs such as culture, language, consciousness and shared meaning. Goldkuhl (2012) further states that the research that is conducted within this philosophical assumption usually takes a qualitative approach and applies inductive reasoning.

This study used open-ended questions to study and understand the behaviour of BCMM employees (study participants) when it comes to water management (specifically water billing information systems). The open-ended questions were administered in focus group interviews to acquire different perspectives of reality and knowledge from the respondents. Antwi and Hamza (2015) state that research studies that adopt the interpretive research design usually follow or employ the inductive research approach.



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5.3 Research Approach

Soiferman (2010) states that a research approach allows the researcher to define and utilize research methodology in an effective manner. Moreover, Creswell (2014) states that a research investigation should follow a systematic and orderly data collection method and analysis to ensure that valuable information is obtained from the data. There are two research approaches in social research, namely deductive and inductive research approaches (*cf.* Figure 10). Furthermore, Figure 11 indicates the steps involved in these research approaches.

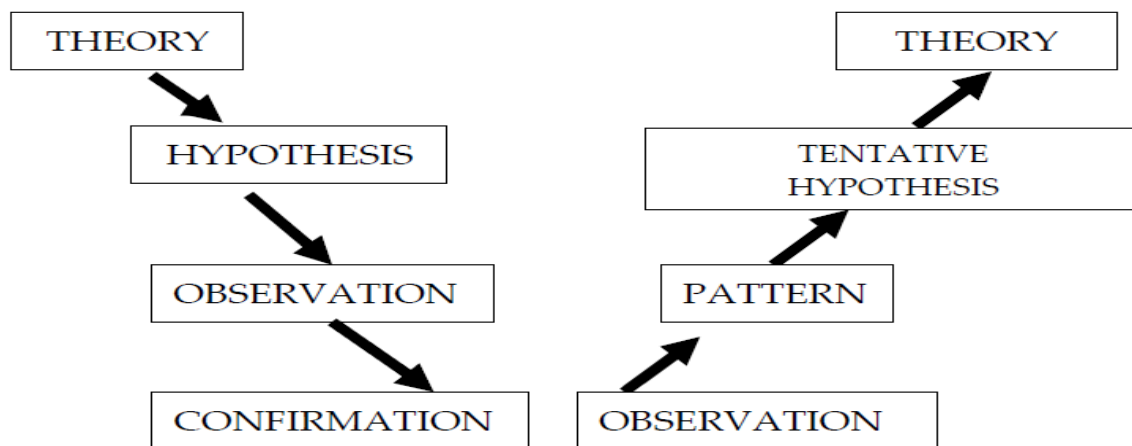


Figure 11: Research Approaches

The inductive and deductive approach are different. The reasoning in an inductive research approach is moving from specific to general, while a deductive research approach begins with general reasoning and ends with the specific (Soiferman 2010). Zalaghi and Khazaei (2016) mention that the deductive researcher works from the “top-down”, from the theory to hypothesis to data to add to or contradict the theory (*cf.* Figure 11). In a deductive approach various arguments are used to provide adequate reasoning for a particular fact and these arguments are based on definitive laws, rules and regulations. The inductive research approach is used to overcome the limitations of deductive approach. In the inductive research approach researchers work from the “bottom-up” using participants’ views to build broader themes and to generate a theory interconnecting the themes. Furthermore, Zalaghi and Khazaei (2016) reveal that the deductive approach is related to the positivism paradigm, while inductive approach is associated with the interpretivism paradigm.

In the case of this research study, the inductive research approach has been adopted. An inductive reasoning is the appropriate approach because this study sought to understand the challenges that BCMM experiences concerning water management. In this study primary data about water billing and associated IS was collected and analysed with regards to the water billing processes at BCMM. Furthermore, the inductive approach was employed because it allowed the researcher to obtain new ideas, understand the concept of water billing and link the themes which resulted in the development of Critical Success Factors. Once the research approach is chosen, the next step is to select the research strategy that will be suitable for that research approach.

5.4 Research Strategy

The research strategy that is used in this research study is a case study. In order to fully understand a case study, as case must be defined. It is difficult to give a clear explanation of a case since almost everything can serve as a case (Punch, 2014; Gustafsson, 2017). However, Miles, Huberman and Saldana (2013) describe a case as a phenomenon of some sort occurring in a particular context. Therefore, a case study strategy is the method of understanding and studying a case in depth in its natural setting by recognising its complexity and its context (Punch, 2014; Yin, 2014). Miles, Huberman and Saldana (2013) reveal that a case may be individual, or a role, a small group, an organisation or a community or nation. Furthermore, it could be an event, a decision, policy, programs and incident. For the purposes of this research study, the case is identified as the public organisation called Buffalo City Metropolitan Municipality (BCMM), where the focus is on investigating the information systems capabilities associated with water management.

Yin (2014 p.16) provides a twofold definition of a case study strategy, stating that it is an “empirical inquiry that investigates a contemporary phenomenon (the case) in depth and within its real world and especially when the boundaries between the case and context may not be clearly evident”. Gustafsson (2017) states that a case study strategy can be defined as an intensive study about a person, a group of people or a unit which is aimed to generalise over various units. Yin (2014) states that a case study strategy is an interactive process that is made up of elements such as plan, design, prepare, collect, analyse and share (*cf.* Figure 12).

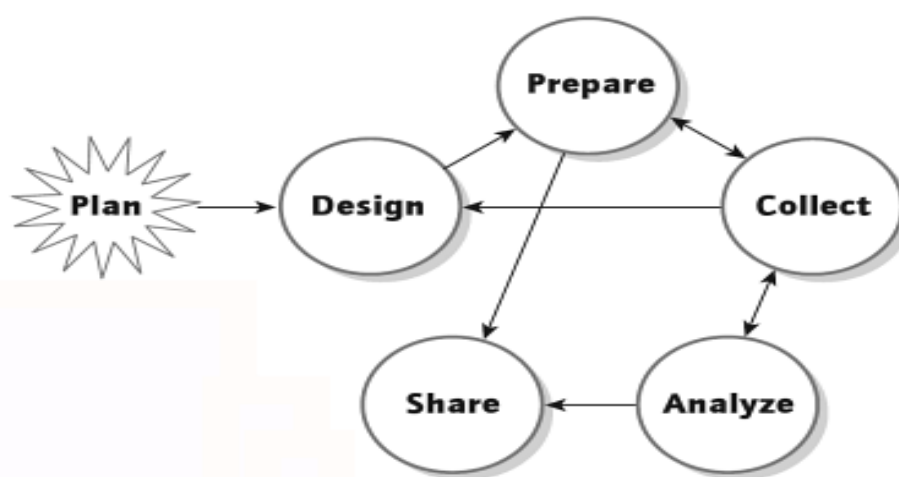


Figure 12: Interactive Process of the Case Study Strategy (Yin, 2014)

Plan – When planning a case study, a researcher needs to identify a relevant situation for conducting a case study. An example that is proposed by Yin (2014 p. 2) is that a case study can be used when the main research question is a "how" and/or "why" question. The main research question for this study is *"How can the information systems capabilities of the business processes associated with water management be Enhanced at Buffalo City Metropolitan Municipality?"*. Therefore, this research study met the criterion for using case study strategy, because the main research question starts with keyword *"How"*.

Design – In designing a case study, the researcher needs to select a type of case study. According to Yin (2014) case studies can be either exploratory (using open-ended questions and the study explores the case), descriptive (describes the natural phenomena which occur within the data in question) or explanatory (examine the data to explain the phenomena). *This research study employed exploratory case study, simply to explore and understand how BCMM is affected by incorrect billing due to the immaturity of the information systems capabilities.*

Prepare – Yin (2014) states that preparing to do a case study begins with researcher's skills, values and training for conducting a case study. The skills that a researcher must have include the ability to ask good questions and listen and they must know how to avoid biases and bring high ethical standards to research. *The interview questions for this study have been selected to address the context of the water management activities at BCMM. Furthermore, the participants were provided with a consent form and the option to opt out of the study, if they so desired.*

Collect – Collecting case study evidence may come from six sources, namely documents, archival records, interviews, direct observations, participant-observation and physical artefacts (Yin 2014). *In this research study, we collected case study evidence using focus group interviews and semi-structured interviews; however, these will be discussed later in this chapter (cf. Section 5.6.).*

Analyse – Analysing case study evidence consists of examining, categorising, tabulating and testing to produce empirically based findings (Yin, 2014). Yin (2014) further warns researchers that analysing a case study is difficult because there are not well-defined techniques. However, computer-assisted tools such as Atlas.ti, HyperResearch and NVivo can be used. *This research investigation used software called NVivo to sort, organise and code the data that the researcher received through interviews. This software was used to minimise the manual tasks in the analysis process because manual tasks can result in incorrect findings. This aided in speeding*

up the whole analysis processes. Furthermore, we employed the processes of thematic analysis to analyse the data output from NVivo software.

Share – The last task in conducting case study research is to share the findings and conclusions, either in writing or orally. *In sharing the findings, we gave the interviewees the feedback in form of a report. Moreover, we provided participants with the summary of the interview session and asked for clarity on issues that were unclear.*

This interactive process is very important when conducting case study research to ensure that case study findings are correct (Yin, 2014). Another important element that is mentioned by Punch (2014) is to decide on the type of case study that one is going to employ. Punch (2014) states that there are three categories within case study approach, namely intrinsic, instrumental and collective case study.

- Intrinsic case study – It is where the study is undertaken because the researcher wants a better understanding of the particular case.
- Instrumental case study – This is when a particular case is examined to give insight into an issue, or to refine a theory.
- Collective case study – A study in which the instrumental case study is extended to cover several cases and learn more about the phenomenon.

The intrinsic and instrumental case studies are single case studies, where the focus is on a single case. Gustafsson (2017) points out that a single case study can be used when the investigator wants to study a single thing (i.e. a person from a specific group) or a single group (a group of people). The benefit of this method is that it is inexpensive and it is not time-consuming. Furthermore, the single case study method allows the researcher to have a deeper understanding when exploring a subject (Gustafsson, 2017).

However, Willis (2014) argues that the single case study strategy has been subject to criticism which includes issues of methodological rigour, researcher subjectivity and generalisability. Willis (2014 p.4) further states that the use of a single case study does not "absolve" the researcher from any kind of methodological consideration. The second critique, which is concerned with researcher's subjectivity, means that the use of a single case study can result in biases in research findings. Reis (2009) reveals that since a single case study focuses on a single unit many researchers are concerned with the issue of generalisability of findings. Reis (2009) clearly states that a single case study is generalisable because what is being learned in

the single case study can be transferred to other situations. In contrast, a collective case study is also known as a multiple case study as its focus is both within and across cases. Since the case in this study was only BCMM, the researcher employed a single case study. Additionally, during this research investigation, the researcher ensured that there were no biases in findings by using trustworthy qualitative data strategies. The findings of this research study will not only be applied to the other metropolitan municipalities in South Africa, but also to smaller municipalities and maybe even to municipalities that face similar situations in the developing and developed world.

Case Study: Buffalo City Metropolitan Municipality (BCMM)

The BCMM is a category A (Metropolitan) municipality and is located in the Eastern Cape Province with its administrative offices in East London (Buffalo City Metropolitan Municipality, 2011). There are eight metropolitan municipalities in total in South Africa. BCMM comprises nine directorates (*cf.* Table 9), which manage towns such East London, Bhisho and King William's Town as well as the two largest townships in the Eastern Cape namely, Mdantsane and Zwelitsha.

Table 9: Buffalo City Metropolitan Municipality (BCMM) Directorate and Departments

Municipality Directorate	Departments
Executive Support Services	▪ International Relations and Development Cooperation ▪ Public Participation and Special Programmes ▪ Integrated Development Planning ▪ Performance Management ▪ Geographical Information System ▪ Communications
Chief Operating Officer	▪ Human Settlement ▪ Mdantsane Urban Renewal Programme (MURP) ▪ Duncan Village Redevelopment Initiative (DVRI)
Corporate Services	▪ Human Resources ▪ Organisational Support
Community Services	▪ Environmental Services ▪ Art and Culture ▪ Amenities ▪ Solid Waste Management ▪ Integrated Environmental Management Unit
Financial Services	▪ Asset and Risk Management

	▪ Budget and Treasury ▪ Revenue Management ▪ Supply Chain Management
Engineering Services	▪ Water and Scientific Services ▪ Road and Design ▪ Electricity ▪ Fleet
Health and Public Services	▪ Health Services ▪ Fire ▪ Disaster Management ▪ Law Enforcement ▪ Traffic Service
Development Planning and Local Economic Development	▪ Development Planning ▪ Transport Planning and Operations ▪ Local Economic Development ▪ Tourism ▪ Investment

The collection of the primary data in this study focused on the Department of Revenue Management in the Directorate of Financial Services. Revenue Management is responsible for the collection of debts and the billing of the customer for water resource use. For the study, the employees in the Revenue Management Department participated in focus group interviews and semi-structured interviews.



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A historical problem that was identified by the Auditor General Report (2013) is that BCMM does not have adequate processing and reconciling practices for information, due to the poor documentation and operationalizing of policies and processes concerning delivery of services, such as water resources. This proved that even though BCMM has information systems in place for effective service delivery of water resources the capabilities of its information systems are immature. The researcher developed interview questions to get an understanding of how information systems are being used for the effective billing of customers and, furthermore, to test whether or not the information system capabilities associated with billing processes are mature or immature. The empirical evidence was obtained using these interview questions. The research choice that was used in this research study will be discussed next.

5.5 Research Choice

Sidani (2014) states that research choice can be viewed as a functional plan in which certain methods and procedures are linked together to acquire reliable data for empirical grounded analyses, conclusion and theory formulation. It gives the researcher a clear research framework

(Sidani, 2014). A research choice provides the overall roadmap or blueprint of how the study is going to be carried out (Thomas & Magilvy, 2011; Sidani, 2014). Punch (2014) reveals that research choice is concerned with four main ideas, namely strategy, conceptual framework (Sidani, 2014), the question of who and what will be studied and the tools to be used for the collection and analysis of data. Creswell (2014) further states that there are three research choices that can be used to carry out a research study and these include quantitative, qualitative, and mixed methods (*cf.* Figure 10). These choices are found in the fourth layer of the research onion diagram (*cf.* Figure 10) (Saunders, Lewis, & Thornhill, 2009). The research will only focus on the qualitative research choice as it was used in this research study.

5.5.1 Qualitative Research Choice

Hancock, Ockleford and Windridge (2009) state that the qualitative research choice is concerned with developing an explanation of the phenomena. It seeks to help people to understand the social world in which they live and why things are the way they are (Hancock, Ockleford, & Windridge, 2009). “Qualitative research choice seeks to answer four questions” (Hancock, Ockleford, & Windridge, 2009 p. 6):

- Why do people behave the way they do?
- How are opinions formed?
- How are people affected by the events that they encounter?
- How and why have cultures and practices developed in the way they have?

Moreover, Williams (2010) describes qualitative research choice as an effective model that occurs in a natural setting that enables a researcher to develop a level of detail from an involvement in the actual experiences. Creswell (2014) states that qualitative research refers to the meanings, concepts, description, metaphors and the symbols of things. Unlike quantitative research, a qualitative approach focuses on the qualities of meanings that are not experimentally measured in terms of quantity. "These are characteristics of qualitative research" (Creswell, 2014 p.176):

- Research is conducted in the field, allowing direct interaction with people which are being studied in their own context;
- Researchers collect data themselves by examining documents, observing behaviour and interviewing participants;
- Multiple sources of data are preferred over a single source; and
- Researchers build their patterns and themes from the bottom up.

For the purposes of this research study, the researcher has adopted a qualitative approach, as it was a relevant and appropriate choice. It has been mentioned before that the qualitative approach explores the natural setting to find meaningful answers. This study explored the water billing workings at Buffalo City Metropolitan Municipality to find out how information systems capabilities for water management processes can be Enhanced. This approach was relevant to this study as the researcher wanted to find out how BCMM customers are being affected by inaccurate water bills due to immature information systems that are being used. Furthermore, this study was conducted in the field and that allowed the researcher to have direct interaction with the research participants (BCMM employees).

When conducting a qualitative research study is critical to evaluate the reliability of the findings to check whether the findings are accurate and that there were no biases. This research study employed various methods to ensure the trustworthiness of the findings of this investigation. The section below discusses the data trustworthy methods in a qualitative research study.

5.5.1.1 Data Trustworthiness

Anney (2014) makes the following comparison; in quantitative studies data trustworthiness is referred to as validity and reliability, however, in qualitative studies, this concept is more unclear. Anney (2014) states that because of this lack of clarity many qualitative researchers are evaluating the trustworthiness of research findings using quantitative trustworthiness criteria. Elo, Kääriäinen, Kanste, Pölkki, Utriainen and Kyngäs (2014) point out that a level of data trustworthiness in a qualitative research study can be measured or established using four components, namely credibility, transferability, confirmability and dependability. These will be discussed in greater detail below.

5.5.1.2 Credibility

The credibility of research findings refers to how the qualitative researcher is confident about the research study findings (Elo et al., 2014). The credibility of this research study was established by using triangulation (a process of collecting evidence using different methods from different sources). Methods that were used include focus groups as well individual interviews with BCMM water billing managers. Furthermore, the researcher provided participants (BCMM employees) with feedback to ensure that the interpretations were accurate.

5.5.1.3 Transferability

Thomas and Magilvy (2011) state that transferability refers to the generalisation of the research findings to other situations. Furthermore, Anney (2014) defines transferability as the degree to which the results of the qualitative research can be transferred to another context with other participants. The transferability in this study was maintained by ensuring that proposed critical success factors for enhancing information systems capabilities can be used by and applied to other metropolitan municipalities.

5.5.1.4 Confirmability

Confirmability refers to the degree of neutrality of the research findings (Anney, 2014). This means that findings of the research study are based on the participants' responses and not on potential biases or motivations of the researcher (Anney, 2014). In order to maintain the confirmability of the research findings, we performed a follow-up analysis on each individual and focus group interview and documented any instances of biases, personal feelings and novel insights. We asked the participants for clarification of definitions, acronyms and municipality specific terms during interviews.

5.5.1.5 Dependability

Dependability refers to the stability of research findings over time (Anney, 2014). It involves participants evaluating the research study findings together with the interpretation and recommendation of the study to ensure that they are all supported by the data received from informants of the study (Anney, 2014). In this research study, dependability was achieved by including peers who assisted the researcher in the analysis process. The peers were my class mates, who assisted the researcher in note taking during focus group interview and transcribing voice records. Additionally, dependability was attained by providing a detailed description of the research methods.

5.6 Time Horizons

According to Saunders, Lewis and Thornhill (2009), time horizons refer to the time framework regarding when the research study will be completed. Saunders, Lewis and Thornhill (2009) state that time horizons are needed for the design, independent of the research used. There are two types of time horizons, namely longitudinal and cross-sectional. The longitudinal time horizon research studies are repeated over an extended period. In contrast, cross sectional studies are limited to a specific time (Chidi, 2016). This research investigation was also limited to a specific time of two years; therefore, a cross-sectional time horizon was employed.

5.7 Research Techniques and Procedures

This section seeks to explore and discuss the research techniques that were used in this research investigation, firstly, to collect and analyse primary data. Secondly, this section explores the procedures used to choose the appropriate participants of this research study. The next section will discuss these techniques and procedures in detail.

5.7.1 Data Collection

In this research investigation, we focus on primary and secondary data. Primary data is the data that is unpublished and that which the researcher collects from the research participants (Surbhi, 2016). In contrast, secondary data refers to the data that has been collected already, recorded by someone else and is readily available from other sources (Surbhi, 2016). Additionally, secondary data is any previously published material such as books and journals. The secondary data of this investigation was collected through utilising readily available sources such as books and journal articles focusing on the work that has been previously done in the water management domain, as discussed in Chapters 2-4. Prior to the collection of primary data, we established a research sample.

5.7.1.1 Research Sample

It is very important to know and understand the research sample before one can understand the process of research sampling. The research sample is defined by Alvi (2016) as the finite part of the population (individuals who met the criterion specified for a research study) whose properties are studied to acquire information about the whole population. When a research study deals with human beings, the sample would be defined as the set of participants selected from the larger population (Alvi, 2016). Research sampling can be thought of as the act, process or techniques that are used to select an appropriate and suitable sample for a research study (Gentles, Charles, Nicholas, Ploeg, & McKibbon, 2016). In a case study research a sampling can be thought of as part of the process of selecting cases and data sources that assists in better understanding the case (Yin, 2014; Gentles, Charles, Ploeg, & McKibbon, 2015). Alvi (2016) states that research sampling techniques can be broadly categorised into two major types: non-probability and probability (*cf.* Figure 13).



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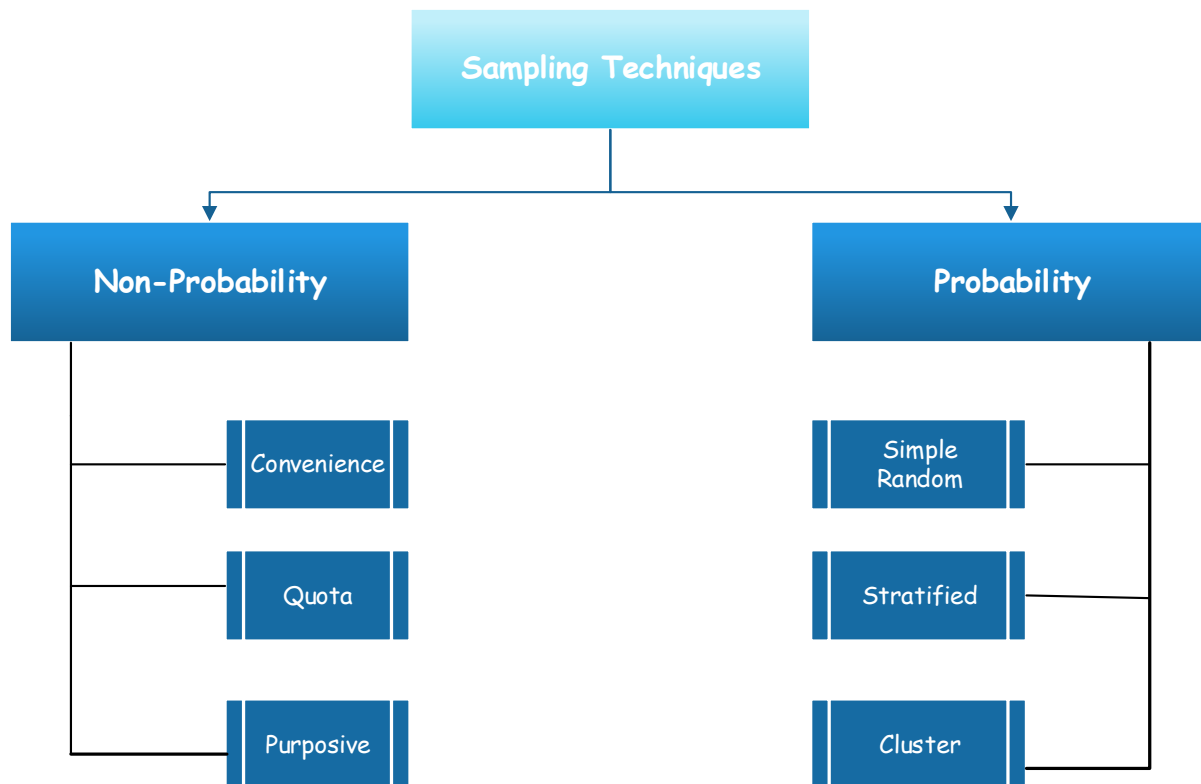


Figure 13: Sampling Techniques (Alvi, 2016)

The non-probability sampling is a sampling technique whereby samples are gathered in a process that does not give participants equal chance to be selected (Ritchie, Lewis, Nicholls, & Ormston, 2013; Etikan, Musa, & Alkassim, 2015). On the other hand, in probability sampling, each person in the universe has the equal opportunity of being chosen for the sample (Ritchie, Lewis, Nicholls, & Ormston, 2013). Furthermore, the methods that are used when adopting each type of sampling techniques are also shown in the diagram. However, this research investigation focused only on the non-probability sampling which was used to select a sample.

Tongco (2007) reveals that non-probability sampling does not attempt to select a random sample from the population. However, it uses subjective methods to decide which elements are included in the sample. Tongco (2007) and Ritchie et al. (2013) further state that this type of technique is also known as the judgment or non-random sampling, which means every unit in the population does not get an equal chance to participate in the research study. Researchers often use this method because the procedures for selecting a sample are much quicker, easier and cheaper compared to probability sampling. However, Etikan, Musa and Alkassim (2015) state the generalizability is questionable in non-probability sampling. Etikan et al. (2015) state that it is imperative for a researcher to determine which non-probability sampling is applicable to the study. The technique to be used heavily depends on the type, nature and purpose of the

study (Etikan, Musa, & Alkassim, 2015). There are three methods that can be used in non-probability sampling techniques (*cf.* Figure 13) these include: convenience, quota and purposive (Alvi, 2016; Gentles, Charles, Ploeg, & McKibbin, 2015).

- Convenience – The researcher uses those participants who are easy and/or convenient to approach (Alvi, 2016). Battaglia et al. (2013) further indicate that in this method the primary selection criterion relates to the ease of obtaining participants. Ease of obtaining participants includes the cost associated with locating elements of the population, the geographic distribution of the sample and obtaining the interview data from the selected participants (Battaglia et al., 2013).
- Quota – This type of method is used when the population is heterogeneous (when the population does not match all the specified characteristics).
- Purposive – Ritchie et al. (2013) state that purposive sampling is precisely what the name suggests: participants or units of a sample are chosen with a ‘purpose’. Additionally, Horwitz, Green, Wisdom, Duan and Hoagwood (2013) reveal that this method involves identifying and selecting participants that are knowledgeable about the investigated case. Ritchie et al. (2013) further elaborate that in this approach the sample units are chosen because they possess particular features or characteristics which enable a detailed understanding of the areas which are being investigated.

The researcher needs to select a method that will be appropriate and relevant to their respective research studies. For the purposes of this research study, we adopted the non-probability purposive sampling method. This method was appropriate for this research investigation as the research is studying a particular group of a population with the intention of finding certain information. Furthermore, this research study used participants (BCMM employees) who have knowledge about the area that was going to be investigated, which is water management (focusing on billing) in this case. Moreover, since this research investigation adopted a case study strategy, the use of non-probability purposive sampling played a vital role in helping the researcher to understand the case that was being investigated. The sample for this study was BCMM employees who deal with water billing and associated information systems. After the sample and sampling techniques are chosen for a study the next step is to choose appropriate data collection and analysis methods. The data collection and analysis techniques are explored in the next section.

5.7.1.2 Respondents

This section discusses the data collection techniques that were used in this research study. These techniques include focus group and semi-structured interviews. The two techniques are discussed in detail in this section. The research study used seven respondents for the focus group and two respondents for semi-structured interviews (*cf.* Table 10)

Table 10: Summary of Respondents Used for Focus Group and Semi-Structured Interviews

Respondents	Job Role	Work Experience	IS Experience
Employee 1 (Resp 1)	Water Billing Officer	15 years	8 years
Employee 2 (Resp 2)	Water Billing Officer	10 Years	4 years
Employee 3 (Resp 3)	Water Billing Officer	4 Years	2 years, 3 months
Employee 4 (Resp 4)	Water Billing Officer	n.d	n.d
Employee 5 (Resp 5)	Water Billing Officer	n.d	n.d
Employee 6 (Resp 6)	Water Billing Officer	n.d	n.d
Employee 7 (Resp 7)	Water Billing Officer	n.d	n.d
Manger 1 (Mgr 1)	Water Accounts Manager	8 Years, 6 months	6 years
Manager 2 (Mgr 2)	Water Accounts Manager	2 Years, 1 month	2 years, 1 month

*N.D – Not disclosed

Table 10 further indicate two keys that will be used to refer to the respondents when discussing themes in this research investigation. Key Resp will be used to refer to the respondents who participated in focus group interviews, while key Mgr will be used to refer to the respondents who participated in the semi-structured interviews.

5.7.1.3. Research Instruments

The researcher conducted focus group interviews as this method of data collection proved inexpensive and allowed the investigator to collect a large volume of data in a short period of time. The researcher organised seven participants with the help of BCMM senior managers and conducted focus group interviews. The group of seven participants was made up of BCMM employees who work as water billing officers. After the focus group interviews, the

researcher conducted semi-structured interviews with water resource billing managers. The individual semi-structured interviews were conducted to obtain an understanding of the important aspects that were overlooked during the focus group interview section. The last step in the data collection process was to propose CSFs for review with managers (experts) at BCMM, for them to validate the proposed CSFs and to provide their comments and feedback. The questions that were asked during the focus group and semi-structured interviews were formulated using the themes from Work System Theory to structure the research.

Focus Group

Abumere (2015) states that the focus group interview has been used in social research for some time as the method to collect qualitative data. Additionally, Abumere (2015) defines a focus group interview as a smooth interview happening in a natural way with a small group of participants, typically between six to ten individuals, led by a moderator. In this research study, the moderator was the researcher and the group was made up of seven BCMM employees who work in Water Billing and Revenue Management Departments.

This data collection method assisted the researcher in getting insights into the problem based on the beliefs, experience, and knowledge that BCMM employees have with regards to water billing and water management. Then, we employed semi-structured interviews to cover the important issues that were omitted during the focus group interview.

Semi-Structured Interview

Yin (2014) point out that an interview is one of the most important sources for case study information. An interview is defined by Yin (2014) as the form of interrogation that involves verbal communication between the investigator and the research participants. Adding to the definition of Yin (2014), Alshenqeeti (2014 p.40) describes an interview as the conversation whose purpose is to gather a description of the interviewee. There are three types of interview data collection methods, namely structured, semi-structured and unstructured interviews (Alshenqeeti, 2014):

- **Structured Interview** – This type of interview is organised around a set of predetermined direct questions that mostly require ‘yes ‘or ‘no’ type of answers (Alshenqeeti, 2014).

- Unstructured (open-ended) Interview – Unlike a structured interview, this type of interview is more flexible and freedom is offered on both sides (i.e. interviewers and interviewees) in terms of planning and organising questions.
- Semi-structured Interview – This type of interview allows depth to be achieved by giving an interviewer an opportunity to probe and expand the interviewee's responses.

This brief description of the types of interviews that exist in social research guided the selection of the most appropriate interview type for this research. This research study collected primary data using the semi-structured interview. Due to the flexibility of this interview type, the researcher was able to engage the participants (i.e. water billing managers) actively on the questions being covered. After the data was collected using these various data collection methods, the researcher proposed Critical Success Factors (CSFs) based on the collected data and literature. The qualitative data analysis techniques that were used in this research investigation to code, organise and analyse the collected data will be discussed next.

5.7.2 Data Analysis

Kowalski and Kulczycki (2017) define data analysis as the process of bringing together order, structure and meaning of the collected data. Ibrahim (2012) mentions two principles that must be followed by researchers when analysing qualitative case study data. The first principle is to arrange raw data in a succinct structure, which entails organising raw data into tables. The latter is the process of transcribing and coding primary data. The second principle is to establish the relationship between the research objectives and summary. Yin (2014) argues that analysing case study evidence is one of the challenges that face novice researchers. The reason is that these researchers start case studies research without deciding how the evidence or data collected is going to be analysed. However, Yin (2014) further points out that a researcher can use computer-assisted tools to analyse case study evidence, including Atlas.ti, HyperResearcher and Nvivo. Yin (2014) warns that these computer-assisted tools will not do the finished analysis on their own, but they serve as assistants and reliable tools.

This study employed the software tool called Nvivo to code and organise primary data collected from participants who attended the focus group session and participated in the semi-structured interviews. Furthermore, a thematic analysis was used in this research study to analyse or interpret interview transcripts. The section below discusses the steps involved in analysing qualitative data. These steps include transcribing, coding and thematic analysis.

5.7.2.1. Transcribing Processes

Dilshad and Latif (2013) state that recording an interview section is very important and is mostly suggested for all focus group and individual interview sessions. The recording of interview sessions gives the advantage of accessing a full record of the rich source of data (Dilshad & Latif, 2013). The investigator asked for permission to use a recording device (cell phone) to record interview sessions (focus group and semi-structured) with participants. All participants agreed and signed the informed consent form to confirm their agreement. Then, a researcher recorded the whole interview session. The recordings/audio files were saved on multiple storage devices as a backup, should anything go wrong.

Then researcher listened to the recordings carefully in order to capture all the information that was supplied by participants without being subjective or biased. Additionally, for the focus group there was an assistant moderator who helped the researcher (who was the moderator) in taking notes on important aspects of the interview. Furthermore, concerning organising, structuring and coding primary data the researcher used Nvivo as a computer-aided tool.

5.7.2.2. Coding Using Nvivo

Hilal and Alabri (2013) and Ibrahim (2012) state that due to the increase in innovation in software technology, electronic techniques of coding data are being introduced and employed to obtain rigour in dealing with collected data. Thus, NVivo software has been used in this study to sort, organise and code the data that the researcher received through interviews. The use of this software yields many positive results as it reduces a number of manual tasks, gives us more time to discover patterns, recognise themes and derive conclusions. As a result, qualitative researchers are encouraged to adopt this tool as much as possible in their research studies (Hilal & Alabri, 2013).

Nvivo is just a software tool that assists the researcher to organise the primary data in a systematic manner; it does not automatically analyse the data (Yin, 2014). The first task that the researcher took advantage of when using the software was the task of importing interview transcripts (focus group as well as semi-structured interviews) (*cf.* Figure 14). Before these files were imported into this software, the researcher did a data cleaning to ensure that only relevant information was included. Furthermore, the researcher made use of Microsoft Word to format the interview transcript, where the interview questions in the interview transcript were formatted as headings, while the responses from the participants were presented in the form of paragraphs.

Nvivo software allowed the researcher to code documents automatically. The participants' responses were grouped according to the interview questions that made things easier for us to understand the data. Then we arranged the themes that had been discovered from the literature as nodes using Nvivo. Figure 14 indicates the tasks that were carried out using Nvivo software.

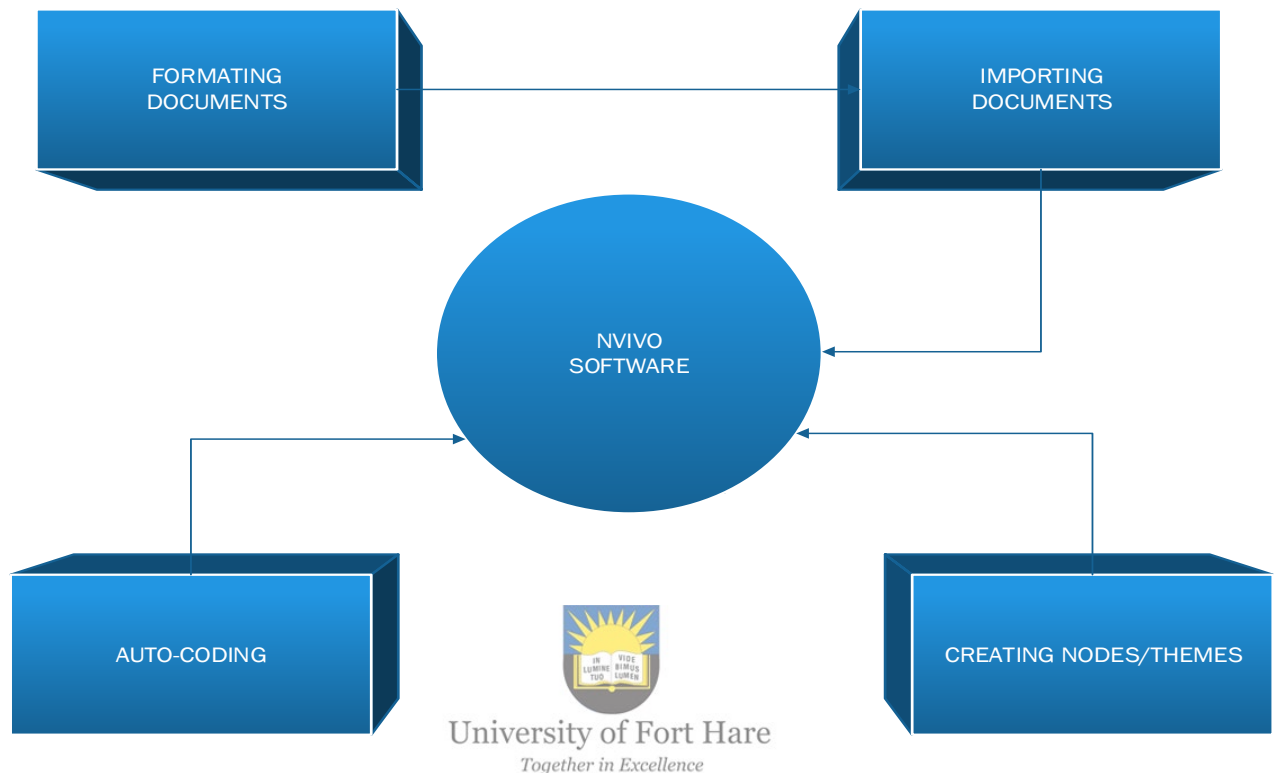


Figure 14: The Nvivo Process (Authors' Own Work)

Once all the interview transcripts were loaded into the Nvivo software and notes were created, the actual analysis of primary data could commence whereby we looked for patterns and trends in the responses that were provided by participants during focus group sessions and semi-structured interviews.

5.7.2.3. Thematic Analysis

The researcher used the computer-aided software only for the purposes of preparing and structuring the raw data that had been collected. Furthermore, this software tool was used to assist the researcher in making meaning from the collected data. For the purposes of analysis, the researcher has employed a thematic analysis. Ibrahim (2012) defines thematic analysis as a type of qualitative analysis that is used to analyse classifications and present patterns that relate to the data. The thematic analysis processes in this research study were carried out by organising and reducing the collected data. The collected data was tabulated using Microsoft Word prior to organising it. The researcher read the transcripts of interviews multiple times to get an understanding the data. During the process of reading the interview transcript, the

researcher noted important aspects. Secondly, the organised data was then displayed in tables clarify the meaning of the data. The themes that were already discovered in the literature review were attached into the data (*cf.* Table 11). The responses from the participants, both from the focus group and semi-structured interviews, were used to discover the sub-themes.

Table 11: Research Themes and Sub-themes

Theme & Sub-theme	Objectives of the Themes
Main: Processes and Activities Sub: <i>Billing process occurs to produce services for municipal customers</i>	To understand whether BCMM employees follow procedures when performing water billing processes for their customers
Main: Participants Sub: <i>Training employees to perform billing process effectively</i>	To determine whether BCMM employees are being equipped with suitable training in order to perform billing processes effectively
Main: Information Sub: <i>Measures in place to ensure that information is accurate</i>	To evaluate customer information for accuracy and completeness before processing water accounts
Main: Technologies Sub: <i>Use of technologies to support water billing processes</i>	To determine whether BCMM has technologies in place to support the water billing processes
Main: Customers Sub: <i>Billing Information Systems need to solve customers' problems</i>	To determine the suitability of information systems at BCMM to solve residents' issues and problems
Main: Environment Sub: <i>Minimisation of factors that negatively affect billing processes</i>	To investigate factors that affect BCMM employees when doing their job of processing water accounts.
Main: Infrastructure Sub: <i>Human, information and technical support</i>	To establish the infrastructure available in BCMM to support water billing
Main: Strategies Sub: <i>Monitor and Evaluate</i>	To understand the measures in place to monitor and evaluate water accounts processes and municipal employees

Nvivo played a pivotal role in categorising and coding the collected data into themes. The last step in thematic analysis process, which was adopted in this research study, was to write up the report which serves as an interpretation of the findings based on the perceptions of the participants.

5.8 Conclusion

The objective of this chapter was to outline how this investigation was undertaken. The research onion was used to arrange this chapter, starting from the outer layer to inside layers. This chapter started with the underlying research philosophy of this research investigation.

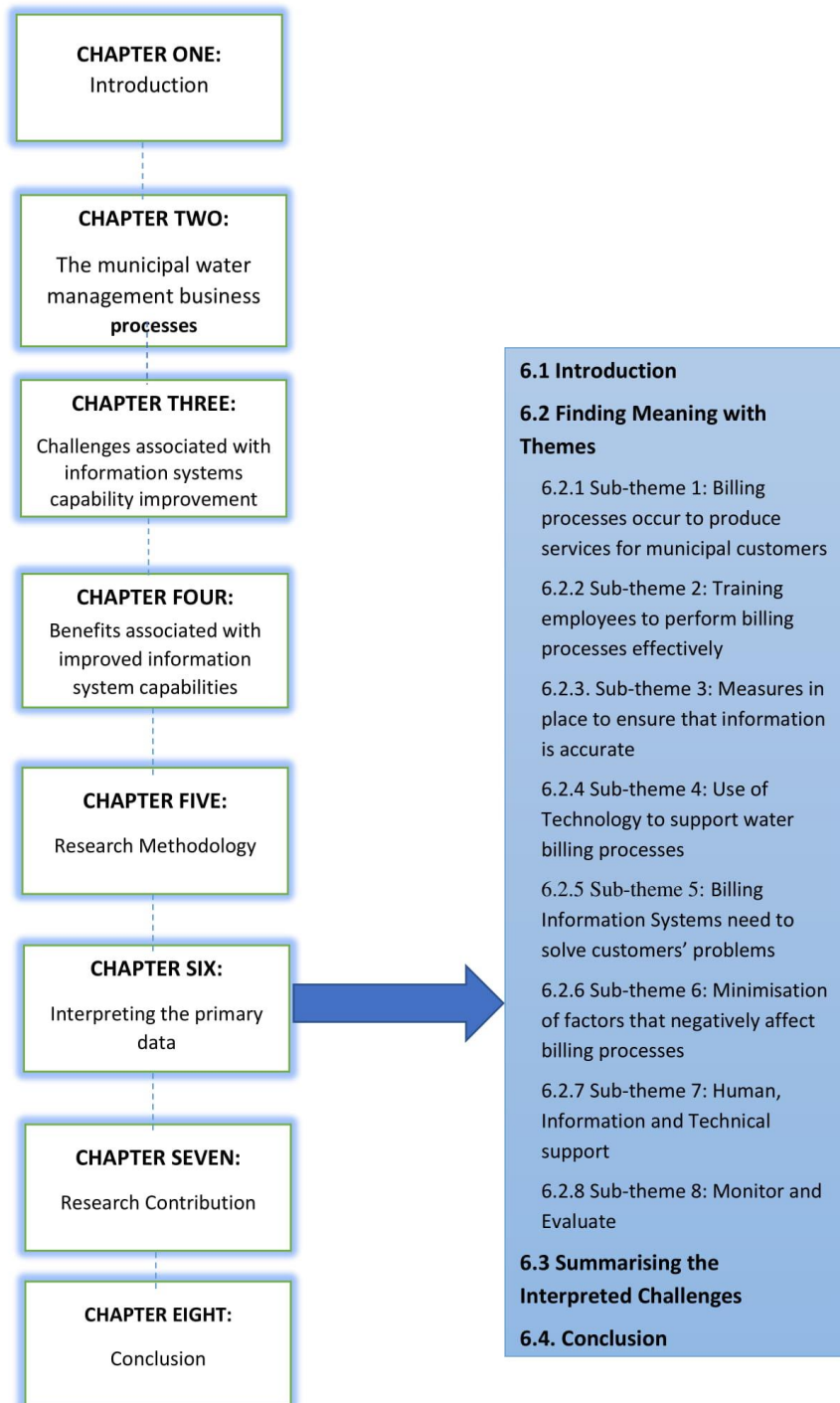
Interpretivism was used as the underlying philosophy of this research study, as this research paradigm allowed the researcher to view the world through the perceptions and experiences of participants. The research approach, research strategy and research choice were clearly outlined in this chapter. This research investigation employed a case study strategy. It was noted that a case study strategy gives researcher an opportunity to understand and study a case in depth in its natural setting. Furthermore, this study adopted a qualitative research approach.

The chapter went on to discuss the research techniques and procedures used in this research investigation. Purposive research sampling was noted as the sampling method that was used, where participants were selected with a purpose. Focus group and semi-structured interviews were also discussed in chapter as instruments that were used to elicit the primary data. A total of seven BCMM employees and two managers were used in focus group and semi-structured interviews respectively. Subsequently, data analysis techniques were explained in this chapter. Prior to the analysis of primary data, the recordings were transcribed to capture all the information that was supplied by the participants. Then the computer added tool NVivo was used to code and organise the primary data before it was analysed using the thematic analysis process. The next section interprets the collected primary data to explore and find meaning in this data.



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Chapter 6: Interpreting the Primary Data



6.1 Introduction

The focal point of this chapter is to interpret the primary data collected from the participants of a focus group and semi-structured interviews with managers. Hilal and Alabri (2013) define qualitative data analysis as the process of bringing order, structure and meaning to the mass of collected data making sense of what participant have said. In essence, qualitative data analysis refers to a process of transforming data into findings. This involves reducing the volume of raw data, identifying significant patterns and constructing a framework for communicating the essence of what the data suggests.

BCMM has information system in place for water management, however, the IS used is immature because this municipality has inadequate processing and reconciling practices for information with regards to service delivery (*cf.* Section 1.2.). This is the problem that the research study seeks to address. The goal of this chapter is to interpret primary data to understand the cause of this problem in BCMM and also to provide measures that BCMM must put in place to address this problem.

This chapter begins with the analysis and interpretation of the collected data. In order to give meaning to and establish a clear understanding of the collected data, the researcher used the sub-themes that were identified in Chapter 5. These sub-themes were used to categorise the analysis and interpretation of collected data. Secondly, this chapter will find meaning from the primary data using themes. Ultimately, this chapter will discuss the challenges faced by BCMM with regards to water billing based on the participants' responses.

6.2 Finding Meaning With Themes

The researcher used literature to formulate the core themes for this study. The themes include: **Processes and Activities, Participants, Information, Technology, Customers, Environment, Infrastructure and Strategies.** Using the participants' responses from the focus group as well as semi-structured interviews the researcher further refined the core themes into detailed sub-themes. The participants' responses were grouped into these sub-themes with Nvivo software. The sub-themes include: *Billing Processes occur to produce services for municipal customers [Processes and Activities], Training employees to perform billing process effectively [Participants], Measures in place to ensure that information is accurate [Information], Use of technologies to support water billing processes [Technology], Billing Information Systems need to solve customers' problems [Customers], Minimisation of*

factors that negatively affect billing process [Environment], Human, information and technical support [Infrastructure], and Monitor and Evaluate [Strategies].

Chapter 5 mentioned the key structures that will be used to refer to respondents when discussing and interpreting themes. These keys include **Resp** when referring to the respondents in focus group (***e.g. Resp 1 when referring to the first participants***) and **Mgr** will be used when referring to participants that participated in semi-structured (***e.g. Mgr2 when referring to the second manager***) (cf. Section 5.7.1.2.).

6.2.1 Sub-theme 1: Billing Processes Occur to Produce Services for Municipal Customers

Respondent Data

The primary purpose of this theme was to understand the nature of a municipal billing process as well as procedures and policies that exist in BCMM to regulate the billing process. Additionally, to understand the format of these procedures - that is, whether they are written or not. With regards to the nature of the billing process, the participants in the focus group and interviews were asked to give an overview of how the water accounts are processed at BCMM. All participants agreed that the accounts management and processing in the water billing offices begins at the meter reading section where meter readers read meters located at a given premises. Resp1 pointed out that...

“First of all customer accounts management doesn’t start here at water billing maintenance; it starts from the meter reading section. The meter reader must go to take the water readings then those water readings are being captured, after the reading is captured water billing officers run a report. Then as billing officers, we will use that report to check whether or not those readings that are correct, then we process the account.”

Resp4 mentioned the audit process that takes place after the meter readings are captured on the system.

“Just before we process the accounts, there is an audit process that we run after the meter reading has been captured to verify whether the previous readings correspond with the current reading.”

Based on the responses supplied by Resp4 and Resp1 it is evident that for BCMM, water accounts processing begins in the field where meter readers capture the readings and these

readings are transferred to the system, which is when the account is being processed. Municipalities from developed and developing countries make use of innovative solutions such as mobile-phone information systems, water monitoring and assessment information systems and smart water management, to minimise the human involvement in meter reading and the capture of meter readings (cf. Section 4.2.1.). According to literature, this approach (employing innovative solutions) enhances the entire water billing process because mistakes and irregularities are mitigated.

The participants were then asked about the existence of procedures and policies to regulate water billing processes. Resp4, Resp5 and Resp6 jointly revealed that there are written policies and procedures that exist in BCMM. Resp4 further explained that there are policies such as the Municipal Financial Management Act and Risk Policies that are relevant to water accounting. Additionally, Mgr1 confirmed the existence of procedures that were done by a company who was awarded a tender by the municipality to do Standard Operating Procedures for the whole municipality, and these are documented. In pursuit of understanding the procedures that are utilised to regulate the billing process, participants were asked the following question: How are procedures that are followed for the management of residential water accounts documented and communicated to you by superiors/managers? How often this is done? (cf. Appendix F). Resp5 and Resp6, respectively, stated:

‘By law, procedures need to be reviewed and communicated on quarterly basis but that doesn’t happen here.’

“Staff follow the instruction that is given to them by supervisors. With regard to how often this is being done, I don’t want to lie, this is municipality things do not happen according to plan.”

The same question was asked of managers during the individual interview with them. Mgr1 stated that workshops are the tool that is being used to communicate the policies and procedures. When asked how often this is done, Mgr1 stated that the municipality plans to conduct these workshops on an annual basis. This manager further revealed that communication of procedures takes place during the year because there are meetings that take place on a monthly basis. Mgr2 made a statement that at BCMM communication regarding procedures with employees is not viewed a regular activity. Mgr2 clarified by saying:

“When you as a manager you pick up a problem that is related to procedures you sit down with that employee and advise him/her,”

Employees are the ones who perform water billing activities for customers. Therefore, communicating procedures to employees frequently is vital as it will enable them to perform billing tasks effectively. Furthermore, for municipalities to achieve effective and efficient water billing, they need to enhance the current water billing processes, through robust recordkeeping and billing procedures (*cf.* Section 3.5.1.).

Interpretation

Based on the responses received from the participants and managers, it is evident that BCMM has policies and procedures in place. Nevertheless, these policies and procedures are not communicated adequately to employees and, as a result, employees find easy ways to accomplish tasks (the processing of water accounts). Furthermore, it appears from the responses that BCMM does not have sufficient training sessions on policies and procedures. Nzewi (2013) outlines key aspects of work procedures, which include:

- Work-study and measurement - This is the collection of techniques used to examine work, for example, what is being done and how it is done (Nzewi, 2013).
- Design of workflow – This includes the set of tasks that are grouped in a chronological order into processes and the set of employees and resources needed to accomplish a given task. With regards to the billing process at BCMM all, the stages in the billing process, from the meter reading section to accounts processing, should be grouped together along with the employees who are responsible for accomplishing those processes.
- Training and communication of work procedures – Nzewi (2013) points out that training is critical for the successful application of procedures. BCMM employees should not only be made aware of the billing procedures, they must receive adequate training. The manager engagements with employees with respect to training employees about procedures should be done formally on a monthly basis.

6.2.2 Sub-theme 2: Training Employees to Perform Billing Processes Effectively.

Respondent Data

This theme seeks to inform the researcher on areas where training can benefit employees in the water billing processes. The researcher started by asking the participants who was responsible for meter reading and how readings are supplied to the water accounts department. The water meter reading, according to Resp2, is the engine or the critical part of the water billing processes. All the participants agreed that meter readers use handheld devices to capture the meter readings. Resp5, Resp3 and Resp4 further stated that meter readers use these devices to enter the meter readings manually.

“These handheld devices are just being introduced now, meter readers used to go around with books.”

“The meter reading handheld devices are being programmed to the system, as soon as the meter reader reads the meter it appears to the system.”

“These handheld devices communicate with the system that we use at the back office, if there is a problem that needs to be reported this system tell us.”



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Furthermore, the participants revealed that after the meter readers have finished the meter reading process, these meter readings are transferred by billing officers to the financial system called Vernas/Solar and that is when the water accounts are processed. Judging from the responses received from the participants, it is evident that computer use is very important.

The researcher wanted to know about the importance of computer literacy in the municipal work environment and whether or not there is any suitable training on the systems used for water accounts management. All participants agreed that computer literacy is very important in the municipal workplace. Resp4 pointed out that computer literacy is important since it is listed as a job requirement for billing. Resp5 and Resp6 stated that on a scale of one to ten an employee needs to have level seven in computer literacy. In supporting this, Resp3 revealed that the municipal billing systems are not so easy to use; therefore, if someone is not computer literate, that person will experience challenges.

“The billing process is being divided into three sections, there are people who perform meter reading there are those who conduct audit process, then I am at the last step

before the accounts can be processed, therefore compute skills help me in getting what I want in the system.”

When the participants were asked about the availability of suitable training on water accounts management, they mentioned that formal training is being offered only when someone is being employed or when a new system is introduced. Resp5 did mention that informal training in BCMM is an on-going process because an employee can ask colleagues or supervisors if there is a feature or something that an employee does not understand.

Interpretation

Schuster and Dufek (2010) state that identifying and developing the skills of existing employees and training, in order for those employees to perform tasks effectively, are all critical for success in government institutions. The training of employees is crucial as it assists employees in becoming familiar with using new tools, features and techniques. Jehanze and Bashir (2013) define training as modification of behaviour through learning which occurs as a result of instruction, education, development and planned experience. Furthermore, training is a planned process that modifies the attitudes or knowledge of individuals through learning so that particular activities can be performed effectively (Jehanze & Bashir, 2013). The main purpose of the training in an organisation is to develop the abilities of individuals to achieve the current and future needs of the organisation.

Therefore, BCMM should create suitable training programs and interventions where employees are educated on how to use the systems for effective billing. The municipality should develop a training plan first, then implement the plan to ensure that all employees are adequately trained. Effective training will equip BCMM with all the necessary skills that are required in water billing.

As mentioned in theme 1, it is important that employees receive training on following the correct procedures for water billing processes. Training BCMM employees will empower them to be confident in the use of water billing software as well as with water billing procedures, which can play an important role in reducing incidents such as incorrect billing.

6.2.3. Sub-theme 3: Measures in Place to Ensure That Information is Accurate

Respondent Data

The aim of this sub-theme was to understand whether BCMM has measures in place to ensure that customers' or residents' information is complete and accurate before the accounts are processed. Under this sub-theme, research participants were asked two questions. Firstly, they were asked what is done at BCMM to check the accuracy, currency and completeness of the stored information of residential account holders. Secondly, they were asked whether there is any way that residents could update their own information electronically.

Based on the responses obtained from the research participants it is evident that BCMM staff rely on an audit report and manual measures to check the accuracy and the completeness of residential information. All participants agreed that there are no systematic measures in place to check the accuracy of information. The employees depend largely on the report that is being generated by their supervisor. Resp6 pointed out that:

“Once the supervisor is happy with my work, meaning that the information is accurate before the account is processed I call my own report to check the changes that might happen.”



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When water-billing managers were asked about how the municipality ensures that information is accurate and complete, Mgr1 indicated that the municipality sends forms that contain residents' information to all the counter services for data cleansing. Then, these forms are manually transferred to the department that deals with data collection. This department is the one that is responsible for updating and verify customer information. Mgr2 agreed with the employees that were the part of a focus group that employees check the accuracy of information from the reports that are coming from the meter reading section manually. Mgr2 further revealed that due to the large volume of these reports, supervisors are unable to check them on a one-by-one basis; instead, they perform random checks.

“I will stick to the billing side of information, however is not our part to deal with the data part. What we normally do is that every month we have the report that are coming from the meter reading section. The employees are given these reports at that stage the information is still raw, they manual check that for accuracy, once they are done they submit those report to the supervisors. The supervisor will also check, but due to the volume of these reports the supervisor will just perform a random check.”

Concerning the question about whether BCMM has a platform where city residents can update their own information, participants held different views as they provided different responses. Resp4 stated that there is no such thing, customers do not electronically update their own information, however, customers go to the municipal offices should they need to update information. Another participant disagreed with this statement, claiming that customers can update their information using the IVR system. Resp6 indicated the lack of shared knowledge by stating:

“No there is no such thing, in the olden days, consumers would be called to make the information updates for example if a consumer is moving out.”

“We don’t know about this.”

The researcher noticed that the employees were unsure about the existence of such systems. When the water billing managers were asked the same question, Mgr1 revealed that it was not known whether the recent website could allow customers to update their own information while Mgr2 manager mentioned two platforms that customers utilise to update their information, one platform being the use of the call centre.



“We can use call centre- if for example, you have a complaint about your account you can call the call centre number, then you will be given a reference that confirms that you have lodged a complaint, however, I am not sure how long they take to give customers feedback”

The same respondent added (after some thought on the topic):

“Therefore, this is the platform that we can use when a customer has the information that he/she wants to update”

The second platform that Mgr2 mentioned was the use of satellite offices that have been introduced by the municipality. Mgr2 stated that instead of going to town to update the information, customers can take the advantage these satellite offices to update their information locally. It should be noted that both the self-service options identified by the manager have a human layer between the customer and the system. Therefore, there does not appear to be any direct interaction between the customer and their data.

Interpretation

Mithas, Ramasubbu and Sambamurthy (2011) state that information is very important for every organisation, be it private or public. Good and error-free information can enhance decision-making processes and enhance efficiency in municipal institutions (*cf.* Chapter 3). Organisations such as municipalities need to have innovative measures in place that allow people to receive or have access to accurate and timely information when it is needed to perform a task or make a decision (Schuster & Dufek, 2010). According to Boell and Kecmanovic (2010) accuracy is one of the characteristics of quality information. Boell and Kecmanovic (2010) further point out that information should be fair and free from errors and mistakes. Additionally, Cotton (2014) reveals that in any organisation if the information accuracy levels are low that may affect the decisions that will be made which in turn will have a negative influence on the end-results. Organisations need to realise that quality is more important than quantity when it comes to information (Cotton, 2014).

The responses from the research participants indicate that BCMM still depends on manual processes to accomplish tasks such as ensuring the accuracy and completeness of customer information as well as updating customers' information. The manual processes in accomplishing these tasks (updating customer information and ensuring accuracy in customer information) can invite a number of risks, such as lack of integrity or errors in customer information.

BCMM should investigate adopting systems such as Management Information System (MIS) and Customer Relationship Management (CRM) systems to ensure that customer information with regards to water billing is accurate and complete. Karim (2012) defines MIS as an integrated user-machine system that is used to provide accurate information to support the operations, management, analysis and decision-making processes in an organisation. This information system can enhance water managers' decision-making as it will provide a true view of customer information that is accurate, timely, relevant and complete. The self-check and cross-check feature that this information system possesses will assist in mitigating the errors.

Olivier (2015) reveals that information needs to be accurate, readily available and have an adequate audit trail so that it can be reported. Furthermore, the information must be available in real-time so that it can be effectively managed by the organisation managers to meet organisational objectives. In order for an organisation to have accurate information, it needs

to ensure that its information flows and systems are put in place to control that information flow (Olivier, 2015). Therefore, BCMM should not rely on the manual processes to ensure the accuracy of the customers' information; they need to have information systems available that will manage customer data in real-time.

With regards to the electronic update of customers' information, customers cannot rely solely on a call centre to update their information. BCMM should investigate automated platforms such as a dynamic website or mobile applications that will allow municipal customers to update their own information related to water billing. BCMM needs to bridge the digital gap between the municipality and its water resource users with regards to information update and access.

6.2.4 Sub-theme 4: Usage of Technologies to Support Water Billing Processes

Respondent Data

The technologies that are used in water billing processes are the software and hardware that enable efficient and effective water billing processes. This sub-theme seeks to find out whether BCMM has technologies in place to support effective water billing processes. Under this sub-theme, the research participants were asked four key questions. The objectives of the four key questions that were asked of participants under this theme are:

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- to understand what computer-based information BCMM uses to collect and process the water accounts of the customers;
 - to determine if the information systems are automated or if there is still manual data capturing involved;
 - to assess the frequency of introducing software and/or hardware at BCMM to enhance the existing processes;
 - to learn about the challenges that BCMM employees experience when technology/a system is being introduced; and
 - to understand how technology assists in enhancing water accounts management processes.

Participants from the focus group revealed that BCMM has two systems that support the water billing processes. These systems include meter reading systems as well as Vernas/Solar systems for customer billing. When asked about the automation of the systems that they use, Resp6 stated that:

“This system is half automated and half manual basically its 50% automated and 50% manual, reason why I am saying this is because when you log on to the system it comes with default options, and you manually manipulate those options to achieve your tasks.”

Resp3 explained in detail what this meter reading system does. Resp3 started his explanation by paraphrased what participants have said during the focus group section, that meter readers get devices such as smartphones that are used to capture readings. When the meter reading is being punched into the system, it goes directly to the meter reading system. The senior meter readers are using this meter reading system. With the assistance of this system, senior meter readers are able to see the location of the meter reading in the field. Resp3 made his concluding remarks, stating that there is a challenge of network connectivity that affects the effectiveness of this system.

Additionally, Resp2 revealed that previously they were using the Vernas system to process the customer water accounts, however, they are currently using Vernas/Solar. Resp2 further stated that when using Vernas/Solar one is able to perform tasks such as capturing readings. The only disadvantage that was noted by Resp2 was that there is a lot of manual capturing that takes place in this system. In agreement with this participant, Mgr2 revealed that:

“Meter readings don’t go to billing system automatically, someone must press a particular button to transfer the readings to the billing system.”

In pursuit of finding out whether there are technologies in place at BCMM to support water billing processes, the participants were asked how often new technologies are introduced to enhance existing processes. The responses of Resp4, Resp5, Resp6 and Resp7 revealed that at BCMM it takes some time to introduce new technologies. Furthermore, before BCMM introduces new software employees or customers need to complain. The respondents indicated that:

“I have many years working at this municipality, but the system has been changed 3 times ever since I started working here because there was a system before Vernas system was introduced, then there was Vernas and this system we are currently using.”

“It takes some time for a system or software to be changed here.”

“It depends on the nature of the [technology] problem and how the [technology] problem persists.”

“They update the system they don’t necessarily change it, but what I have noticed is that the system doesn’t change they just add some add ons.”

“You have to complain for so many years in order for a new system or technology to be introduced, I can say they introduce new technology after many years.”

Without being biased or subjective, the responses from the participants gave the researcher an idea that at BCMM there is no enhancement in the existing processes - or that it is very slow. If anything, the responses seemed to indicate a reactive rather than a proactive approach.

The researcher wanted to know from the participants what sort of challenges they experienced when a new system or technology was introduced at the municipality. Resp2 and Resp4 mentioned challenges such as training issues as well as network problems. Resp4 further revealed that when a new system is introduced there are network challenges, and, as a result, there are system processing delays. Resp5 indicated that is not possible to pinpoint these challenges specifically but obviously when a new feature is introduced, challenges can be expected. Resp5 further made an example that when the new system is introduced it will change things and affect how they (employees) do their work. Resp5 made a bold statement that when the municipality decides to introduce new software or technology employees are not consulted to provide their inputs and ideas.

“Problem is that they do not ask or consult us before introducing a new system so that we can have our inputs because at the end of the day we are the ones who are going to use this system.”

Lastly, participants commented on how they think technology can assist in enhancing water accounts management processes. Participants felt that there could be a lot of enhancement in water accounts management if meter readings were scanned and not manually captured on the devices. Resp6 and Resp7 believed that technology plays a pivotal role in enhancing water accounts management processes as it enables or allows municipal customers to participate in the meter reading process and technology makes things faster. Because of technology, customers can take a picture of their meter readings and send it to the municipality via WhatsApp or by e-mail. Resp5 held a different view, claiming that if more technology were introduced, they would lose jobs:

“If more technology is introduced that means we won’t have jobs; things can’t be all automated as a person I must be included in the process.”

Interpretation

From the responses it is clear that at BCMM there are technologies in place to support the water billing processes, as the participants stated that they are using two systems, namely a meter reading system (for the capturing of the meter readings) as well as financial system called Vernas/Solar for the processing of water accounts. However, there are two challenges that the researcher identified during interviews. Firstly, there are many manual tasks in these systems. Secondly, these systems are not integrated - they work in silos. The problem with a manually-focused and siloed system for BCMM’s water management systems is that it can lead to the inaccuracy of information as implied by respondents, when information is entered on the system. In addition, the response speed to customer queries will be very slow when compared with an automated system. Therefore, BCMM should investigate the automation of their information systems associated with the water billing process to reduce manual tasks.

With regards to the integration of the systems, BCMM needs to investigate implementing a suitable ERP system to integrate its systems. Chandiwana and Pather (2016 p.87) define an ERP system as a “system that offers the organisation a comprehensive and integral solution for managing services on a single integrated software system”. The implementation of an ERP system will combine different segments of the billing process, as well as centralise the monitoring of water billing operations. However, the implementation of ERP systems comes with its own set of challenges and benefits (Kalema, Olugbara, & Kekwaletswe, 2014). Paramount for challenges is the municipal context, which will require system customisation. The Cape Town City Metropolitan Municipality has experienced numerous challenges in introducing the SAP ERP software into its systems (State of Cape Town Report, 2016) The implementation of an ERP system could address the challenges at BCMM with regards to water management processes because it won’t only integrate the segments of water billing process, it will streamline and enhance the handling of information for timeliness and accuracy. It was noted that using technologies or enhancing IS capabilities plays a pivotal role in enhancing water billing processes. The use of technologies leads to enhanced communication, availability of information, enhanced decision-making and cost-effectiveness in water billing process (cf. Section 4.4)

6.2.5 Sub-theme 5: Billing Information Systems Need to Solve Customers' Problems

Respondents Data

The primary aim of this sub-theme was to determine the challenges municipal customers might encounter with regards to query resolution on the billing of their water resources. The objective was to assess whether the available information systems at BCMM can easily address and solve the water billing challenges that residents are facing.

Davoren (2017) states that in order for an organisation to realise benefits from the use of an information systems they need to exploit all of its capabilities. In exploiting information system capabilities organisations need to ensure that the information system they are using is able to processes the information that will be relevant to the customers and solve their problems (Davoren, 2017). In the case of government institutions, such as municipalities, information systems use can solve residents' problems by ensuring that communication is fast and effective between the municipality and residents.

Participants were asked about the typical challenges customers have with regards to their water accounts. The customers' challenges that were mentioned by the participants include queries about high water consumption, delayed communication on queries and response issues to water leaks near their residence/business. Another challenge that was mentioned by Resp7 was the issue of transferring the municipal services to the new owner in a case where the customer buys a new house. When the water-billing managers were asked this question, Mgr1 stated that customers often come to the municipality to inquire why their meters were not being read and often experience challenges in this process.

The participants in the focus group agreed as a group that BCMM customers do not have sufficient knowledge regarding their exact water billing and customers do not always report incidents such as water leaks to the municipality in time. According to Mgr1:

“In the municipality, we have indigent customers; these are people who do not afford to pay for municipal services. These people have an understanding that they do not pay for municipal services they are getting them free. Of which that is not the case, the indigent people are being subsided and for an example, they are getting 6 Kilolitres every month. Then if someone exceeds that 6 Kilolitres that means she has

to pay. The people do not pay these amounts to an extent that the municipality block the electricity.”

The participants further explained that the available water billing information systems in place sometimes solve the challenges. Resp4 stated that the ability of available information systems to solve customers’ challenges depended on the nature of the challenges faced by that particular consumer. However, participants agreed that BCMM does not solve these problems quickly, the reason being the information systems used in the municipality do not communicate with one other. As mentioned earlier, the main problem facing BCMM is that their systems work in silos. Resp4 and Resp5 respectively indicated that:

“Our systems don’t talk with one another, for example when you pay, the system that we use which is Vernas/Solar doesn’t take that to a system called Condo (system used when buying electricity), when you go there to buy an electricity you will find out that you are blocked and you will be shocked that how can that happen because you have paid.”

“In the municipality we have a problem, the systems do not communicate with each other for example the customer can change the ownership of the house, but in the municipal system it will reflect as if a customer didn’t change the ownership, it becomes a long process with lot of paperwork for BCMM to transfer the municipal services of the previous owner to the new owner, this long process affect the customers, These systems that are involved in this process do not report from one another.”

Lastly, the participants were asked whether BCMM gives customers the opportunity to upload their own meter readings to their water accounts. Furthermore, participants were asked whether BCMM has plans in place to integrate the entire meter reading activity. All participants agreed that customers can not upload the meter readings onto their own water accounts. They can only e-mail, call or visit the municipality to submit their meter readings. When participants were questioned about whether BCMM plans to automate the entire meter reading process fully, Mgr1 indicated that BCMM would love it if the whole meter reading activity were automated but the challenge is that the automation of such process would be very expensive. However, Mgr2 raised the concern that if this process were automated, employees would lose jobs.

“If the whole meter reading can be automated that means meter readers will lose their jobs. But I don’t think that automating whole meter reading processes can be easy.”

Interpretation

Although, BCMM has a water billing information system in place, it is not adequate to assist customers to solve their problems easily and in a timely manner. Ideally, BCMM needs to ensure that their systems communicate with one another to avoid delays in communication and responses to their customers. Information system integration is being mentioned as critical element in enhancing water billing as it harmonises multiple IS in the organisation so that they can communicate with each other (*cf.* Section 4.3).

Lack of system integration leads to challenges such as the duplication of tasks, delays in processing, inaccurate information and data redundancy (Wallace, 2017). These are challenges that BCMM faces due to the lack of a water billing IS system. There are quite a number of forms of system integration mentioned in the literature, including strategic integration, horizontal integration, vertical integration, ergonomic integration and data integration (*cf.* Section 4.3). Vertical integration is the appropriate form of integration that BCMM needs to consider as it will ensure that all BCMM stakeholders, including their customers, will have access to real-time water billing information.

BCMM should raise awareness of the importance of information systems to their staff as BCMM employees currently believe that as more technology and information systems are introduced, they have a greater chance of losing their jobs. They are not considering the benefits that effectiveness and efficiency in these systems would bring. They would also provide opportunities for upskilling to some employees. BCMM needs to ensure that it invests in information system awareness programmes, training and education, as these will assist in changing employees’ behaviour towards information systems.

6.2.6 Sub-theme 6: Minimisation of Factors That Negatively Affect Billing Processes

Respondents Data

Under this sub-theme, Mgr1 and Mgr2 indicated that weather conditions are one of the factors that can have a negative impact on the billing process. Mgr1 made an example that when it is raining, meters will not be read. When meters are not read it means that the billing process will not take place. Resp5 indicated that there is no communication between the employees and

supervisors, and, as a result, they encounter delays in processing residential water accounts. Another factor that has been mentioned is network issues as well as budget constraints. Resp1 further indicated that:

“Budget is also a problem, for example, BCMM is growing the more the municipality is growing that means that new employees must be employed. If we don’t get new staff that means the water reading and the processing of water accounts will be affected.”

“When I am processing an account a supervisor would come to do his own thing in my system instead of using their own system. Also, the supervisor will come with new information that you don't have.”

Interpretation

BCMM needs to identify proactive measures to minimise numerous factors, including weather conditions, network issues and lack of communication between the employees and supervisors. Weather conditions is a challenge that is beyond the control of the municipality. However, BCMM needs to consider using information systems that are available to assist in forecasting and analysing future weather conditions (Srinivasa & Mehta, 2014). They can use the information that they will obtain in forecasting information systems to plan their water meter reading processes. Srinivasa and Mehta (2014) state that government institutions are investing budgets and employing advanced computer information systems for weather forecasting to better understand water provision. Furthermore, municipalities need to increase the available budgets for technologies needed for water billing processes. The Billing Department is an important department in the municipality as it directly inputs revenue collection. Municipal revenue collection is problematic in South Africa and is caused by challenges that municipalities encounter in billing their customers for water consumption (Molobela, 2016).

In order, to enhance revenue collection processes there are several technologies and IS that BCMM need consider investing in. These include transaction procession systems, enterprise resource planning, enterprise information system and electronic government (*cf.* Section 3.5.1). Investing in these technologies will enhance water billing processes as these systems would ensure that all the factors (mentioned by respondents) that affecting the water billing negatively are minimised. Mitigating the challenges that affect water billing would result in financial stability at BCMM.

6.2.7 Sub-theme 7: Human, Information and Technical Support

Respondents Data

This theme deals with the resources that need to be available at the municipality to support the management and processing of water accounts. Participants agreed that human, information, as well as technical support, are very important for effective water billing. Resp2 and Resp5 stated that computers, as well as printing devices, need to be available. The other resources that are important in the workplace include a financial system as well as meter reading devices.

Resp7 held a different view regarding this issue, stating that control policies need to be available to manage customers' water accounts. Control policies include the measures that BCMM needs to put in place to regulate and control residential water accounts. For example, BCMM should design policies and rules to manage water consumption, residents' critical information and other water account-related matters.

Furthermore, participants were asked about the integration of systems that the municipality use to manage and process residential accounts. The participants expressed that the systems in the municipality are not integrated at all, and, as a result, the municipality receives many inquiries from customers. However, when asked about this, Mgr1 pointed out that the municipality is still working on the integration of all systems that are used. With regards to the integration of systems, Resp4 revealed that:

“Systems are not integrated at all.”

“I will say municipality is currently working on that, they are working on integrating all the municipal systems. Because I believe currently our systems are not integrated.”

“The systems are not integrated; as a result, we have many queries from our customer.”

Interpretation

Participants mentioned that information is one of the critical factors that supports effective water billing. However, in order for information to support water billing it should be available to all stakeholders in real-time (*cf.* Section 4.4.2.). Furthermore, water-related information needs to be accurate and error-free so that it can add value to the relevant stakeholder as well as to the entire municipality (*cf.* Section 4.4.4.). However, based on the participants' responses, information at BCMM doesn't support water billing due to a lack of system integration in water

billing information systems. The lack of or poor system integration is the cause of all challenges that BCMM faces with regards to water billing management and processing. The major obstacle towards effective water billing management at BCMM is the siloed system approach that is currently used. BCMM needs to adopt an integrated systems approach where all information flows on a single information management system.

Raisiene (2011) believes that a system integration approach is beneficial to any organisation as it reduces the extent of documentation, which arises due to work organising and control. In the case of BCMM, the system integration approach will allow business process optimisation because the water billing processes will be organised smoothly. In order to achieve system integration, BCMM can implement Enterprise Application Integration (EAI). EAI has been defined by Raisiene (2011) as the process of coordinating the operation of various applications across an organisation. Raisiene (2011) argues that the primary reason for using EAI is not to build a new system from scratch but to combine multiple systems. Alternatively, BCMM needs to consider adopting Enterprise Information System (EIS) (cf. Section 3.5.1.3). The implementation of EIS leads to benefits such as water billing process efficacy and effectiveness. EIS can enable a municipality to have a single system that will be central within the municipality. Furthermore, it will ensure that water-related information is shared across all functional areas (cf. Section 3.5.1.3).



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6.2.8 Sub-theme 8: Monitor and Evaluate

Respondents Data

This sub-theme seeks to assess whether BCMM has the available strategies to monitor and evaluate its employees as well as the water accounts processes. Resp5 noted that the municipality is using a scorecard method to evaluate the performance of its employees. Furthermore, Resp3 mentioned that the municipality tried to introduce peer assessment, however, it did not work. When Mgr1 and Mgr2 were asked about this, they responded with contradicting statements. Mgr2 stated that employee performance monitoring and evaluation is an ongoing process as the supervisors are constantly monitoring employees' work.

“Employees are being monitored; there is a constant monitoring, and the monitoring starts with supervisors. For example, the meter readers are being monitored by senior meter readers; also, the supervisor is there to monitor the whole process of meter reading whether it is going smoothly or not.”

While Mgr1 indicated that BCMM does not have any measures in place to monitor and evaluate employees or water billing processes. However, Mgr1 further stated that as they worked with employees, a manager can see where there is a problem and the manager will sit down and talk with that employee.

Interpretation

Respondents Data

Given the responses from the participants it was clear that BCMM does not have appropriate measures in place to monitor and evaluate the water billing processes or employees' performance. Concerning the monitoring of water billing processes, this needs to take place on a regular basis to check for loopholes in these water billing processes. Furthermore, the monitoring of water billing processes is imperative so that processes can be enhanced to achieve effective billing. The fifth element of the Capability Maturity Model (CMM) calls for organisations to enhance their business processes continuously (*cf.* Section 2.5.1.). The first step in enhancing BCMM's business processes is to monitor the existing water billing processes.



Furthermore, the employees who perform water billing processes need to be evaluated to ensure that they follow the correct procedures in performing billing processes. However, before BCMM can evaluate their employees, training and educational programmes regarding the bill processes should be introduced to equip them with all the necessary skills (*cf.* Section 3.6.1.1). Thereafter, they can introduce evaluation programmes and ensure that employees treat these programmes with the utmost respect and seriousness. BCMM needs to encourage its staff to perform water billing processes effectively. It can encourage its employees by providing incentives and bonuses to those employees to follow procedures when billing municipal customers

6.3 Summarising the Interpreted Challenges

This section summarises challenges that have been interpreted for each theme from the data collected through the focus group and manager interactions. The challenges are tabulated in Table 12. Each challenge is mapped according to the sub-themes that they affect. In some instances, a challenge may be present in multiple sub-themes.

Table 12: Challenges Faced by BCMM With Regards to Water Billing

No.	BCMM Challenges	Sub-themes							
		1	2	3	4	5	6	7	8
1	Procedures and policies are not standardised	*							
2	Lack of regular training and workshops to assist employees in adhering to procedures when managing and processing customers' water accounts	*	*						
3	Procedures and policies are not communicated adequately to municipal employees	*							
4	Inaccuracies in the meter reading process		*	*					
5	Reliance on manual measures to check the accuracy and completeness of information stored in customers' water accounts			*					
6	Lack of electronic platforms where customers can update their own information. Customers don't have a choice but to come to the municipal offices should they need to change or update their information			*					
7	Much manual capturing in the financial system (Vernas/Solar) that is used to manage and process customers' water accounts				*				
8	Slow introduction of software and technologies to enhance the water billing processes				*				
9	Network problems on meter reading devices	*	*						
10	Lack of management of water billing and information systems are not integrated				*	*		*	
11	Lack of employee awareness about the importance of information systems and information technology in the workplace		*			*			
12	Budget constraints with regards to the employment of new staff - as result other meters are not being read and this results customers making queries at municipal offices						*	*	
13	No clearly understood pre-defined measures for the monitoring and evaluation of water billing, employees and processes								*

Lack of integration in water billing information systems was the major challenge that was identified during the interview session. Challenge 10 affects a number of themes (4, 5, 7) seen in Table 12. Challenge 10 has led to many manual processes in water billing as well as delays in communication between the municipality and its customers. Another common challenge was the lack of training and education support. According to respondents, BCMM doesn't

conduct training and support workshops regularly to ensure that employees are familiar with the information systems used in water billing. The reliance on manual tasks when billing customers for water consumption was also noted as a significant challenge by the participants as it lead to irregularities in water billing processes.

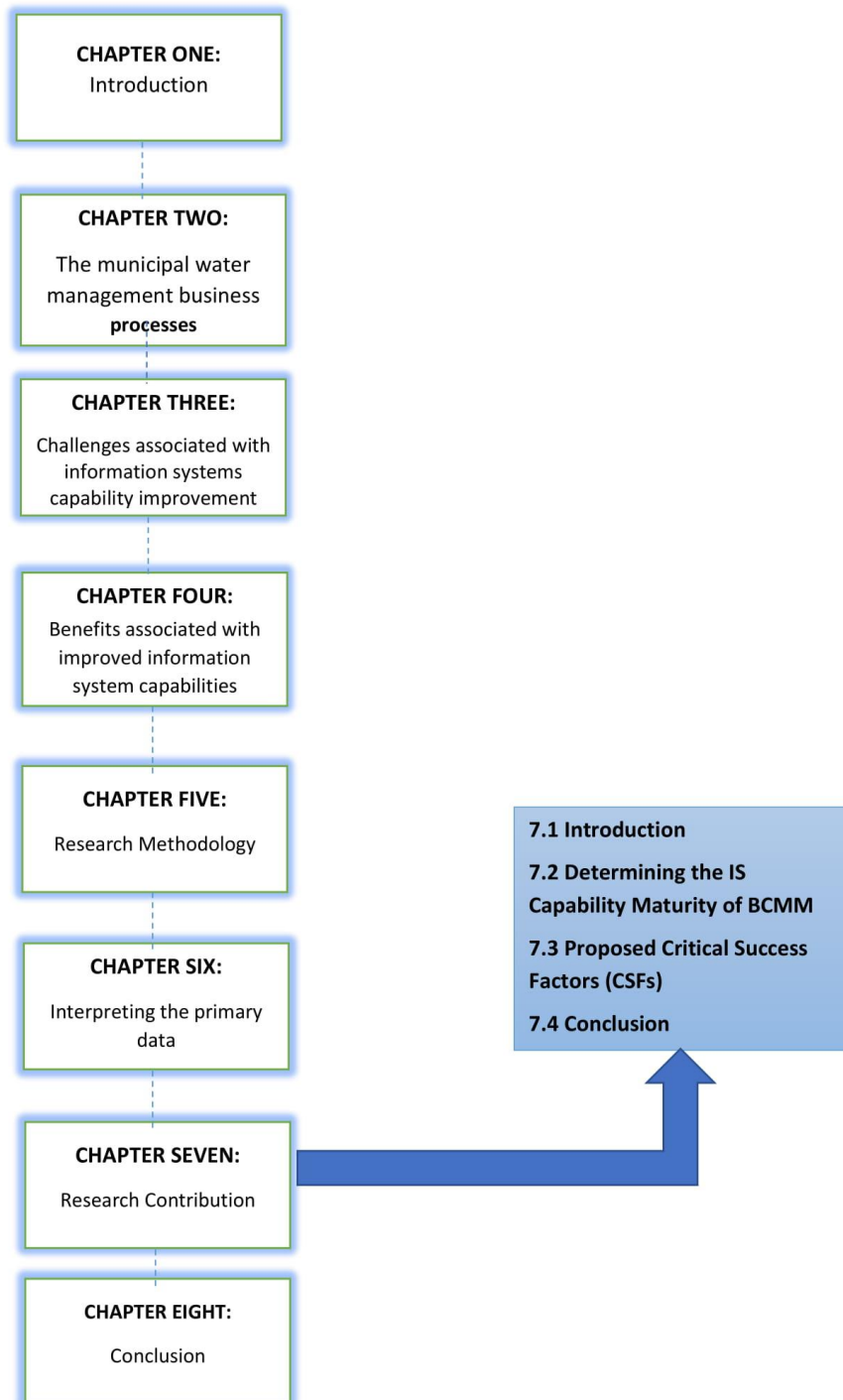
6.4. Conclusion

The objective of this chapter was to interpret and analyse the primary data that was collected through focus group and semi-structured interviews. The sub-themes were used to find meaning in the primary data. Two structured keys have been used in the Chapter to refer to the participants. These keys include Resp, that was used to refer to participants of the focus group, and Mgr, used to refer to the participants of the semi-structured interviews. Furthermore, the Chapter tabulated all of the challenges that BCMM faces with regards to water billing, based on the responses from the participants. The lack of water billing information system integration was noted as a major challenge. However, suggestions were made as to how BCMM can address the challenges of system integration. These suggestions included the implementation of systems such as Enterprise Resource Planning (ERP) and Enterprise Information System (EIS). The next chapter will discuss the contributions of this research study.



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Chapter 7: Research Contribution



7.1 Introduction

This research study seeks to answer and address the main question: ***How can the information systems capabilities of the business processes associated with water management be Enhanced at Buffalo City Metropolitan Municipality?***. In addressing the main research question, this chapter will start by identifying the current capability maturity level at BCMM. Then the critical success factors (CSFs) that BCMM needs to implement to enhance the capability of the water management processes (i.e. water billing) and IS that is used will be identified and discussed. The proposed CSFs in no particular order include: communicate water billing procedures, processes and policies, train and educate employees on information system and technologies use, enhance the quality of customer data, automate water billing processes, use integrated information systems, provide e-Government self-service solutions for customers, allocate funding for water billing process automation and continuously monitor and evaluate water billing processes. Consequently, this chapter will link BCMM water billing challenges with the proposed CSFs.

7.2 Determining the IS Capability Maturity of BCMM

Based on the challenges that BCMM is currently experiencing with regards to water billing (cf. Table 12), CMM will assist in identifying BCMM's current maturity level. CMM is a model that was developed in 1991 to support enhancement in the software development processes (cf. Section 2.5.1.). The objective of CMM is to assist organisations with selecting process enhancement methods by determining their current process maturity first and identifying the problems that hinder the process enhancement. The CMM judges the maturity of information system capabilities of an organisation.

The BCMM water billing processes will be evaluated using five levels of maturity. Furthermore, the researcher will establish or develop Critical Success Factors (CSFs) that are required or that must be met to increase the maturity of information system capabilities in those processes (water billing). The five CMM levels include Initial, Repeatable, Defined, Managed and Optimised.

Level 1: Initial

In the first level of CMM, organisational performance is driven by the competence, talent and heroics of the people doing the work. Crowston and Qin (2011) state that success relies on individuals rather than documented business processes. High quality and excellent performance are possible as long as the best people are hired. The business processes are inconsistent and occasionally even chaotic.

An organisation is at this level if:

- there are no key processes;
- there are weak management practices;
- it has poorly controlled processes;
- the results of processes are unpredictable; and
- processes are ad hoc and chaotic.

From the data collection it can be deduced that BCMM has processes in place for water billing. Furthermore, these processes are well-defined, for example, there are key processes including water meter reading, the capture of meter readings and water account management processes. It can therefore be concluded that the municipality meets the criteria for competence and therefore maturity at this level.



Level 2: Repeatable

In maturity level two the business processes are properly managed through the policies and procedures established within the organisation. Organisational policies and procedures merely guide the implementation of business processes (Paulk, 2009). Furthermore, in this level, business processes are documented and followed.

An organisation is at this level if:

- the policies for managing system integration and procedures to implement those policies are established; and
- the system integration activities are planned and followed.

From the data collection it can be deduced that BCMM has document policies and procedures; however, these policies and procedures are poorly communicated within the organisation. Furthermore, even though the procedures are present they are not standardised. The responses

from the respondents indicate that BCMM depends primarily on workshops to communicate procedures. Furthermore, supervisors only communicate the procedures to employees when a certain employee fails to adhere to a certain procedure. It can be deduced that BCMM is still on this level with regards to its water billing process maturity because the policies and procedures to manage water billing information systems are not communicated adequately to employees.

Level 3: Defined

Defined maturity level means that processes are documented, integrated and standardised across the organisation and then tailored and applied to particular activities. The emphasis on this level shifts to the organisation; it supports the activities by establishing common processes for management and training (Paulk, 2009).

An organisation is at this level if:

- training plans are created and followed;
- the organisation focuses on process definition and processes usage; and
- there is integrated software management

From the data collection it can be deduced that BCMM doesn't provide training and educational intervention programmes to their employees. Furthermore, a lack of training results in employee ineffectiveness when performing water billing-related activities. In order for BCMM to be at this level of maturity, training plans for water billing employees should be developed. Furthermore, they need to ensure that these plans are implemented and managed so that employees can have confidence when billing customers for water consumption.

Level 4: Managed

At this level the organisation sets quantitative goals for business processes. Furthermore, the organisational performance of business processes are controlled using statistical and other quantitative techniques. The data is systematically collected and analysed to evaluate the business processes (Poppelbub & Roglinger, 2011).

An organisation is at this level if:

- there are established and measurable goals.

From the data collection it can be deduced that at BCMM, no measurable goals have been established. When the participants were asked whether the municipality has any plans to fully automate the meter reading activity, some of them expressed that the automation of the meter reading section is impossible. This proves that this municipality does not have goals with regards to the enhancement of how the process of meter reading is carried out.

Level 5: Optimised

Optimising means that the organisation is focused on enhancing business processes. In an immature organisation no one is responsible for business process enhancement (Poppelbub & Roglinger, 2011) while in a mature organisation participant are engaged in enhancement activities at any given point and everyone is involved.

An organisation is at this level if:

- continuous process enhancement is in place;
- processes and technology are continuously evaluated; and
- individuals are empowered to enhance their processes.

From the data collection it can be deduced that BCMM lacks continuous enhancement for water billing. Firstly, it takes years for this municipality to introduce a technology or information system that that will optimise the water billing processes. Secondly, BCMM does not have pre-defined or pre-established measures for the monitoring and evaluation of water billing processes as well as employees. In addition, municipal employees are not made aware of the importance of information systems and how they can enhance water billing processes.

The five levels of CMM were utilised to evaluate the level of maturity at BCMM with regards to information systems capabilities. It has been noted that BCMM is currently identified at level two concerning the maturity of their water billing processes. The provision of Critical Success Factors will assist BCMM in enhancing their information systems capabilities so that the water billing processes are enhanced.

7.3 Proposed Critical Success Factors (CSFs)

The Critical Success Factors refer to elements that are imperative for successful strategy and could affect the performance of the organisation either positively or negatively (Fredrik, Marcus, & Johan, 2014). Fredrik et al. (2014) further state that CSFs can be thought of as “those

things that must be done if an organisation is to be successful” or those factors within an organisation that help it to achieve its objectives. However, the proposed CSFs in this study have been developed to enhance IS capabilities that are associated with water billing at BCMM. These CSFs have been identified and developed based on challenges that BCMM experiences concerning water billing (*cf.* Table 12). These CSFs can be generalised and used by other metropolitan municipalities with similar challenges. Table 13 summarises the proposed CSFs with water billing challenges.

Table 13: Summarising Proposed CSFs

No	CSFs	Water billing challenge
1	Communicate water billing procedures, processes and policies	1,3
2	Train and educate employees on information system and technology use	2,11
3	Enhance the quality of customer data	5,6
4	Automate water billing processes	4,7,8
5	Use integrated information systems	7,10
6	Provide e-Government self-service solutions for customers	5,6
7	Allocate funding for water billing process automation	9,12
8	Continuously monitor and evaluate water billing processes	13

Table 13 links the proposed CSFs with water billing challenges at BCMM, which were discovered during data collection processes. These CSFs are discussed below and their order is not significant as all should be addressed for success in municipal water management,

CSF 1: Communicate water billing procedures, processes and policies

The municipality needs to find effective ways to communicate their procedures and policies that are related to water billing to their employees. The effective communication of policies and procedures will help employees to understand the water billing processes better. When they understand them, it will be easier for them to adhere to these policies and procedures. Siponen, Mahmood and Pahnla (2014) state that if employees are kept well-informed about the procedures and given the opportunities to provide feedback, they are likely to perform them well. In order to communicate the procedures effectively, the municipality can use platforms, such as training sessions, staff/team meetings, newsletters, the intranet and public board meetings.

CSF 2: Train and educate employees on information system and technology use

The municipality should adopt the education and training of employees as part of their culture and norms because it can play an important role in ensuring that employees become comfortable when using the water billing information system. Furthermore, well-trained staff would result in municipal customers being satisfied with better service as the number of inquiries would be reduced. The report that was conducted by IBM (2014) on the value of training suggests that organisations (private or public) should maximise their human capital by providing the right skills at the right time to right the people through the right training and education.

CSF 3: Enhance the quality of customer data

Accurate and complete customer information will lead to effective decision-making (Top, 2015). In the absence of error-free or accurate information, municipal stakeholders will make bad decisions. Therefore, the municipality needs to invest in systems and technology that will ensure that the residents' information with regards to water billing is accurate, timely, complete and updated at all times. The municipality should increasingly make use of automated solutions to audit all data in their systems,



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CSF 4: Automate water billing processes

As mentioned earlier, too many manual processes in the water resource billing process can result in errors. The municipality should find innovative ways to reduce the manual activities in the billing process (Khan, Zoha, & Ali, 2016). If the municipality can move from manual business processes to automated processes then they can work with online water-related information and the processes will be transparent to all municipal stakeholders.

CSF 5: Use integrated information systems

The root cause of the problems and challenges that the municipality experiences is the lack of integration of their systems that they use for water billing management. The municipality needs to ensure that the systems they use are fully integrated and they are able to communicate. The integration of systems at the municipality would lead to benefits such as the standardisation of water billing processes as well as the minimisation of communication problems among different municipal stakeholders (Abrahamsson, Hansson, & Isaksson, 2010).

CSF 6: Provide e-Government self-service solutions for customers

Mawela, Ochara and Twinomurinzi (2017) state that municipalities in South Africa are facing challenges with delivering services including: slow response rates to citizens request, limited and inconvenient hours offered by municipalities and long distances to reach municipal offices. Local government institution is at the forefront of understanding citizens' needs and is the delivery arm of the government (cf. Chapter 2). Therefore, the implementation of e-Government can result in several benefits which include enhancement in efficiency of water billing processes and greater trust between the municipality and citizens.

CSF 7: Allocate funding for water billing process automation

The water bill is calculated in three steps. Firstly, meter readers (employees) go household to household to record the readings manually. Secondly, the readings are sent to the municipal offices to be captured. Thirdly at the end, the bills (in paper form) are sent to customers (cf. Section 3.5.1). This traditional billing process is manual and prone to a number of errors. However, implementing an automated billing water system will solve the challenges that are associated with human involvement (Khan, Zoha, & Ali, 2016). Therefore, the municipality should provide more monetary resources for the upgrading of the current information systems for water metering and billing. Furthermore, the municipality should purchase software and technology that will enhance the residential water accounts management. Lastly, the municipality should invest in hiring highly skilled workers with experience in water management information systems.

CSF 8: Continuously monitor and evaluate water billing processes

The municipality should find innovative ways to ensure that there is continuous enhancement in how the residential water accounts are being handled. They should regularly monitor water billing as well as meter reading processes to check for inefficiencies. The municipality should employ the evaluation and monitoring framework as it provides guidelines on how to monitor billing processes and evaluate employees (Molepo, 2011). Furthermore, employees who are part of the water billing processes need to be assessed and monitored on regular basis. They should also be incentivised to provide more efficient work processes.

The managers at the municipality had the opportunity to assess all eight of the CSFs. They found them all relevant to their current work environment and agreed that they were of value to the organisation. However, they chose to comment further on CFS5 and CSF6. The nine proposed CSFs for enhancing information systems capabilities in water management were presented to the managers (Mgr1 and Mgr2) at BCMM to provide expert feedback and comment. The managers were of the view that the proposed CSFs would play an important role in addressing the challenges of water management, specifically the issues in water billing at municipalities. When managers were asked to comment on what they thought was the most critical CSF, they identified CSF 5: **Use integrated information systems (see CSF5)**. They jointly revealed that:

“Billing errors will be minimized once the project to integrate all manual systems is finalized.”

“This will also contribute to a reduction of time spent in preparing the final bill to the customer.”

Furthermore, these experts believed that the automations of the entire billing process could solve many of the challenges that are related to water management at BCMM. They believed that once the water billing processes are automated, the billing issues such as error data capturing would be mitigated. They also mentioned that the municipality (BCMM) is currently planning to automate the water metering process by installing integrated SMART Meters

Lastly, the experts were given an opportunity to comment on CSF 6: **Provide e-Government self-service solutions for customers**. They maintained that self-service systems would make things easier for customers, especial for those who live far from municipal offices. The experts stated that:

“This [self-service system] will enable customers to:

- view their accounts online*
- log account queries online*
- make payments online*
- view progress made in resolving account queries”*

Furthermore, providing e-Government self-services solutions to municipal customers would result in transparency at municipality with regards to information distribution. The more transparent a municipality is, the more customers trust that municipality.

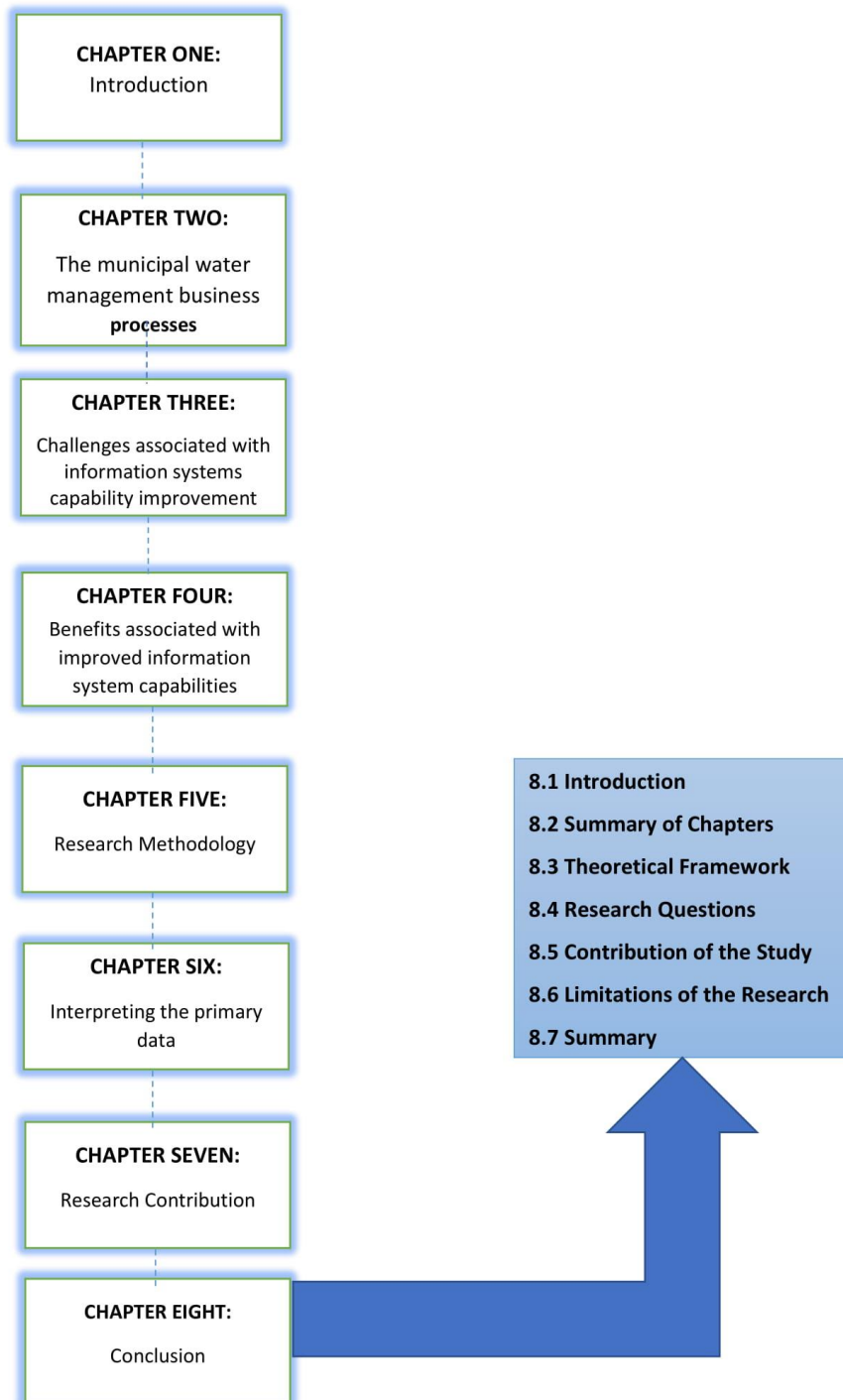
7.4 Conclusion

This chapter discussed the contribution of the research study, which are the critical success factors that must be followed by BCMM and other municipalities to enhance information systems capabilities in water management processes. Prior to the discussion of the research contribution, the levels CMM were used to identify BCMM's current position concerning information system capabilities of water billing processes. BCMM is still on level 2, **repeatable**, with regards to its water billing process maturity because the policies and procedures to manage water billing information systems are not communicated adequately to the employees. However, eight CSFs have were identified and discussed in this chapter. These CSFs will serve as a guide to how can BCMM enhance its IS capabilities of water billing processes. These CSFs were then summarised and linked with the challenges that BCMM face regarding water billing. The conclusion of this research investigation is discussed next.



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Chapter 8: Conclusion



8.1 Introduction

The previous chapters (Chapters 6 and 7) provided an interpretation of the collected data as well as the research findings. The main finding was that BCMM is using unintegrated information systems for water billing. Furthermore, BCMM relies on manual processes in billing customers for water consumption. Thus, the municipality experiences problems and challenges in water billing processes. These problems include errors in water billing and delays in communication between municipalities and customers.

This chapter provides a summary of this research investigation that focused on investigating how information systems capabilities can be Enhanced in water management. This research focused on the water billing processes and the information systems involved directly. The chapter begins by providing a brief summary of the chapters that were presented in this research investigation together with two theories that were adopted. The main research question, as well as the sub-questions, is explored. Subsequently, this chapter presents the significance and limitations of this research investigation.

8.2 Summary of Chapters

This research investigation was triggered by the findings of the Auditor General Report (2013) stating that Buffalo City Metropolitan Municipality (BCMM) still has inadequate processing practices for information concerning water provision. Findings further revealed that even though BCMM has the information systems in place for the management of water billing processes, their capabilities are immature. Water management or provision is quite broad so the researcher narrowed the study to focus only on water billing process.

Chapter 2 provided a background of the local government, stating that a local government is a body that has control over its jurisdiction. The local is divided into three categories, namely Category A (Metropolitan Municipalities), Category B (Local Municipalities) and Category C (District Municipalities). The research study focused on BCMM, which falls under Category A. This chapter went on to mention that local government is the one that has the obligation to deliver services, such as water, to the community. Furthermore, this chapter defined business processes in detail and in the context of water management and water billing. In general, business processes was defined as the the collection of tasks or actions that convert the input to output in order to add value to an entity. In the context of water management, water service business processes would be the tasks or activities that are put in place by municipalities to ensure effective and efficient water resource management. These activities include effective

water billing that will result in efficient water management and Enhanced revenues. In this chapter, the laws and acts that regulate the management of water were identified and discussed. These laws comprise the National Water Act of 1998, the Water Service Act and the Free Basic Water Policy.

Chapter 3 focused on challenges that are associated with enhancing information systems capabilities in water management. However, this chapter started by explaining the differences that exist between information and data. It was mentioned that data is raw facts while information is defined as processed or meaningful data. The challenges that hinder the enhancement of information system capabilities in water management processes were categorised into three factors, namely humanistic, organisational and environmental. Humanistic factors include the issues of overlooking the importance of people in enhancing IS capabilities for water billing processes. This chapter suggested that municipalities need to ensure that their employees are aware of the importance of information systems. Organisational factors refer to challenges that are less visible such as organisational culture, change, attitudes of employees, inadequate capabilities, poor coordination and distribution of responsibilities. Finally, environmental factors refer to the lack of methodology, procedures and rules that can be employed to ensure that the information system delivers positive results.



Chapter 4 focused on benefits that are associated with enhancing information systems capabilities. This chapter started by discussing the innovative solutions that are used by municipalities to enhance water billing processes. These innovations include: mobile phone-based information system, water monitoring and assessment information systems and smart water management. This chapter indicated that in order for municipalities to enhance their IS capabilities they should eliminate manual processes in water billing processes and integrate the information systems used. This chapter further mentioned the importance of information systems integration as another method to enhance information systems capabilities. Palmer (2012) describes information systems integration as the process of melding existing and new technologies to form one capable system that is intended to take on additional tasks in order to enhance the existing system.

This chapter identified the benefits that municipalities can obtain through enhancing information systems capabilities. These benefits include better communication between the municipality and its residents, availability of real-time water-related information, cost-effectiveness and enhanced decision-making in water management as a whole. In conclusion,

this chapter revealed that the full benefits of Enhanced information systems will only be achieved if the information systems that are used in water management and water billing are integrated.

Chapter 5 discussed the methodology that was used to undertake this research project. This research investigation followed the layers that are found in the research onion model developed by Saunders, Lewis, & Thornhill (2009). The interpretivism paradigm was used as the underlying philosophy in this research study. Thereafter, qualitative research methods were used to collect and analyse primary data. This research investigation collected both secondary and primary data. Secondary data was collected through the review of published material such as journals, articles, books and conference proceedings. Primary data was collected through focus groups and semi-structured interviews at Buffalo City Metropolitan Municipality. Lastly, the proposed CSFs were reviewed by the experts to verify their validity and relevance in the water billing sector of BCMM. Nvivo software was used to code and organise the collected data. The thematic process was used to analyse the primary data. The themes were derived from the theories that were adopted by this research study.

Chapter 6 provided the analysis and interpretation of the primary data. In this chapter, sub-themes were utilised to find the meaning of the primary data. The key structures (Mgr & Resp) were used to refer to the participants in data collection. Key Mgr was used to refer to the participants of the semi-structured interviews and key Resp was used to refer to the focus group respondents. Lastly, this chapter identified and tabled the challenges that BCMM face concerning water billing.

Chapter 7 provided the contribution of this research study, which are the Critical Success Factors that must be met at BCMM to enhance IS capabilities in water management (solely water billing process). Prior to the discussion of the CSFs, stages of the Capability Maturity Model were used to assess the current level at BCMM in regarding water billing processes.

The two theories that were used in the research investigation will be discussed next.

8.3 Theoretical Framework

This research investigation utilised two theories, namely Work System Theory (WST) and the Capability Maturity Model (CMM) which includes business process maturity. The argument of the first theory (WST) is that a work system is a fundamental component of every organisation, be it private or public. The reason behind the adoption of this theory is that

BCMM is seen as the organisation that utilises a work system in billing their customers for their water usage. Furthermore, the nine elements of this theory were used to formulate interview questions.

This research study adopted Capability Maturity Model. Firstly, this model was used to assist BCMM to evaluate and assess the maturity of their water billing business processes and secondly, as a guideline for how they can enhance their business processes to ensure that they are matured. Based on the responses received from the respondents during interview sessions, BCMM still has immature water business processes. The main research question that this research study sought to answer is discussed next.

8.4 Research Questions

This research investigation sought to answer and addresses the main research question that was introduced in Chapter 1:

Main research question: ***How can the information systems capabilities of the business processes associated with water management be enhanced at Buffalo City Metropolitan Municipality?*** This main question was further broken down into three sub-questions, which are briefly discussed below. The critical success factors are proposed by this research study managed to answer the main research question by providing guidelines as to how BCMM can enhance water billing business processes.

Sub-question one: **What business processes are associated with water management at municipalities?**

The aim of this sub-question was to explain the business processes that are associated with water management. In Chapter 2, business processes that are associated with water management, particularly water billing, were explained. A further objective of this sub-question was to provide the background on the three spheres of government.

Sub-question two: **What challenges do municipalities encounter when enhancing information systems capabilities?**

This main objective of this sub-question was to identify and discuss the challenges that municipalities face with regards to information systems capabilities enhancement in water management. The challenges were discussed in detail in Chapter 3. These challenges include lack of information systems awareness by municipal employees, lack of top management

involvement and support in water management, resistance of municipal employees to change, existing political fights and middle and senior management attitudes at municipalities, lack of consistency and complexity of the existing information systems that are being used by an organisation to manage its processes, to name a few.

Sub-question three: **What benefits can municipalities realise from enhanced information systems capabilities?**

The main objective of this sub-question was to identify and discuss the benefits that BCMM and other municipalities can obtain when their information systems capabilities are enhanced. Chapter 4 explained these benefits, such as enhanced communication in water management, Enhanced decision-making and the availability of real-time information in water management. This chapter stated that enhanced information systems capabilities would lead to a reduction in manual processes in water billing as well as a reduction in errors in the capture of customers' data.

8.5 Contribution of the Study

Water is a scarce resource as has been stressed throughout this research investigation. However, the literature revealed that the percentage of water wastage is quite high in South Africa. It was further discovered during the research investigation that wastage arises from the poor management of the existing infrastructure as well as the non-payment of citizens for services delivered. Furthermore, wastage is attributed to the inability of municipalities to collect payment actively from citizens for water service provision and for future infrastructure maintenance. Lastly, respondents during the interview process stated that at BCMM water billing systems are not integrated, thus delays in communication and multiple errors are experienced.

Therefore, the CSFs that are proposed in this research study will play an important role in addressing and solving the above-mentioned problems. If municipalities such as BCMM adopted these CSFs properly, it would result in their information systems capabilities being Enhanced. When information systems capabilities are enhanced, the system used in water billing would be properly integrated, thus water wastages and non-payment for water usage would be mitigated.

8.6 Limitations of the Research

This research study focused solely on the information systems that are used in water billing as well as challenges that are associated with water management in municipalities. This research study did not focus on the infrastructural side of water management. However, this study mentioned that ageing water infrastructure, such as pipes, is another challenge in water management. Lastly, this study focused on the local government Category A (Metropolitan Municipalities), and, as such, BCMM has been used as a case study. However, the contribution that is proposed by this study could be generalised to other municipalities with similar water management challenges.

8.7 Summary

The main aim of this study was to identify the challenges that are facing municipalities with regards to water management. This research study was narrowed to focus only on water billing and the systems that are used in municipalities to capture information and bill customers for water usage. This study found that business processes related to water billing at BCMM are still immature. Because the information systems used for billing activities are unintegrated there are delays in communication and many errors and mistakes occur in data capturing. Therefore, this research investigation proposed critical success factors that can help BCMM and other Category A municipalities to enhance information systems for water billing processes.

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University of Fort Hare
Together in Excellence

Appendices

Appendix A: Ethical Clearance Certificate



University of Fort Hare
Together in Excellence

ETHICAL CLEARANCE CERTIFICATE REC-270710-028-RA Level 01

Certificate Reference Number: BOU031SNAK01

Project title: **Critical Success Factors for improving information systems capability in water management processes: A case of Buffalo City Metropolitan Municipality.**

Nature of Project Masters in Public Administration

Principal Researcher: Avuyile Naki

Supervisor: Mr D Boucher

Co-supervisor: Prof O Nzewi

On behalf of the University of Fort Hare's Research Ethics Committee (UREC) I hereby give ethical approval in respect of the undertakings contained in the above-mentioned project and research instrument(s). Should any other instruments be used, these require separate authorization. The Researcher may therefore commence with the research as from the date of this certificate, using the reference number indicated above.

Please note that the UREC must be informed immediately of

- Any material change in the conditions or undertakings mentioned in the document
- Any material breaches of ethical undertakings or events that impact upon the ethical conduct of the research

Appendix B: Request for Permission to Conduct Research Letter

54512 Khayelitsha

Reeston

East London

5247

Date: 01 July 2017

THE CITY MANAGER

BUFFALO CITY METROPOLITAN MUNICIPALITY

PO BOX 134

EAST LONDON

5200



Dear Sir,

University of Fort Hare

RE: REQUEST FOR PERMISSION BY STUDENTS TO CONDUCT RESEARCH STUDY AT BCMM

I am a student at University of Fort Hare, completing Masters degree in Information Systems. I am sure you are aware that any post graduate study involves completion of a Dissertation. It is for this reason that I request your personal and professional permission to partake in my research in directorates and departments within BCMM.

The title of my research Dissertation is Critical Success Factors for enhancing information systems capabilities in water management processes: a case of Buffalo City Metropolitan Municipality, and is being undertaken under the Supervision of Mr Duane Boucher (Supervisor) and Prof Ogo Nzewi (Co-supervisor). The objectives and aims of this research is to explore and evaluate the existing business processes that are in place at BCMM for the water management and to propose critical success factors for enhancing the information systems capabilities of water management processes for better service delivery. The research study shall make use of interviews with key selected potential participants chosen through a purposive research sampling. The potential participants would thus include employees who deals with water management processes. The study will be beneficial to BCMM by ensuring

that BCMM enhances the information systems that associated with water mangement processes to resduce the water wastage.

The ethical research principles will be strictly adhered to throughout the research process so as to maintain a high standard of work and a high quality of the research study. The infomation obtained will be used only for purposes of this study, and will ensure anonymity and confidentiality of potential research participants A copy of the full research report, once approved by the University will be handed to BCMM.

I thus request granting of permission to collect the necessary data/information from relevant officials (and Councillors) at BCMM for the purposes of completion of my Research Dissertation.

Your kind assistance in granting me permission will be highly appreciated and thank you for taking the time in allowing your staff to be part of this research study as I am sure it will not only be of benefit to me but to them as well..

Yours faithfully,

Avuyile Naki



University of Fort Hare

E-mail address: a.vnaki@gmail.com/201210949@ufh.ac.za

Cellphone: 063 0099 309

ACTING MANAGER

Approved	Not Approved
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Appendix C: Supervisor Letter to BCMM

University of Fort Hare

DEPARTMENT OF INFORMATION SYSTEMS

East London Campus:

P.O. Box 7426, East London, 5200, South Africa
50 Church Street, East London, 5201, South Africa
Tel: +27 (0) 43 704 7073 • Fax: +27 (0) 43 704 7070
Email: Infosys@ufh.ac.za



The City Manager
Buffalo City Metropolitan Municipality
PO Box 134
East London
5200

1 July 2017

Dear Sir/Madam

RE: Introduction for UFH Masters of Information Systems student Mr Avuyile Naki

This communique serves as confirmation that Mr Avuyile Naki (student#: 201210949) is registered at the University of Fort Hare in the Department of Information Systems for a Master of Commerce in Information Systems degree. The student's research proposal has been accepted by the Faculty of Management and Commerce Research Committee and ethical clearance has been approved by the University Research Ethics Committee. Mr Naki is being supervised by myself with the assistance of a co-supervisor, Prof Nzewi from the Department of Public Administration. The ethical clearance certificate erroneously states the degree as a Master of Public Administration, which is in the process of being corrected to Master of Commerce in Information Systems.

Mr Naki's research area of interest is the information systems associated with water management billing at municipalities and as part of his research he will need to collect primary data from the municipality. The primary data will be collected by conducting a focus group with six to eight people who are involved in water management billing activities and associated information systems support. It may be necessary for Mr Naki to conduct some follow-up interviews to clarify any issues that are unclear when he starts transcribing his notes.

Mr Naki is expected to conduct his data collection in a professional manner that complies with the ethical guidelines of the University for conducting research. He is therefore required at all times to remain impartial and avoid bias when conducting his research. If it is felt at any time during the data collection that Mr Naki is not conducting himself professionally and ethically, then this should be communicated to the undersigned and Mr Naki must be asked to leave your premises. Naturally, this would have implications for the completion of his research, but maintaining a good relationship with BCMM is important in order to foster future opportunities to conduct research.

Prof Nzewi and I will monitor the analysis and write up of Mr Naki's Master's dissertation, but will not necessarily be physically present when he conducts his focus group and interviews as his taking ownership of the data collection process is an integral part of his postgraduate studies.

I trust that you will allow Mr Naki access to the BCMM to conduct his research, and I can be contacted on the email below should you require any additional information.

Yours sincerely

Mr Duane Boucher
Email: dboucher@ufh.ac.za

School of Business and Enterprise
Faculty of Management and Commerce: Tel: +27 (0) 43 704 7196

www.ufh.ac.za

Appendix D: Approval Letter from BCMM

BUFFALO CITY METROPOLITAN MUNICIPALITY



MEMORANDUM

Date: 20 JULY 2017

From: HEAD:INFORMATION
KNOWLEDGE
MANAGEMENT, RESEARCH
AND POLICY

To: AVUYILE NAKI

Our ref:	Please ask for MR J.FINE (043) 705 9742	Your ref:
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**RE: REQUEST FOR PERMISSION TO CONDUCT RESEARCH IN BCMM:
MR. AVUYILE NAKI**

It is hereby acknowledged that **Avuyile Naki**, a student at **Fort Hare University**, completing the **Master's Degree in Information Systems**, has met the prerequisites for conducting research at Buffalo City Metropolitan Municipality (BCMM) for partial fulfillment of his degree. He has provided us with all the necessary documentation as per the BCMM Policy on External Students conducting research at the institution. With reference to the letter to the Acting City Manager received on the 19th of July 2017, permission was requested to conduct research at BCMM for his Research Report, entitled "**Critical Success Factors for improving information systems capability in water management processes: a case of Buffalo City Metropolitan Municipality**". This request was acknowledged by the Office of the Acting City Manager, and forwarded to the Information & Knowledge Management, Research & Policy Unit for further

assistance. **Avuyile Naki** was asked to provide the Unit with the necessary documentation, which he subsequently did.

The relevant Officials to assist in the research were identified and duly informed about the research, and the fact that **Avuyile Naki** has met all the prerequisites. Their contact details have also been provided to him and he was informed to contact them directly for assistance.

We wish you good luck in your studies.



DR T F NORUSHE

HEAD: INFORMATION, KNOWLEDGE MANAGEMENT, RESEARCH AND POLICY

54512 Khayelitsha
Reeston
East London
5247

Date: 01 July 2017

THE CITY MANAGER
BUFFALO CITY METROPOLITAN MUNICIPALITY
PO BOX 134
EAST LONDON
5200

Dear Sir,

**RE: REQUEST FOR PERMISSION BY A MASTERS STUDENT TO CONDUCT
A RESEARCH STUDY AT BCMM**

I am a student at the University of Fort Hare, completing a Masters degree in Information Systems. I am sure you are aware that any post graduate study involves completion of a dissertation. It is for this reason that I request your personal and professional permission to partake my research in the applicable directorates and departments within BCMM.

The title of my research dissertation is: ***Critical Success Factors for improving information systems capability in water management processes: a case of Buffalo City Metropolitan Municipality***, and is being undertaken under the Supervision of Mr Duane Boucher (Supervisor – Information Systems) and Prof Ogo Nzewi (Co-supervisor – Public Administration).

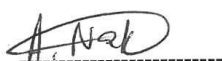
The objectives and aims of this research is to explore and evaluate the existing business processes that are in place at BCMM for the water management and to propose critical success factors for improving the information systems capability of water management processes for better service delivery. To conduct the research study it will be necessary to conduct a focus group and individual interviews with employees who are involved in the billing activities associated with the water management processes. **It is expected that the study will benefit BCMM by identifying areas of potential improvement in the use of information systems in the water mangement processes in order to improve service delivery.**

Ethical research principles will be strictly adhered to throughout the research process so as to maintain a high standard of work and a high quality of the research study. The University Research Ethics Committee has approved the underlying principles of the research and issued **ethics reference: BOU031SNAK01**. The information obtained will be used only for the purposes of this study, and the researcher will ensure the anonymity and confidentiality of potential research participants. A copy of the final research report, once approved by the University Research Committee will be made available to BCMM.

I thus request permission to collect the necessary data/information from identified employees associated with the billing of water management and the associated information systems support at BCMM for the purposes of completing my degree. It is my intention to make as minimal disruption to the day-to-day work procedure of the staff that will participate in the research.

Your consideration for the granting of permission is appreciated and for allowing the relevant staff the necessary time to participate in the focus group and interviews.

Yours sincerely,



Avuyile Naki
E-mail address: a.vnaki@gmail.com/201210949@ufh.ac.za
Cellphone: 063 0099 309


(ACTING)-MANAGER

Approved	Not Approved
----------	--------------

Appendix E: Ethics Research Confidentiality and Informed Consent Form

Research Instrument for the Masters Dissertation titled:
Critical Success Factors for improving information systems capability in water management processes: a case of Buffalo City Metropolitan Municipality

Research Ethics Confidentiality and Informed Consent Form

Dear Interviewee

The University of Fort Hare is requesting relevant individuals involved in the water accounting management and the associated information systems support at the Buffalo City Metropolitan Municipality to participate in a focus group and interviews to assist the researcher in gaining a better understanding of water management practices at municipalities.

A Master of Commerce in Information Systems student, Mr Naki Avuyile, who is registered at the University of Fort Hare, is conducting research related to critical success factors for improving information systems capability in water management processes. We seek to investigate to what extent water accounting management processes make use of information systems and to understand areas are impacted by the use / non-use of these systems, and the impact / difficulty in making use of them. Please understand that your participation in this research is voluntary. We would really appreciate it if you share your thoughts with us. If you choose not to take part in answering these questions, you will not be affected in any way. If you agree to participate, you may stop me at any time and tell me that you don't want to go on with the interview. If you do this there are no consequences of doing so.

Confidentiality will be observed throughout. I will not be recording your name or that of the organisation anywhere on the questionnaire and no one will be able to link you to the answers you give. The information will remain confidential and will not be shared with anyone in the organisation or anyone outside the organisation except for the presentation of the findings in academic conferences and / journals. At all times the names of participants will be kept in confidence.

The interview will last a minimum of 1 hour. I will be asking you some questions and ask that you are as open and honest as possible in answering these questions. I know that you cannot be absolutely certain about the answers to these questions but I ask that you try to think about these questions. If possible, the focus group questions would have been shared in advance, which would give you additional time to formulate your answers. When it comes to answering questions there are no right and wrong answers. In order to ensure that I don't miss any important comments that you make when answering the questions, I may ask your permission to record your responses during the focus group session. Note that the recorded comments will be kept secure and any transcripts generated from it will not identify you in any way, but rather as Respondent A, B, etc.

**Research Instrument for the Masters Dissertation titled:
Critical Success Factors for improving information systems capability in water
management processes: a case of Buffalo City Metropolitan Municipality**

If possible, I would like to be given permission to return to your organisation once I have completed my study and share my findings. Should have any questions please contact me on 063 0099 309/a.vnaki@gmail.com or my supervisor on 086 445 0188/dbouchera@ufh.ac.za

**Research Instrument for the Masters Dissertation titled:
Critical Success Factors for improving information systems capability in water
management processes: a case of Buffalo City Metropolitan Municipality**

INFORMED CONSENT

I hereby agree to participate in the research being conducted regarding critical success factors for improving information systems capability in water management processes at Buffalo City Metropolitan Municipality. I understand that I am participating freely and without being forced in any way to do so.

I also understand that I can stop my participation in the focus group at any point should I not want to continue and that this decision will not in any way affect me negatively.

I understand that this is a research project whose purpose is not necessarily to benefit me personally.

I have received the contact details of a person to contact should I need to speak about any issues which may arise in this interview.

I understand that this consent form will not be directly associated with the questionnaire, and that my answers will remain confidential.

I understand that if at all possible, feedback will be given to my organization on the results of the completed research.

.....

Signature of participant

Date:

I hereby agree to the voice recording of my responses to the interview questions.

.....

Signature of participant

Date:

**Research Instrument for the Masters Dissertation titled:
Critical Success Factors for improving information systems capability in water
management processes: a case of Buffalo City Metropolitan Municipality**

Interview preamble

The following questions focus on the involvement of information systems in water management focusing on billing processes at Buffalo City Metropolitan Municipality.

Interview Questions

1. Processes and activities

- a) Can you give me an overview of how residential water accounts are managed (processed) at the municipality?
- b) What can you tell me about the municipal rules, regulations, policies and procedures that are relevant to residential water account management? Are they clear and easy to follow?
- c) How are procedures that are followed for the management of residential water accounts documented and communicated to you by superiors/managers? How often is this done?

2. Participants

- a) How and by whom is the water meter reading supplied to the accounts department?
- b) How important are computer literacy skills in the municipal workplace? Is suitable training provided to staff on the systems used for water account management procedures and features?

3. Information

- a) What is done to check the accuracy, currency, and completeness of the stored information of residential account holders?
- b) Is there any way that residents can electronically update their own information?

4. Technologies

- a) What computer-based information systems are used at BCMM for collecting and processing residential related water accounts information? Are these systems automated or is there still much data capturing involved by employees? [Prompt: What parts of the process for water account management are automated and which require capturing?]
- b) How often are new technologies (hardware and software) being introduced into your workplace to improve the existing processes?

**Research Instrument for the Masters Dissertation titled:
Critical Success Factors for improving information systems capability in water
management processes: a case of Buffalo City Metropolitan Municipality**

- c) What challenges (e.g. cultural, political, etc.) are experienced when new technology/systems are introduced at the municipality?
- d) How do you think that technology can assist in improving the residential water account management process?

5. Customers

- a) What kind of problems do residents typically experience when it comes to their residential water accounts? Are these easily and speedily resolved using the available information systems?
- b) How can residents currently log a fault related to their water consumption and billing? Has there been an improvement in how this is done over the last couple of years?
- c) Is there a process for a resident to upload their water meter reading onto their account? Are there any plans to fully automate water meter reading activity?

6. Environment

- a) What factors in your workplace might impact on how you do your job when processing residential water accounts?

7. Infrastructure

- a) What resources (human, technological, informational) need to be available in your workplace to support the managing of residential water accounts?
- b) How easy is it to get a complete 'picture' of a resident, i.e. their bill, queries logged, services requested, etc. from one system at the municipality? i.e. are the systems integrated?

8. Strategies

Does the municipality monitor and evaluate the performance of the water account processes and the employees who are a part of them? How is this done?

Your time taken to participate in this focus group is appreciated.

Appendix F: Focus Group Interview Sample

FOCUS GROUP NOTE-TAKING SUMMARY

Participants: Resp1, Resp2, Resp3, Resp4, Resp5, Resp6, Resp7,

Interview Questions

Main Theme: Processes and Activities

Sub-theme: *Billing processes occur to produce services for municipal customers*

- a) Can you give me an overview of how residential water accounts are managed (processed) at the municipality?

Participants	Response
Resp1	First of all the customer accounts management doesn't start here at water billing maintenance it starts from the water meter reading section, the meter reader must go to take the water readings then those readings are being captured, after the reading is captured water billing officers run a report. Then we as billing officers we will use that report to check whether or not those readings are correct then we process the accounts
Resp2	There various reasons that can result in differences in meter readings such water leaks, or the meter has been changed.
Resp3	
Resp4	Just before we process the accounts, there is an audit process that we run after the meter reading has been captured to verify whether the previous readings correspond with the current reading being taken. In terms of the consumption if the current reading is less than the previous reading that means something is not right we have to send back the meter readers to re-read the meter and also to check whether that meter didn't get stuck, sometimes It happens that the meter is dirty or you cannot properly access the meter readings Before you can process the customer accounts it very important to report to water works if there something wrong the meter. After all, this has been done that's when the bill or processing of accounts begins

Resp5	The audit process is being done to check whether the meter reading captured this month are the same as the one captured previously in terms of the water consumption
Resp6	
Resp7	

- b) What can you tell me about the municipal rules, regulations, policies and procedures that are relevant to residential water account management? Are they clear and easy to follow?

Participants	Response
Resp1	
Resp2	There are campaigns that are being held in order to find out the problems that residents might have with regards to municipality services and how to rectify them going forward then all this information is being collected and submitted to the council for a resolution.
Resp3	 University of Fort Hare <i>Together in Excellence</i>
Resp4	Also, there is Municipal Financial Management Act and Risk Policies. The employees are getting training about these policies
Resp5	There an annual report that is made up of suggestions from the council how to run a municipality and basic services of the municipality. For example, there are rules on tariffs, the municipality is made up of two types of residents namely indigent (they do not afford based on various reasons) and people who can afford therefore the billing system is being regulated by the tariffs, to ensure that residents are billed fairly. This is called indigent policy There is a Credit Control Policy – it regulates whether the people are being billed at the correct time, the correct tariff was being used, billed for a correct consumption Yes these are clear, they are also communicated to the councillors
Resp6	With regard to the procedures, before the water accounts are run, there are reports that are made to see whether the accounts are being billed accurately. Each employee here is being allocated to her

	area, you have your book that has the meters of that area so each employee has to monitor whether her accounts are being billed correctly before they can go to the final report.
Resp7	Those reports are called dummy run, also we ask one another whether or not it did this correctly before it (report)can go to the supervisor

- c) How are procedures that are followed for the management of residential water accounts documented and communicated to you by superiors/managers? How often is this done?

Participants	Response
Resp1	
Resp2	
Resp3	
Resp4	Yes, there are documented in the annual report, supervisor put the internal procedures about what supposed to be done at a given moment how it is being done.
Resp5	By law, these are supposed to be done on quarterly basis, but that doesn't happen here
Resp6	Staff follow the instructions that are given to them by the supervisor, there are targets, performance appraisal and reviews whereby the check if respond or do the correct thing. With regard to how often this is being done, I don't want to lie this is municipality
Resp7	

Main Theme: Participant

Sub-theme: *Training employees to perform billing processes effectively*

a) How and by whom is the water meter reading supplied to the accounts department?

Participants	Response
Resp1	Our water stations are not digitalised, but the meter readers are using these devices, to avoid a situation in which the paper can be wet in the case where the book is used to read the meter.
Resp2	Back the day meter readers didn't have any devices, they used to write the readings down, and these will by manual captured in the system I hope you now understand this it is not only the responsibility of the municipality to do the meter reading, also you as the resident you have the duty to read your meter. For example you in your house you have a Fence and it was closed during the meter reading, therefore you should read the meter and call the municipality [Moderator question: what will happen if the customer supply an incorrect reading to the municipality?] As the customer you do know what was your previous reading, therefore we can tell you if you are lying and that will result in incorrect billing
Resp3	The meter reading is being done by the municipality employees, they do not read them manually they use handheld devices
Resp4	Those handheld devices communicate with the system that we use here at the office. If there is an incident that should be reported this system will tell us Also, It is a responsibility of the customer to read their own meters and submit the readers to the municipality. The meter reader will generate his/her report before a system can generate its own report. This report will go to the audit section. It is

	supposed to go that route according to the municipal procedures. But here we take shortcuts to do that Most of the time this device will take the meters directly to the system unless the meter is not on the system
Resp5	The handheld device is being programmed to the system, as soon as the meter reader reads the meter it appears in the system. These devices are more advanced because they can also take the picture of the meter if for example the meter is damaged These handheld devices have a sensing capabilities
Resp6	These handheld devices are just being introduced now, meter readers used to go around with books
Resp7	I just want to ask this question to you. You are saying this device takes from the ground to the system reason why I am asking this is that there are meters that are on the ground but they are not in the system.



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Appendix G: Semi-Structured Interview Guide

INTERVIEW NOTE-TAKING SUMMARY

Date of Interview	03 October, 2017
Location of interview	BCMM
Moderator Name	Avuyile Naki
Department	Water Accounts Management

Interview Questions

1.Processes and Activities

- d) How are procedures that are followed for the management of residential water accounts documented? How as a manager do you communicate these procedures to your employees? How often is this done?

Number	Response
1a.	 University of Fort Hare Together in Excellence

2. Information

- a) What is done to check the accuracy, currency, and completeness of the stored information of residential account holders?

Number	Response
2a	

- b) Is there any way that residents can electronically update their own information?

Number	Response
2b	

3. Technology

- a) What computer-based information systems are used at BCMM for collecting and processing residential related water accounts information? Are these systems automated or is there still much data capturing involved by employees? [Prompt: What parts of the process for water account management are automated and which require capturing?]

Number	Response
3a	

- b) How do you think that technology can assist in enhancing the residential water account management process?

Number	Response
3b	



University of Fort Hare

4. Customers

- a) What kind of problems do residents typically experience when it comes to their residential water accounts? Are these easily and speedily resolved using the available information systems?

Number	Response
4a	

- b) How can residents currently log a fault related to their water consumption and billing? Has there been an enhancement in how this is done over the last couple of years?

Number	Response
4b	

- c) Is there a process for a resident to upload their water meter reading onto their account? Are there any plans to fully automate water meter reading activity?

Number	Response
4c	

5. Environment

- a) What factors in the municipality that might impact on how employees do their job when processing residential water accounts?

Number	Response
5a	

6. Infrastructure

- a) What resources (human, technological, informational) need to be available in the workplace to support the managing of residential water accounts?

Number	Response
6a	



- b) How easy is it to get a complete 'picture' of a resident, i.e. their bill, queries logged, services requested, etc. from one system at the municipality? i.e. are the systems integrated?

Number	Response
6b	

7. Strategies

- a) Does the municipality monitor and evaluate the performance of the water account processes and the employees who are a part of them? How is this done?

Number	Response
7a	

Your time taken to participate in this interview is appreciated.

Appendix H: Research Article: A Framework to Mitigate Water Billing Information Systems Integration Challenges at Municipalities

Retrieved:

https://www.researchgate.net/publication/325988349_A_Framework_to_Mitigate_Water_Billing_Information_Systems_Integration_Challenges_at_Municipalities



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Chapter 6

A Conceptual Framework for Information Systems Capability Improvements in Municipal Water Resource Management

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