

UNIVERSITY OF KWAZULU NATAL

**A STUDY OF THE IMPACT OF WATER SCARCITY ON CUSTOMER SERVICE:
THE CASE OF MHLATHUZE WATER**

By

Sithembile Pearl Mntungwa

217030248

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Name: Sithembile Pearl Mntungwa	No: 217030248	
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Abstract

Water scarcity is a major global issue and all spheres of society on a daily basis feel its impact. Stakeholders in the water services sector, especially water services providers, are affected by water scarcity as they are at the forefront of water provision, both for economic growth and for social development; hence the need for mitigation measures to be timeously implemented so as to minimise the impact on the water value chain. This qualitative study aimed to investigate the role of water scarcity, its challenges, and related mitigation strategies to Mhlathuze Water and its bulk water customers. Critical case sampling was used with a sample size of 15. In order to collect data, interviews were conducted with the management of Mhlathuze Water, as well as the management of the institutions where Mhlathuze Water supplies water (i.e. customers). This data was thereafter analysed with the computer programme NVivo in order to conduct thematic analysis of the data. The research indicated that water scarcity plays a role in Mhlathuze Water and its customers in that water scarcity affects customer service. The fact that there is a supplier-customer relationship means that if Mhlathuze Water is unable to supply water due to its scarcity, then the entity is unable to fully meet its contractual obligations, which ultimately affects the services it renders. The challenges of water scarcity were also discussed, with the main ones being the decline in revenue, the inability to service customers, the loss of business and unemployment. This is because Mhlathuze Water's core business operation, as a water board, is the supply of water; hence if water is scarce then it poses economic and social challenges. Finally, based on the challenges that were highlighted, the recommended mitigation strategies were presented. These included awareness, alternative water sources, planning and infrastructure development.

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CHAPTER 1: INTRODUCTION

1.1 Introduction

Water scarcity is included as part of the main issues that the globe is experiencing and water resources are under increasing stress. Various studies have explored how climate change and population growth might have an impact on water scarcity.

Donnenfeld, Crookes and Hedden (2018) reported that South Africa forms part of the list of developing countries that are regarded as water scarce countries. The Department of Water and Sanitation (2015) reported that South Africa ranks as one of the 30 driest countries in the world. Despite this, between 37% and 42% of potable water cannot be accounted for (i.e. non-revenue water) while South Africans use 62% more water than the world average, which further worsens the water scarcity situation. Donnenfeld, Crookes and Hedden (2018) further mention that the 403mm of rainfall that was received by the country in 2015 was the lowest amount ever recorded by the South African Weather Service since rainfall data started being collected in the early 1900s. This was worsened by the fact that the rainfall received 3 years prior the 2015 drought was below average, thus making the drought one of the most severe droughts to ever be experienced in the past 70 years. The drought that was declared in 2014 made the country aware to a certain extent the reality of water scarcity in South Africa, however water scarcity existed before the drought and hence one may conclude that the drought is not necessarily the source of water scarcity, however it intensifies the effects of water scarcity. Studies have shown that there are existing, affordable technologies that stakeholders in the water value chain could employ, such as efforts towards the realignment of supply and demand and parallel to that putting plans in place to utilise water sustainably so as to secure water for the future, such as water demand management. Water availability plays a key part in social and economic development, hence it is no surprise that clean water and sanitation is included in the United Nations' 17 sustainable development goals to be achieved by 2030.

According to the Department of Water Affairs (2013), the South African government recognises the reality and effects of water scarcity hence the National Water Resource Strategy that was adopted in recent years. The government utilises state-

owned entities such as Mhlathuze Water in order to accomplish the targets and objectives that the strategy aims to meet.

Mhlathuze Water (2017) annual report highlights that Mhlathuze Water is a water services provider supplying water to the municipality for domestic and industrial use, as well as supplying some industries directly. The industries in the area utilise a considerable volume of water in the region and range from pulp and paper production; mining; smelting and acid as well as fertiliser production. All these industries require different “grades” of water for their processes and hence water availability is critical for their sustainability.

This chapter provides an introduction to the study that was undertaken, starting with what motivated the study to be undertaken, then the focus of the study followed by the statement of the statement. Following the problem statement will be the objective and research questions as well as a brief outline of the methodology that was followed which includes the limitations of the study. The chapter concludes with a summary of all discussions contained herein.

1.2 Motivation of the study

Water scarcity is on-going and its impacts are felt by all spheres of society on a daily basis in both communities and industries. The study was identified to be of significance since it provides an assessment of how water scarcity impacts on the everyday operations of Mhlathuze Water in relation to the service provided to its customers. Customers rely on Mhlathuze Water as a water services provider to provide reliable service. There is therefore a need to investigate the specific impacts that water scarcity has in the way in which Mhlathuze Water can provide water to customers so that the management of Mhlathuze Water can implement strategies and plans on how to manage the situation. This is critical for the organisation as it depends on water as a primary input to its core business operations. The organisation is also in a position to influence policies in the water sector when it comes to water resources management, as it is an established water board. The recommendations made from this study may therefore assist policy makers within the institution and the water sector as a whole to put together policies that can effectively mitigate the impacts of water scarcity in the future. This study will

therefore help improve current practice. The study can also be used as a basis for future research on water scarcity for institutions similar to Mhlathuze Water.

1.3 Focus of the study

This research concentrated on identifying the role of water scarcity in Mhlathuze Water and its customers, including the explanation of the challenges of water scarcity in Mhlathuze Water as well as the identification of strategies that can be employed to mitigate the challenges of water scarcity to Mhlathuze Water customers. The focus was specifically on Mhlathuze Water because Mhlathuze Water depends on water availability for its core business operations hence unavailability of water would affect its ability to supply water to customers (i.e. customer service).

1.4 Problem statement

The study investigated the role of water scarcity, its challenges and mitigation strategies in Mhlathuze Water and its bulk water customers. Water scarcity is an ongoing phenomenon globally. Research by Mekonnen, Pahlow, Aldaya, Zarate & Hoekstra (2015) suggests that since the demand for water is increasing, water scarcity poses a threat with regards to sustainable development for the global population. According to the World Economic Forum (WEF), in its 2014 annual report, water scarcity is listed as the top global risk when assessed in relation to the perceived impact. Customer service is the combination of activities and that are undertaken in order to ensure continued customer satisfaction in relation to the product or service offering. Customer service plays a major role in sustaining ongoing customer relationships, which is crucial to lasting revenue. However, water is a basic human need therefore the issues of water availability or lack thereof are not only economic but there are social and environmental implications as well. In its report in 2009, the Pacific Institute (PI) states that water scarcity directly affects business operations, raw material supply, intermediate supply chain, and product use in a variety of ways. Therefore water services providers, like Mhlathuze Water, need to ensure that customer needs are met and over and above this ensuring that in the midst of water scarcity proper prioritisation is made for all customers, guided by the appropriate legislative requirements. Mhlathuze Water has contracts with customers however if water scarcity intensifies, for example, when there is drought, first preference is given to domestic consumers thereby affecting the supplier-

customer relationship. There is therefore a need for the entity to understand the role of water scarcity in its business operations.

The study undertook to research the role and challenges of water scarcity and the findings were used to propose strategies for Mhlathuze Water to mitigate the challenges.

1.5 Research objectives

The following were the objectives of the study:

- Investigate the role of water scarcity in Mhlathuze Water and to its customers.
- Explain the challenges of water scarcity in Mhlathuze Water.
- Identify what can be done to mitigate the challenges of water scarcity to Mhlathuze Water customers.

1.6 Research questions

The study aimed to answer the following questions:

- What is the role of water scarcity in Mhlathuze Water and to its customers?
- What are the challenges of water scarcity in Mhlathuze Water?
- What can be done to mitigate the challenges of water scarcity to Mhlathuze Water customers?

1.7 Research Methodology

The inductive approach was chosen as the paradigm underpinning this study. This approach is ideal for converting specific observations of patterns and occurrences to broader generalisations and theories (Saunders, Lewis and Thornhill, 2012). The aim of inductive reasoning is to formulate meanings from the collected data so as to establish connections and patterns to construct a theory (Creswell, 2014). Therefore this paradigm was anticipated to be able to provide the best understanding of the problem being researched.

Qualitative research was selected for this study, specifically using a case study. This research strategy (i.e. case study) was found to be suitable for this study as the research aimed to focus on a particular institution (i.e. Mhlathuze Water) and will be useful in addressing the research questions.

The study was conducted at Mhlathuze Water, in Richards Bay, and this organisation was selected because it is the water service provider in the area. The participants were Mhlathuze Water management as well as bulk water customers (i.e., the relevant managers at the institutions where Mhlathuze Water supplies water to).

Interviews were selected to collect data for this study as they were identified to enable the researcher to gather relevant data from participants. Stuckey (2013) outlines that interviews are a main method of data collection in qualitative research in order to direct the participants to respond to an explicit research question. Semi-structured interviews were used in this study so as to guide the interview process using a specifically designed questionnaire focusing on the role of water scarcity and its challenges. The interviews were recorded using an electronic recording device and then transcribed accordingly for analysis.

The target population was the Mhlathuze Water's management team and their bulk water customers. The target population at these bulk water customers was also their management team. The sample size for this study included 15 participants which were made up of Mhlathuze Water's bulk water customers (six participants) as well as Mhlathuze Water's management (nine participants). Qualitative research uses purposeful or criterion base sampling (Patton, 2015). Critical case sampling was used for this study. Critical case sampling refers to a sampling method whereby the researcher collects samples that have the most potential of giving the vital information that is being sought in the study (Creswell, 2014).

To answer the research questions in this study, contextual, demographic, perceptual and theoretical information was gathered. Interviews were used as the data collection method for the study. The researcher used computer assisted qualitative data analysis by using the NVivo software package in order to perform data analysis effectively and speedily. Qualitative research has its basis on subjective, interpretive and contextual data. This makes the results of the research open to scrutiny and questions. It is for this reason that the researcher has to ensure that the necessary steps are taken to ensure that the findings are reliable and valid. In this study reliability and validity was achieved through data triangulation, thorough record keeping, ensuring that data interpretation is standard and transparent, including

verbatim accounts by the participants in order to substantiate findings and accounting for all types of biases, which may have influenced the findings.

For this study, the researcher ensured that the identifications of the participants in the study were kept private by assigning pseudonyms to each participant. A confidentiality agreement, by means of the informed consent form, was entered into prior to the commencement of the study with each of the participants.

Ethical clearance was obtained from the University of KwaZulu-Natal's Ethics Committee. Gatekeeper's approval was obtained from Mhlathuze Water before the interviews were conducted.

1.8 Limitations of the study

The following limitations were identified:

- The scope of this research was limited to Mhlathuze Water hence the results are valid for Mhlathuze Water however, they can also be extended to similar organisations to confirm applicability.
- Although there are prior studies that have been conducted on water scarcity and its impacts, there is no study that was found to have been done on Mhlathuze Water or similar organisations.
- The interview skills of the researcher may have influenced the participants' responses however this was mitigated by preparations prior to the interview process as well as utilising the interview schedule.
- The language used to conduct the interviews was English, while the interviewees were not all native English speakers, hence the English speakers might have had an advantage in comprehending the questions. The researcher simplified all the questions as and when requested.
- Due to the nature of the study (i.e. case study), only 15 managers were interviewed and this sample size may not represent similar views to the others. This was identified as a limitation.
- There was limited time to conduct the research, it is possible that more details regarding the subject matter were not tapped into which might need to be explored in future research.

1.9 Chapter outline

Chapter 1: Introduction

Chapter 1 outlines the background and context of the study and identifies the study topic, research problem, research objectives, research questions, the motivation of the study, the scope and a brief summary of the research methodology. The limitations of the study is also included. Finally the sequence of the respective chapters of the study are outlined.

Chapter 2: Literature review

The literature review highlights some recent scholarly work and discussions on water scarcity. A description of water scarcity is provided including the greenhouse effect theory, which explains climate change and global warming which ultimately led to water scarcity. Customer service is also defined. Thereafter the legislation surrounding water services in South Africa is explored in detail, including how the entity being studied fits in. The state of water scarcity, including the impacts, both globally and in South Africa is highlighted, as per the various authors and publications.

Chapter 3: Research Methodology

Chapter 3 presents the research design and methodology that guided data collection from the participants. The chapter highlights the sampling procedure that was followed, the instruments used for data collection, as well as how data was collected and analysed in the study.

Chapter 4: Findings and Discussion

This chapter can be said to be at the centre of this research as the findings are presented and discussed at length, with reference and contrast to literature as well as relevance with regards to the objectives of the research undertaken.

Chapter 5: Conclusion and Recommendations

Chapter 5 presents the conclusions and recommendations of the research. An overview of the problem is outlined, followed by a discussion of what was identified and concluded for each research question. Based on these conclusions,

recommendations are made to policy makers at Mhlathuze Water regarding the strategies and plans that can be implemented to mitigate the effects of water scarcity. Finally, the limitations of the study are highlighted as well as recommendations for future research.

1.10 Summary

This chapter has provided a background and overview of the study. The problem statement, objectives and the research questions have been presented and explained. Furthermore, the author has elaborated on what gave motivation for the study to be undertaken and what contribution it will make to the existing body of knowledge in the sector. A brief outline of the contents of each of the chapters of the study has also been explained. Chapter 1, as an introduction for the whole study, is brief and basically lays the foundation of the study in its entirety as presented in the subsequent chapters of this dissertation. From here the next chapter is the literature review including theoretical framework underpinning the study.

CHAPTER 2: AN OVERVIEW OF WATER SCARCITY, CHALLENGES AND MITIGATION MEASURES

2.1 Introduction

This chapter presents a consolidation of previous and current relevant academic literature including the views of the researcher on the subject of water scarcity, its causes and mitigation approaches; based on the research questions, objectives and the problem statement. A number of scholarly publications were reviewed based on relevance to the topic.

The literature review presented begins by presenting important definitions and discussing the state history of water scarcity. Drawing from the South African context, previous studies and their findings are presented on the state of water scarcity, its challenges and mitigation approaches. Furthermore, the literature review presented centres around the research objectives and the questions that the study intends to answer.

2.2 Definition of water scarcity

Scholars have put forward a number of definitions and interpretations of the concept of water scarcity. Van Loon and Van Lanen (2013) define water scarcity as a state whereby water resources are insufficient to meet average water requirements in the long-term. This is when available water is low in relation to water demand, which implies that the available water resources are low and there is long-term imbalances in supply and demand. Jaeger and Plantinga (2013) state that, the general understanding is that water scarcity exists when the amount of water is inadequate and hence insufficient to meet the needs of all users. White (2014) concurs that water scarcity can generally be understood as the absence of access to sufficient amounts of water for the population as well as environmental requirements.

In 2012 the Food and Agriculture Organisation (FAO) defined water scarcity as the situation where the demand by all water users, including environmental requirements, cannot be fully met under current arrangements thereby affecting the users. This definition refers to a state of imbalance of supply and demand.

In general terms, Falkenmark (2007) and Appelgren (1998), cited in Tapela (2012) view water scarcity as lack of water in relation to water requirements.

Winpenny (1995) cited in the FAO (2012) argues that in popular usage, water scarcity is a situation whereby there is inadequate water to satisfy normal requirements. He further refers to different degrees of scarcity (i.e. absolute, life-threatening, seasonal, temporary, and cyclical). This author further claimed that although water scarcity may originate from water shortage, however it may also be a societal or habitual behaviour. The on-going efforts by different countries particularly in Southern Africa towards sustainable water demand management practices suggest that water scarcity may be to a certain extent socially constructed, i.e., it may be a reflection of the history of institutional management practices; infrastructure development and the perception of water being free for all since it is a naturally occurring resource. However, in order to change historical practices, politics cannot be left aside. Thus, managing water demand allows for the creation of more water without interfering with the hydrological cycle.

Hoekstra (1999) raised different views on the subject of water scarcity and defines it as a state whereby water users compete over available water resources. This relates to threats to water resources, for example, people's determination for economic development together with the ever increasing population growth. He further mentions that water scarcity can be managed by monitoring water consumption, setting pricing structures (i.e. tariffs) and on-going awareness of all water users regarding the status of water resources. Furthermore, Hoekstra (1999) refers to the generally recognised concept of water as an economic good and that the cost of water is a suitable indicator of the water scarcity situation.

2.3 Measurement of water scarcity

Nepomilueva (2017) found that various researchers in recent years have developed tools for quantifying water scarcity (called indexes) with the aim of measuring water scarcity within a particular area or region or even a country in order to support decision-making and policy expansion aimed at addressing water scarcity. According to Nepomilueva (2017), the Falkenmark indicator is the most commonly used index that is used to quantify water scarcity. A Swedish expert, Falkenmark, developed the indicator, depicted in Table 2.1 in 1989.

Table 2. 1: Falkenmark water stress indicator

INDEX (m³/capita/year)	CLASS
greater than 1700	No stress
1000 – 1700	Stress
500 - 1000	Scarcity
less than 500	Complete scarcity

Source: Nepomilueva (2017)

According to Table 2.1, this indicator is used to calculate the level of water security in a particular country taking into consideration the water availability and the population of the country. According to this indicator, 1700m³ of water resources per person annually is the acceptable amount to have supply of water that can be sustained by the water resources. This threshold takes into consideration the average water requirements for all water users (domestic, agricultural, industrial) as well as the environmental requirements. This means that if a country's renewable water supplies are unable to sustain this threshold then the country is under water stress. A figure of 1000 m³ per person signifies that a country is under water scarcity while a figure below 500m³ means absolute water scarcity. The Department of Water and Sanitation (2015) reported, in the year 2000 that the index for Southern Africa was estimated to have between 1000- 2000m³ annually. Estimates indicate that water availability will be lower than 1000 m³ per person per year within the next 3 decades.

2.4 Water scarcity on a global scale

Water scarcity is one of the main issues that the globe is experiencing. Prevailing pressures on water resources are aggravated by population growth and climate change (Gosling and Arnell, 2013). Towards the end of the 18th century, a Swedish scientist by the name of Svante Arrhenius, was the first to assert that the burning of fossil fuel (thereby release of Chlorofluorocarbons, commonly known as CFCs), will possibly lead to heightened global warming. The theory indicates that emissions of certain gases, mostly from industrial activities, leads to higher than normal temperatures which then affect weather patterns leading to natural events like droughts and the on-going water scarcity.

The issue of climate change is important and of global concern. The use of fossil fuels as one of the energy sources in the world makes a contribution to the increase in greenhouse gases (GHG) concentrations. Sithole (2016) cites that there is a widespread view that the increase in the concentration of the GHGs including carbon dioxide, water vapour, nitrous oxide and methane is leading to climate change which has negative environmental impacts. In 2013 the Intergovernmental Panel on Climate Change (IPCC) reported that climate change can be identified by changes in its properties over long periods resulting from natural variability and man-made events. Global climate change patterns include impacts on rainfall, extreme weather events and sea level rise, rather than just moderate air temperature increases.

On the global scale, climate change has several effects. However, the global situation is of lesser importance when compared with the effect of global warming on water availability in different continents/ countries/ seasons. The IPCC technical report (2014) concluded that, regardless of additional rainfall received, a number of dry countries including countries in the Southern African region are expected to be badly affected by the reduced rainfall and increased evaporation and it is estimated that approximately 1 000 000 000 people in these regions will continue to be faced with water scarcity.

2.5 Water scarcity in the South African context

In 2013 the Department of Water and Sanitation (DWS) reported that South Africa is semi-arid, with only 9% rainfall ending up in rivers and 5% of rain ending up in ground water aquifers. More recently the DWS (2015) reported that the country is placed in the top 30 dry countries globally. The report further states that South Africa is known for extended dry and wet conditions that create extreme temporal and spatial variability in water availability. In addition to this, more than half of the river basins receive some of their flow from other countries (WWF-SA, 2016). WWF-SA (2016) further elaborates that the highly periodic rainfall received in South Africa means that it is critical that water be stored in order to ensure sustained water supply throughout the year. Raw water storage infrastructure, specifically dams, as well as inter-basin transfer schemes are the main support for the engineered or “hard” water infrastructure (WWF-SA, 2016).

The primary input to water resources is rainwater and South Africa's rainfall, at 490mm per year, is half the world average of 814mm (WWF-SA, 2016). There is a high variation in the rainfall distribution with 21% of the country reported to receive less than 200mm and 65% of the country receiving less than 500mm of rainfall annually. Making matters worse is the fact that potential evaporation is approximately 4 times higher than the average rainfall per year. When compared with neighbouring Namibia, in relative terms, the country is more water scarce due to low rainfall and a larger population, even though Namibia receives almost half of the rainfall. (WWF-SA, 2016).

An estimated 20% (9 700 000) South Africans are unable to access sufficient water supply (DWS, 2013). Rising water demand in South Africa is caused by the increasing population and on-going industrial developments, more especially electricity generation. Therefore, South Africa is faced with the dilemma of having to ensure access to water for all, while improving on water management on a national, regional and local scale at the same time.

Water quality in South Africa is also a major concern. Surface water quality is the most threatened by pollution due to mining activities, agricultural production, urbanisation and power generation. In South Africa many of the nation's major cities are located upstream while storage facilities (dams and reservoirs) are located downstream. For this reason, most of the country's storage facilities are contaminated due to poor sewage treatment. Groundwater quality is variable in most parts of the country. The status of water quality therefore further exacerbates the water scarcity situation since out of the water available for use, a considerable percentage cannot be utilised as needed.

DWS (2015) further elaborates that the South African water sector is faced with a number of challenges, including intensified water shortages, water contamination and the ever declining quality of water. These challenges also have adverse impacts on the health of people, deteriorating water and wastewater infrastructure and a suitably experienced workforce. The water scarcity situation in South Africa is such that demand already exceeds supply in numerous urban areas.

In South Africa as is the case globally, water is becoming one of the crucial scarce natural resources, particularly because both humans and businesses require water

and electricity for their existence. However, the distribution of water from raw water sources, mainly dams or rivers, in order to sustain humans and industries in urban areas is a difficult task, particularly because dams are seldom constructed in easily accessible areas.

It is however positive to note that at national government, the National Development Plan 2030 (NDP) identifies the shortage of water as a limitation to the development of the country hence the emphasis by national government to implement the objective contained in the National Water Resources Strategy (NWRS) second edition published in 2013.

Below is a summary of water statistics in South Africa, as reported in the WWF-SA report 2016:

- 21% of South Africa receives <200mm of rain per annum
- Average annual rainfall is 490mm vs 814mm global average
- 98% of available water resources have already been allocated to users
- 37% of water is lost in the current urban infrastructure

Figure 2.1 further outlines the distribution of water per sector as outlined by DWS (2015).

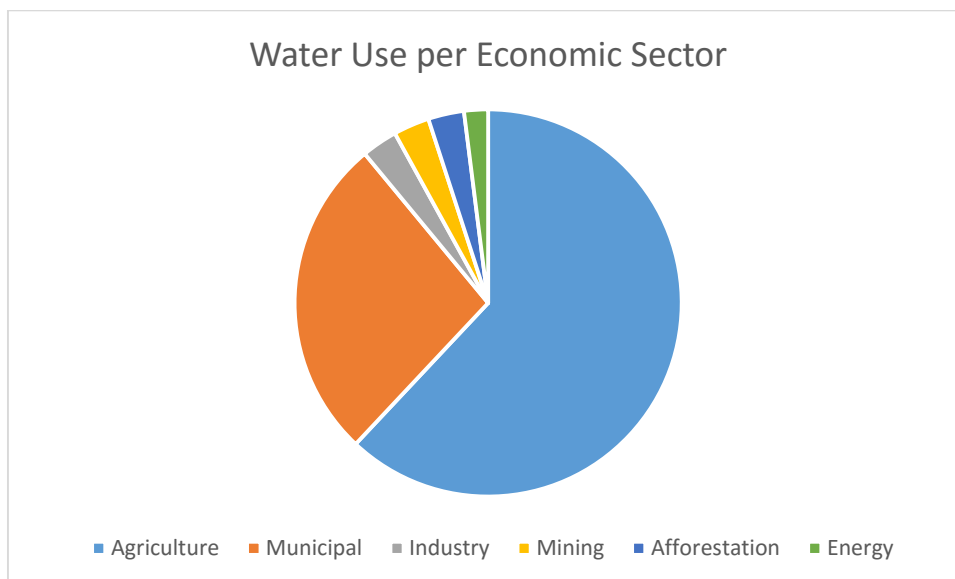


Figure 2. 1: Water Use per Economic Sector

Source: DWS, 2015

The NWRS (2013) states that it is highly probable that climate change might have a substantial effect in South Africa, resulting in negative results for humans, the ecosystem and economically, mainly demonstrated through water. This is because climate change alters rainfall patterns, increases the intensity of thunderstorms and the severity of droughts and floods and increases evaporation, to name but a few. This is because climate change increases the variability of the climate. Furthermore, climate change is one of 5 critical trends noted in the NDP, which recognises that South Africa is not only a contributor to greenhouse gas emissions – it is also particularly vulnerable to the effects of climate change on health, livelihoods, water and food, with a disproportionate impact on the poor, especially women and children. While adapting to these changes, industries and households have to reduce their negative impact on the environment. This will require far-reaching changes to the way people live and work. The NDP identifies that the water sector will experience the effects of climate change and recognises the need to have a sustainable economy that is resilient to climate change.

WWF-SA (2016) highlights that a 2^oC increase in global temperatures will result in a 4^oC increase for South Africa. South Africa is characterised by highly variable and below average rainfall which is a major problem in the development of the economy as well as the well-being of the population. The majority of the country has encountered periods of droughts and floods in the past.

As applied to this study, the researcher concludes that one would expect water scarcity to have an effect on an organisation like Mhlathuze Water because it depends on water availability for its operations hence unavailability of water would affect its ability to supply water to customers (i.e. customer service). Also, with Mhlathuze Water situated in a highly industrialised area (water intensive industries), it means that water use is higher and that the industries emit more greenhouse gases into the atmosphere thereby contributing to global warming and ultimately to climate change.

2.6 Causes of water scarcity

Water management research has concluded that there are human and natural causes of water scarcity. Human activities and behaviour can modify the physical environment in such a way that useful water becomes scarce, such as population

growth which may lead to water scarcity (Sithole, 2016). The high percentage of South African citizens that are unable to access drinking water is partially due to the country being listed in the top “driest” countries globally, but it is also as a result of the lack of effective water management and government intervention.

2.6.1 Climate change

It is estimated that about 98% of water on the planet is the ocean while 2% is considered to be fresh water. Approximately 70% of the 2% is in the glaciers while 30% is in aquifers, less than 0.5% is surface water and less than 0.05% is in the atmosphere, (IPCC report, 2013). Indirect influence on water resources is associated with climate change mainly caused by the emission of greenhouse gases leading to global warming, whereas direct influence is due to poor management (water is wasted almost everywhere, be it in agriculture, industry or domestic use) and inefficient use of water which is worsened by rapid population growth.

The IPCC report 2014 further states:

- Human impact on the climate is visible, and recently recorded greenhouse gas emissions are the highest ever recorded. In the recent years, climate change has had a number of effects on people and the physical environment. The increase in greenhouse gas emissions has been driven mostly by urbanisation, population and economic growth, and is noticeably more than ever recorded. The result of this has been the intensified concentrations of these gases in the atmosphere that are unmatched in the past 1000 years. The effects of these gases, in addition to other drivers, have been discovered are most likely to have been the main cause of global warming.
- Global warming is clear, and since the mid- 19th century a number of changes are incomparable over centuries and decades. The atmospheric and sea temperatures have increased, glaciers have melted, and the sea level continues to rise.
- In recent decades, climate change has impacted the natural and human systems globally. Irrespective of its cause, the impacts are indicating the sensitivity of natural and human systems to the changing climate. Changes in many extreme weather and climate events have been observed since

around the mid-19th century. Changes such as cold temperature extremes, warm temperature extremes, and the rise in high sea levels have been associated with human interferences. In short, the IPCC report conclusion was that there is unanimity that the increase in greenhouse gas emissions in the atmosphere affects the climate. This will increase the frequency of climate related risks, which may lead to deaths, social interruption and economic challenges.

The construction of dams for water storage alters the hydrological cycle. Humans also contribute to this by increased water abstraction. Climate change is expected to further affect water supply and demand. There is a probability that climate change will alter the hydrological cycle resulting in impacts on water availability. Although when there are periods of intensified water shortages, like droughts, it may seem as if water scarcity is new, whereas it is not.

2.6.2 Population growth

According to the FAO (2013), the world population is growing at an alarming rate, in 2020 it is projected to be at 7.9 billion, which is 50% more than in 1990. This has an impact on the already stressed water sources, which is further worsened by the contamination of water sources through poorly managed sewer systems. In South Africa, it was estimated in the year 2000 that water stress was already experienced in a number of Water Management Areas, such as Inkomati and Thukela. National water demand is predicted to increase by 32% by the end of the next decade as a result of population growth as well as industrial development, according to the report by WWF-SA (2016).

Kottatep, Polprasert and Pussayanavin (2015) found that rapid population growth causes serious water scarcity and water pollution problems. Okello, Tomasello, Greggio, Wambiji and Antonellini (2015) suggest that population growth particularly limits the amount of water available per person.

2.6.3 Contamination of existing water sources

Water sources are often contaminated by a number of sources. This is an on-going challenge in both developed and developing countries. This may lead to contamination of purified water supplies and may also cause difficulties during the treatment of water before consumption. Contamination of water not only leads to

water scarcity but also directly affects the health of consumers as it may lead to increased incidents of water borne diseases. The most dominant sources of contamination affecting water quality in South Africa are, as per WWF-SA (2016):

- Insufficiently treated sewage effluent from inefficient sewage treatment works as well as leaking sewage network pipes
- Substandard sanitation practices
- Mining processes
- Improperly managed or illegally discharged or insufficiently treated industrial effluent containing a variety of chemicals;
- Agricultural runoff which includes fertilisers and pesticides which results in water pollution.

2.6.4 Leaking water pipes

Sershen et al. (2016) found that the condition of bulk water and wastewater infrastructure is a serious concern for the country. Water is often conveyed through pipeline networks for longer distances. Pipes may leak due to age; improper operation and/or maintenance which may lead to inadequate water volumes getting to the desired destination.

According to Donnenfeld, Crookes and Hedden (2018), the latest DWS data (from 2012), estimates that 36% of water utilised by municipalities in South Africa was non-revenue. This situation requires strategies for detecting leaks or installation of new pipes (Hunaidi and Wang, 2006 cited in Fontana and Morais, 2016). Proactive infrastructure investments and programmes aimed at reducing the leaks and unauthorised connections is an urgent requirement, from potable water supply sources (water treatment plants) to taps (WWF-SA, 2016).

2.6.5 Lack of / poor water management

O'Brien (2014) argues that, location, climate and weather conditions contribute to the unavailability of water, however blame cannot be placed on nature alone. O'Brien (2014) further states that lack of effective water management is the main cause of the challenge of access to water. However, many water services institutions are revising strategies and approaches and are investigating ways for more efficient and effective water use, including improved water demand management and water reallocation in order to reduce the mismatch between

demand and supply. Okello et al. (2015) found that with growing water scarcity, mismanagement of the available water resources is one factor that intensifies the situation.

2.7 Challenges of water scarcity

2.7.1 Economic challenges

Water is ranked as the first high impact risk to business development and continuity and is considered as a resource under stress, states the World Economic Forum (WEF). Resulting from the drought in 2016 to 2015 in South Africa, the private sector has a desire for understanding their water risk and willing to working with other stakeholders to mitigate shared risks, cites WWF-SA (2016).

Water scarcity has a wide range of implications for business. These may include stricter regulation, which limits water use; the costs of water (tariffs) may be higher; there may be an undesirable conflict between the communities and industries, businesses may have to incur costs relating to the use of water efficient products and technology. Water scarcity has a direct impact on the operation of businesses such as the supply of raw material, supply chains and ultimately the products. Insufficient water supply can destabilise industrial processes where water is a critical input either for production, irrigation or material processing etc.

DWS (2015) report further highlights that risks relating to water quality are often disregarded however this should not be the case because these risks often result in increased costs. The quality of process water is critical in different industrial processes and if polluted it usually requires additional infrastructure to treat as well as additional pre-treatment costs. Furthermore, the generation of electricity depends on having adequate water supply, regardless of the technology used in the process.

Water scarcity is expected to result in escalation of the price of water. Among other observations, water scarcity is seen to be changing pricing structures with the aim of encouraging efficient water use. Water institutions in highly industrialised countries are implementing tiered pricing where consumers pay a higher rate for using more water in a bid to encourage water conservation.

As water scarcity continues to be a severe challenge globally, there is intensified regulatory and reputational pressure on the manufacture of products that require

significantly high quantities of water to produce. There is a possibility that the production of such products and services may eventually be discontinued, and thus companies lose market share.

2.7.2 Social challenges

In water-scarce countries, where the local communities do not have access to potable water, tensions may arise between businesses and the communities. The concept of “access to clean water as a human right” is recognised throughout the world, however governments fail to render water services to everyone meaning that businesses may end up facing community unrests when using large volumes of water in areas where communities do not have access to sufficient water for their livelihoods.

According to the Constitution of the Republic of South Africa, every citizen has a right to clean and safe water. The majority of water is used for agricultural activities in South Africa (DWS, 2013), hence the notion that water security and food security are interdependent holds true. In this case, if water security decreases, so does food security.

Research by Dotse (2016) reported that there are about 80% of populations that were involved in farming in the Southern African region but agricultural productivity remains low in the region due to a variety of reasons including water scarcity. This has affected food and nutritional security over the years. Water scarcity is therefore a major threat to food and nutritional security.

2.7.3 Environmental challenges

The freshwater ecosystem serves a number of purposes other than providing a source of drinking water for communities. It provides cultural, social and economic value. As a result, increased abstraction of water or poorly treated effluent discharge increases the risk of conflict within communities. Furthermore, it is expected that the ecosystems will be more vulnerable as a result of climate change.

Water scarcity, accompanied by growing concerns within communities about water abstractions, will pressurise local, provincial and even national government to review legislation and policies, water reallocations, and development of water

markets that cap usage, suspend water use licences and abstraction permits, and lead to stricter water quality standards.

Sershen et al. (2016) found that the state of water and wastewater infrastructure and the impacts of water contamination pose serious concerns in the country. The quality of surface water resources in the majority of catchments in South Africa is also endangered by excessive nutrients from raw or poorly treated domestic, industrial and sewage effluent, agricultural run-off and disposal of wastewater from informal settlements.

2.8 Approaches to mitigate water scarcity

Water resources management and water demand management (WDM) strategies are the main strategies to mitigate water scarcity (DWS, 2015). WDM is a prospective and effective strategy employed in regions that are considered to be water-scarce. This includes water conservation and improving the water use efficiency; treatment of wastewater and effluent reuse, exchanging treated effluent with freshwater allocations (e.g. utilising treated effluent for irrigation).

The following are some of the water scarcity mitigation approaches that various scholars have cited:

2.8.1 Construction of more dams for inter-seasonal water storage

Constructing more dams is one of the ways of increasing water availability and reduced water scarcity (Schyns, Hamaideh, Hoekstra, Mekonnen and Schyns, 2015). However because of the capital investment required, its strategy requires extensive planning and investigations to be undertaken, which may include the strategic location of the dam, the capacity and so forth. The dams could then be utilised to store water during seasons of high rainfall and be utilised during low flow conditions, as recommended by Schyns et al. (2015)

The FAO (2012) refers to the construction of dams as one of the proposals for coping with water scarcity. Dams should be constructed and located in convenient areas while ensuring that the water resources are able to meet the demand from all users, and ensuring the protection of the natural ecosystem and water quality.

This strategy was alluded to by Hoekstra (1999) when it was reported that the construction of dams has become the dominant engineering solution to water

scarcity, with the main benefits being the ability to stabilise variable water inflows throughout the year.

2.8.2 Desalination

In recent years, desalination (i.e. reverse osmosis seawater desalination) has become the key way to supplement freshwater supplies and to improve the quality of water particularly in areas where natural water resources are unable to satisfy the increasing water demands. Over the past 3-4 decades, desalination technology has evolved as a viable, albeit costly means of producing water, opening up non-traditional sources of water such as brackish water and seawater (Voutchkov, 2018). Desalination of seawater is most ideal for supply to coastal regions that are close to the sources.

2.8.3 Treatment and reuse of wastewater effluent

Countries such as Israel and Jordan have incorporated the reuse of sewage effluent in water demand management. If such a strategy is adopted, it needs to be guided by regulations and in order to ensure that domestic waste water treatment plants produce effluent of high quality so as to take advantage of the potential that exists for effluent re-use, minimize health and environmental risks and enable the effluent to be used for industrial purposes in exchange for the fresh water resources for domestic use (Schyns et al., 2015). Sershen et al. (2016) found that water re-use is a critical approach to mitigate the imminent water scarcity in the country.

2.8.4 Maintenance of water supply infrastructure

According to Fontana and Morais (2016), not all water produced reaches the customers, instead a considerable amount of it is lost mainly due to leakage from bulk distribution systems and reticulation networks. Leakage is recognised as one of the key challenges in the operation of water distribution systems and hence effective maintenance is essential.

Sershen et al. (2016) cites a report, which concluded that the majority of the bulk water infrastructure in South Africa either requires upgrading or replacement in the near future as most of the infrastructure is reaching the end of its useful life. Maintenance of water supply infrastructure helps to reduce water supply shortages on the consumer side but does not necessarily reduce water scarcity from the water resource side.

The estimated amount of non-revenue water is comparable with the world average, however South Africa is considered a water-stressed country and needs to ensure that its water infrastructure does not continue deteriorating (Donnenfeld, Crookes and Hedden, 2018).

2.8.5 Tiered water pricing

According to Donnenfeld, Crookes and Hedden (2018), tiered water pricing is a system of water conservation which has been confirmed to be highly effective in many regions globally. This pricing system is based on the amount of water that customers use and they are charged based on that amount. Customers who use more than the amount that is considered sufficient for human consumption are charged a higher price. The advantage of this pricing system is that it is not dependent on government regulation nor does it prohibit users from utilising more water. The main aim of the system is that water that is meant for basic human consumption is made affordable, whereas water for recreational purposes is made relatively expensive. This helps create a culture of water conservation while avoiding more burdensome interventions such as restrictions.

2.8.6 Water resources allocation

Regarding climate change predictions, Iglesias and Garrote (2015) in their research found that the reallocation of water resources appears to be a key mitigation measure to wrestle the challenge of water scarcity. However, Semenza et al. (2011), quoted in Iglesias and Garrote (2015) argue that it is crucial to integrate the interests of the different stakeholders affected by the consequences of water resources reallocation, including the different government structures, irrigators and the public, as failure to do this can often lead to conflict among the different stakeholders.

The FAO (2012) concurs that re-allocation is one of the solutions to water scarcity. Water has become insufficient to meet the total demand of all water users hence policies need to be centred on the cost-effective optimisation of water, while emphasizing re-allocation from one user to another.

2.8.7 Inter-basin transfer

According to the FAO (2012), inter-basin transfer refers to the diversion of water from basins that are water rich to basins that are water scarce as a result of negotiations between authorities in those regions. This practice has been observed

over a number of decades and offers an opportunity to address imbalance between supply and demand, however, negotiations between regions are becoming more complex since water scarcity is intensifying globally.

2.8.8 Awareness campaigns

Several researchers have reported that programmes to coach water users and raise awareness among all stakeholders could assist in water conservation. This includes campaigns such as water-saving blocks for consumers to place in toilet cisterns, to reduce water used during flushing of the toilet as indicated by (Donnenfeld, Crookes and Hedden, 2018). Hoekstra (1999) concurs that a decrease in water usage could be attained, by increasing “water literacy” among the population and by using the correct pricing systems that will ensure that users pay for the full costs of water and if necessary, pay an additional amount in the form of a tax.

2.9 Water scarcity and customer service

Customer service is the combination of activities and that are undertaken in order to ensure continued customer satisfaction in relation to the product or service offering. Customer service plays a major role in sustaining on-going customer relationships, which is crucial to lasting revenue. In the water services provision sector, water is a product that water services institutions provide to end users. Therefore the availability of water or lack thereof (scarcity of water) has a direct impact in the manner in which the service is provided, be it in terms of quantity or quality.

2.10 South African Legislation relating to Water

In 2016 the World Water Forum of South Africa (WWF-SA) found that the country has revolutionary regulation that identifies the criticality of the entire water system. This legislation does not only recognise humans but also and awards the environment a basic right to water.

The right to access “sufficient water” as a basic human right is enshrined in the Constitution of the Republic of South Africa. The Constitution further lays the foundation for the right of South Africans to have “an environment not harmful to health”. It has therefore recognised the right of all South Africans to have access to water.

The Water Services Act (1997) and the National Water Act (1998) govern the South African waters. According to the NWRS (2013), these two pieces of legislation were effected to improve the management of water and related services. The National Water Act caters for the conservation, utilisation, development, management and control of natural water resources in the country. The management of water resources is assigned to national government as indicated in the Constitution of the Republic of South Africa (1996). This responsibility was later delegated to water boards, which were set up in terms of section 34(1) of the Water Services Act. The National Water Act (1998) further created a comprehensive legal framework for the management of water resources, while the Water Services Act is there to regulate the provision of water services.

As per the Water Services Act (1997), a water board is as an organ of state established to primarily perform public functions. In this study, water board refers to Mhlathuze Water Board (herein referred to as Mhlathuze Water). The Water Services Act (1997) further explains that the main function of a water board is to supply treated water in bulk to municipalities. The municipalities then supply to communities.

The Minister establishes the water board for the following reasons:

- The provision of water services to other water services institutions.
- Water boards may carry out secondary activities as long as they do not interfere with the primary function of supplying other institutions or creating financial problems for the board.

Secondary activities of a water board may include:

- The provision of management and other support services as well as training.
- The supply of untreated water to users for industrial or agricultural purposes (not for household purposes).
- The provision of catchment management services with the approval of the water services authority.
- The supply of water directly to industries
- The disposal of industrial effluent.
- The provision of water services directly to consumers on behalf of the water services authority

- Performing water conservation activities
- Providing public water services.

The government's institutional framework in South Africa is categorised into a three-tier system as depicted in Figure 2.2

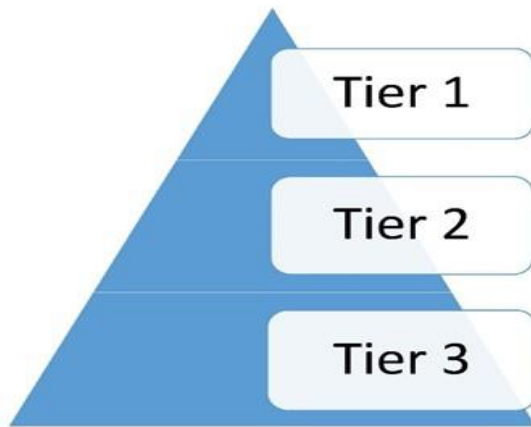


Figure 2. 2: South African Governments Institutional Framework

Source: Researcher

Tier 1: The National Government represented by the Department of Water and Sanitation (DWS). The key responsibilities include water resources management, support to municipalities, the establishment of norms and standards, and monitoring the administration of the Water Act. DWS operates at all government levels (national, provincial and local) and monitors the entire water cycle from water resource management, abstraction allocation and permits, water purification and distribution, wastewater collection, to treatment and disposal. DWS does not necessarily execute all of these functions; some are delegated to sector partners as guided by legislation. DWS owns the majority of the dams and related infrastructure in the country and is responsible for planning and implementation of future water resource development projects (DWS, 2015).

Tier 2: Water boards whose function is to commercially supply treated water in bulk to institutions such as, municipalities and other organisations as well communities.

Tier 3: Municipalities that supply water and sanitation services directly to the public.

2.11 Conceptual framework

According to Miles and Huberman (1994), a conceptual framework is “a written or visual presentation that explains either graphically or in narrative form the main things to be studied, the key factors or variables and the presumed relationship among them”. A conceptual framework has concepts that are placed logically and sequentially and is based on specific concepts and propositions. The aim of the conceptual framework is to clarify concepts that are being studied as well as to suggest relationships between the concepts in a study. Furthermore, it aims to provide a background for interpreting the results of the study.

Figure 2.3 is the conceptual framework that was used for the study:

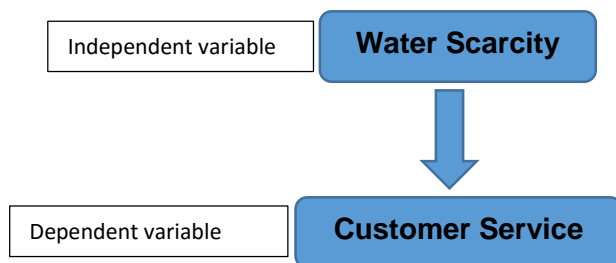


Figure 2. 3: Conceptual Framework

Source: Author

According to the framework above, water scarcity is the independent variable while customer service is the dependent variable. There is a direct relationship between the two variables and it is expected that water scarcity affects customer service.

2.12 Summary

In this chapter, the researcher has provided a discussion of literature relating to the various topics that link or relate to water scarcity and its impact, particular to customer service. The definition of key terms, i.e., water scarcity and customer service, were examined drawing from global and local contexts by various authors. The causes and challenges of water scarcity were examined. Thereafter the mitigation approaches were explored. Legislation surrounding water services in South Africa was highlighted in detail, including how the entity being studied fits in. The state of water scarcity, both globally and in South Africa is highlighted, as per the various authors and publications. The literature further highlighted the economic, social and environmental challenges of water scarcity. The greenhouse effect and

global warming theory indicated that emissions of certain gases, mostly from industrial activities, leads to higher than normal temperatures which then affect weather patterns leading to natural events like droughts and the on-going water scarcity. From the literature review, it was identified that water scarcity is further worsened by man-made events such as population growth and poor management of water services. In the water services provision sector, water is a product that water services authorities and/or water services providers provide to end users. Therefore the availability of water or lack thereof (scarcity of water) has a direct impact in the way in which the service is provided (i.e. customer service). The chapter ends with a short presentation of the conceptual framework for the study. From here, the chapter that follows will highlight the research methodology and design underpinning the study.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

The previous chapters of this document covered the motivation for this study as well as the review of the available literature aimed at answering the research questions. This chapter outlines the details of the research methodology that was used in this research. The purpose of this qualitative case study was to investigate the impact of water scarcity on customer service at Mhlathuze Water in Richards Bay. The independent variable is water scarcity while the dependent variable is customer service. The research questions are: What is the role of water scarcity to Mhlathuze Water and to its customers? What are the challenges of water scarcity in Mhlathuze Water? What can be done to mitigate the challenges of water scarcity to Mhlathuze Water customers?

This chapter covers the description of the study location and the participants are identified. This section will also discuss the research strategy; methodology and underlying paradigm. The sampling strategy, including data collection methods; data analysis will also be discussed. The researcher will then give an overview of the reliability and validity of the research. Finally, the ethical considerations for the study will be highlighted.

3.2 Research Paradigm

According to Kuhn and Hacking (2012), paradigms are a set of universally accepted thinking habits of researchers. A paradigm refers to the recognised research traditions in a specific field, as Collis and Hussey (2009) suggest. It specifically includes accepted theories, traditions, approaches and methodologies and it could be regarded as a framework for observation and understanding. A paradigm is thus a basic set of norms that provide guidance on actions.

The inductive approach was chosen as the paradigm underpinning this study. An inductive approach was employed in this study, as this approach is ideal for converting specific observations of patterns and occurrences to broader generalisations and theories (Saunders, Lewis and Thornhill, 2012). The inductive approach is also known as inductive reasoning. This approach starts with the observations and proposes theories towards the end of the research process based on the observations. This approach also aims to generate meanings from the data

set collected in order to identify patterns and relationships to build a theory (Creswell, 2014). This method allows for the development of an initial hypothesis, which is further developed into an overall theory as the information gathered is analysed and interpreted (Creswell, 2014). The inductive approach does not mean that the researcher disregards theories when formulating the research objectives. The purpose is to formulate meanings using the data that is collected so as to establish patterns and connections to build a theory; however, this paradigm does not inhibit the researcher from utilising prevailing theory to formulate the research questions to be investigated, rather it is centred on learning from experience. Therefore, this paradigm was anticipated to be able to provide the best understanding of the problem being researched.

3.3 Research Design and Methods

According to Sekaran and Bougie (2013), research design is the structure in which data is collected, measured and analysed using the research objectives as a base. It is the technique that is used to gather data, and analyse and interpret the results. The research design is the overall plan that connects the research problem to the pertinent (and achievable) experimental research, i.e., it explains the data that is required, the data collection and analysis methods that will be employed, and how all of this is going to answer the research questions.

A qualitative research method was used, specifically using a case study. Case studies were one of the first types of research to be used in the field of qualitative methodology. Sagadin (1991 cited in Starman, 2013, p.159) states that a case study is chosen when the researcher intends to study an individual person, groups and specific institutions or a problem/s, phenomenon or processes. A case study was identified to be applicable for this study as the study aims to focus on a particular institution (i.e. Mhlathuze Water) and will be useful in addressing the research questions. The case study approach has numerous advantages such as the flexibility it provides for the researcher to use a range of research methods (Davies, 2007), the ability to establish a bond with participants, to obtain adequately rich narratives that can be transferred to similar situations (Merriam, 2009) and ultimately, in-depth insight. Also, the case study is more relevant for this research since the research questions seek to explain current circumstances and the researcher has no control of the set of events being studied.

3.4 Study Setting

The study was conducted at Mhlathuze Water, in Richards Bay and they were selected because they are the water service provider in the area. The participants were the management of Mhlathuze Water as well as their bulk water customers.

3.5 Population and Sample of the study

Sekaran and Bougie (2013) refer to the population as the entire group of people, events, or things of interest that the researcher wishes to investigate. The purposefully selected individuals for the study were Mhlathuze Water management and bulk water customers.

3.6 Research Instrument

According to Rubin and Bellamy (2012), data collection instruments are the devices used to collect data. The researcher selected interviews for this study in order to enable the researcher to gather relevant data from participants. Stuckey (2013) outlines that interviews are the main method data collection in qualitative research in order to guide the participants to respond to a specific research question. This author further highlights that interviews are frequently used as a means to gain an understanding of a topic through the participant's views and experiences. Interviews can take various forms such as structured, semi-structured, unstructured and informal.

Semi-structured interviews were used for the study so as to guide the interview process using a specifically designed questionnaire focusing on the role of water scarcity and its challenges. The questions were open-ended to enable the participants to express their viewpoints and experiences, without being influenced by the researcher and/or experiences or expected research outcomes (Creswell, 2014). This was to enable each participant to give their specific views regarding the questions asked and share their answers freely using their own words. This allows data to be compared as the research questions are common to all those interviewed. The interview guide is attached as Appendix 1.

Interviews are understood to have the ability to provide a "deeper" understanding of phenomena which would otherwise be difficult to obtain from quantitative research. Therefore, interviews are more suitable where there is limited knowledge about the

study phenomenon or where comprehensive information is required from the participants.

The interviews were conducted individually with the participants at their offices around Richards Bay and Empangeni areas. Some of the interviews were recorded using an electronic recording device and were transcribed accordingly for analysis. The average duration of the interviews was 23 minutes.

3.7 Sampling Method

The target population was the management of Mhlathuze Water and their bulk water customers, specifically management at the bulk water institutions. The sample size for this study was 15, which was made up of Mhlathuze Water's bulk water customers. The 6 participants interviewed were from Mondi, the City of uMhlathuze, Foskor, RBM and Tronox as well as the management of Mhlathuze Water's. The 9 participants comprised of functional management and executive management.

Critical case sampling was used for this study. In this sampling method the researcher collects samples with the most likelihood to provide the desired information, specifically critical cases or cases that highlight vital information. Critical case sampling is particularly useful if a small number of cases can be sampled (Struwig and Stead, 2013). This number of critical cases referred to are the ones with a higher probability of providing a wealth of information. Using critical cases is also sensible if the researcher has budget constraints and wants to study the participants with more likelihood to provide vital information.

3.8 Data collection

Qualitative researchers typically rely on 4 methods for gathering information, namely, participation, observation, interviews, and analysing documents and other materials. Contextual information, demographic information, perceptual information and theoretical information were gathered in order to answer the research questions in this study. Interviews were used as the data collection method for the study.

Contextual information: This refers to the context within which the participants in the study are working (Bloomberg and Volpe, 2008). For this study, contextual information was collected via a review of documents (mainly the business plans and

annual reports), which gave insight on the vision, objectives and the overall strategy of the particular organisation/ participant in the study.

Demographic information: This refers to the participant's profile in terms of gender, age, occupation and so forth (Bloomberg and Volpe, 2008). Demographic information, mainly the years of experience, occupation and roles and responsibilities was gathered as part of the interview.

Perceptual information: This refers to the perceptions that the participants in the study have regarding the study (Bloomberg and Volpe, 2008). The researcher used semi-structured interviews to gather this information. The interview schedule consisted of a number of fundamental questions that assisted to define the areas to be explored and allowed the researcher and participants to differ with the aim of pursuing detailed responses. This approach also facilitated the discovery or elaboration of information which the participants deem to be critical but may not have been specifically outlined in the interview schedule of questions.

Theoretical information: This is the information that is gathered as part of the literature review regarding what is already known regarding the study.

3.9 Data analysis

The purpose of data analysis is to answer the research questions. Qualitative data analysis is a process of bringing order, structure and meaning to the mass of collected data (Marshall and Rossman, 1990, cited in Hilal and Alabri, 2013). The analysis of qualitative data analysis is primarily about the identification of the interconnection between categories and themes of data with the aim of increasing understanding of the phenomenon.

Since the data collected in qualitative research is mainly text, the coding process is the foundation of analysing this data. Codes according to (Miles and Huberman (1994) are "tags or labels for assigning units of meaning to the descriptive or inferential information compiled during a study". The coding process entails tracking interconnected words or phrases cited by the participants or in the documentation and then combining these words or phrases to identify the link.

Woods, Paulus, Atkins and Macklin (2016) concur that the analysis of qualitative data includes the identifying, coding and categorising of themes and patterns

contained in the data. The researcher used computer assisted qualitative data analysis by using the NVivo software package in order to perform data analysis effectively and speedily. Thematic analysis was used to identify the themes from the data. The following steps were followed used to analyse the data obtained from the interviews:

- 1) Organising the data
- 2) Identification of themes
- 3) Analysis using NVivo software

1) Organising the data: This was accomplished listening to all the interview audio recordings, and then transcribing them verbatim. The transcripts were then read and similarities identified.

2) Identification of themes: The similarities identified from the transcripts were then given code names and arranged into themes.

3) Analysis using NVivo software: The researcher using NVivo was able to display the themes by exploring the data.

3.10 Reliability and Validity of the Study

Since qualitative research is subjective, it makes the results likely to be scrutinised and interrogated. It is for this reason that researchers make the necessary interventions to ensure the reliability and validity of the findings. The findings have to be credible, consistent and applicable so that they can add value to existing knowledge.

Validity focuses on whether the research is believable (i.e. trustworthiness) and at the same time evaluating what is the study is supposed or intends to evaluate, whereas reliability focuses on the consistency, dependability and replicability of the results obtained from a study. There are four indicators for determining trustworthiness: credibility; transferability; dependability and confirmability.

Credibility – This is usually called internal validity. Credibility refers to the authenticity of the research results (Saunders, Lewis and Thornhill, 2016). Credibility depends on the quality of data (richness) rather than on the quantity thereof. The participants solely decide whether the results of the research reflect the

phenomena being studied and hence, it is crucial that participants have conviction that the findings are accurate and trustworthy (Saunders, Lewis and Thornhill, 2016). Triangulation was employed to verify the accuracy by validating information from numerous viewpoints.

Transferability – This is usually called external validity. Transferability refers to the degree that the readers can transfer the findings of the study to other situations (Saunders, Lewis and Thornhill, 2016). This means that the results can be generalised and be applied to other similar settings. It is the responsibility of researchers to comprehensively provide a description of the context of the research in order to support the reader to generalise the findings and be able to apply them properly.

Dependability – This is also known as reliability. Dependability means that the research findings should be able to be repeated and still produce the same results (Creswell, 2014). The dependability of the findings also serves the purpose of confirming that the research method used was legitimate.

Confirmability – Confirmability gauges the results objectively in order to identify how well the results are supported by the data when scrutinised and interrogated by others (Saunders, Lewis and Thornhill, 2016). Researchers are unique and hence the interpretation of data is subjective. If results are supported or confirmed by others utilising the same data, it can be concluded that there was no inappropriate research biases during data analysis.

In this study reliability and validity was achieved through data triangulation, thorough record keeping, ensuring that data interpretation is consistent and transparent, including verbatim descriptions of participants' accounts to support findings and accounting for all types of biases which may have influenced the findings.

The data required for the study was gathered from experienced managers who were able to opine on the impact of water scarcity on Mhlathuze Water and its customers. The researcher therefore assumed that the sources of information were reliable and the information would be able to answer the research questions.

The researcher recorded all the interviews for the study and each has been transcribed so that the data can be compared with literature. Furthermore, the

interviews were conducted using the same interview schedule to ensure consistency.

3.11 Limitations

The following limitations were identified:

- The scope of this research was limited to Mhlathuze Water hence the results are valid for Mhlathuze Water, however they can also be extended to similar organisations to confirm applicability.
- Although there are prior studies that have been conducted on water scarcity and its impacts, there is no study that was found to have been done on Mhlathuze Water or similar organisations
- The interview skills of the researcher may have influenced the participants' responses.
- The language used to conduct the interviews was English, while the interviewees were not all native English speakers hence the English speakers might have had an advantage in comprehending the questions hence the responses.
- Due to the nature of the study (i.e. case study), few managers were interviewed and may not represent similar views to the others. This was identified as a limitation.
- There was limited time to conduct the research therefore, it is possible that more details regarding the subject matter were not tapped into which might need to be explored in future research.

3.12 Elimination of Bias

It is critical for the researcher, of any study, to eliminate bias as it can affect the outcome and distort the results of the study (Penwarden, 2013). The researcher endeavoured to eliminate the different research bias in the study, as outlined below:

Procedural Bias: Procedural bias occurs when the interview protocol is not followed as communicated to the participants (Penwarden, 2013). This may include pressurising the participants to answer during the interview or not providing them with adequate time to provide answers. The researcher managed procedural bias by outlining the interview procedure including an explanation of the voluntary nature

of the proceedings as well as providing adequate time for each participant to answer the questions.

Interviewer Bias: Interviewer bias generally occurs when the interviewer either consciously or subconsciously gives leading clues in facial or body expressions that can influence the participant to give a distorted response towards the interviewer's preference (Saunders, Lewis and Thornhill, 2016). In this study, the researcher ensured that professionalism and composure were maintained throughout the interview process and did not give any leading questions or body language or even signals that could lead the participants to answer in a certain way.

Response Bias: Response bias occurs when the participants of an interview either consciously or subconsciously provide the researcher with answers that they believe the interviewer wants to hear ((Saunders, Lewis and Thornhill, 2016). In this study, the researcher will restrict the amount of information shared with the participants to prevent any form of interview response bias.

3.13 Ethical Considerations

Some important ethical concerns that should be taken into account while carrying out qualitative research are anonymity, confidentiality and informed consent. For this study, it was ensured that the identifications of the participants in the study were kept private by assigning pseudonyms to each participant. A confidentiality agreement via the informed consent form was entered into with each of the participants prior to commencement of the study.

Ethical clearance was obtained by the researcher from the University of KwaZulu-Natal's Ethics Committee. Prior to conducting the interviews, a gatekeeper's letter was obtained from Mhlathuze Water.

3.14 Summary

Chapter 3 presented the research methodology of the study undertaken. The study aimed to gain an understanding of the role of water scarcity in Mhlathuze Water and for its bulk water customers. The target population was the management of Mhlathuze Water and the managers at the entities where Mhlathuze Water supplies bulk water, due to their knowledge and experience regarding water scarcity. The study was qualitative in nature, using interviews as the instrument to gather the data

so as to gain information that would enable the research questions to be answered. Semi-structured interviews were used for the study so as to guide the interview process. Critical case sampling was used for the study as this method is more suitable for qualitative case studies. The researcher used the NVivo software package for data analysis.

The next chapter will be a presentation of the findings of the study as well as the discussion thereof.

CHAPTER 4: FINDINGS AND DISCUSSION

4.1 Introduction

Chapter 4 presents a discussion of the findings from the data compiled from the detailed interviews conducted with the participants which comprised of the managers at Mhlathuze and the managers at the sites where Mhlathuze Water supplies bulk water, i.e., their customers. The interviews were related to the three research questions. From the data, themes have been identified and these are presented based on the research objectives and are discussed making comparisons to literature.

4.2 Sample Profile

The total sample size was 15 participants and belonged to two sub-sample groups, namely, Mhlathuze Water management and Mhlathuze Water bulk water customers. The aim of the first 2 interview questions was to establish a profile of the participants. The participants were requested to outline the number of years that they have been with their current employers as well as to provide a general overview of their current roles and responsibilities. Table 4.1 and Table 4.2 summarise the key descriptive variables for each participant within the various sample groups.

Table 4. 1: Sample group 1 - Mhlathuze Water management

Participant	Years of experience	Job Title
#1	10	Microbiologist
#2	10.5	General Manager: Operations
#3	10	SHEQ Systems Manager
#4	4	Environmental & Water Quality Manager
#5	6	Internal Audit Manager
#9	18	Laboratory Manager
#12	5	Planning & Development Manager
#14	5	Project Manager
#15	3	Project Manager

An interview schedule was used in order to ensure that all the participants had an opportunity to express their views on the same topics. Below is a discussion of the themes that emerged for each of the objectives of the study.

4.4 Themes for objective 1: The role of water scarcity to Mhlathuze Water and to its customers

4.4.1 Unavailability of water

One of the questions in the interview schedule was, “what is your understanding of the term water scarcity” in which the researcher inquired about the meaning or general understanding of what water scarcity is. This question was aimed to lay the background for the discussions that followed as the study is mainly about water scarcity. This theme gave insight into the different meanings that are assigned to the broad term of water scarcity, so as to then understand what its role is for the organisation being studied. Unavailability of water was mentioned numerous times. The subsequent interview question was for the participants to give a broad understanding of how water scarcity affects them as well as the organisations they work for, so as to enable the researcher to answer the first research objective.

The majority of the participants understood water scarcity to mean the unavailability of water. This is evident from the responses such as:

“Unavailability of water”, “reduces available water”, “limited availability of water”, “the level of water from our resources depreciates”, “shortage of water”, and “when the water that we treat is not enough...”

Jaeger, et al. (2013) state that, it is a general understanding that water scarcity materialises when there is an inadequate amount of water to fulfil the needs of all competing uses.

The United Nations’ Sustainable Development Goal #6 is to ensure access to water and sanitation for all. Furthermore, the vision of the National Development Plan 2030 states, “before 2030, all South Africans will have access to sufficient safe water and hygienic sanitation to live healthy and dignified lives”. This can be achieved through the various government agencies, with Mhlathuze Water being one of them. The primary function of water boards is to supply bulk water hence Mhlathuze Water has a big role to play in assisting government to meet these objectives. Water

scarcity therefore plays a disabling role in the entity's ability to fulfil its mandate. Participant #5 mentioned:

“Also in terms of our roles in terms of the sustainable development goals (SDGs), water plays a critical role in the SDGs: employment creation; poverty reduction; health; education. Water affects almost all facets of life”.

With regards to the impact on customers, the participants mentioned that water is an enabler for growth. When asked about how water scarcity affects Mhlathuze Water, participant #2 outlined:

“Water scarcity puts a cap on the ability to grow. Generally speaking, it means there's a wider impact on economic development and it limits economic growth”.

Participant #11 concurred by stating, *“I don't have the figures, but RBM is a huge contributor to KZN region in terms of GDP, so if there's no income from RBM it means the province itself is losing out, so people are going to stay at home and that's basic social impacts”.*

Therefore, it can be concluded that water has a critical role that it plays to Mhlathuze Water and its customers.

4.4.2 Imbalance between supply and demand

Some of the participants referred to water scarcity as the imbalance in demand and supply. This was identified from the responses, such as

“available water sources do not meet the demand either due to challenges on the supply side or if demand has increased”,

“demand outstripping supply, which means we have a constraint in terms of supply”,

“not meeting the demand or not supplying enough water”,

“I would look at it in terms of demand and supply. The demand will be the users (companies; municipalities; environmental requirements), the supply would be from the resources that you got like streams, the ground water aquifers”.

Van Loon and Van Lanen (2013) define water scarcity as a state whereby water resources are insufficient to meet average water requirements in the long-term. This is when available water is low in relation to water demand, which implies that the available water resources are low and there is long term imbalance in the supply and demand.

Water supply refers to the available volume of water that can be abstracted from the sources and supplied to customers, while water demand is the amount of water that customers require – which has been pumped to the customers. The imbalance that is brought about by water scarcity is the fact that there is inadequate water at the source that can be supplied to customers to meet current and future needs. Participant #6 further referred to water demand management as one of the tools to balance supply and demand. This includes activities such as systems water balance so as to identify areas where water is lost in order to come up with ways to reduce loss; such as pressure management and reduction and leak detection systems. The tariff structure is another way of reducing water demand. The approach is the reduction of current water use (since there is no water) and not necessarily reducing elsewhere so that there is more available to be used. According to Donnenfeld, Crookes and Hedden (2018), tiered water pricing is system of water conservation which has been confirmed to be highly effective in many regions globally. During the interview, one of the participants mentioned that periodic reviews of water allocation versus water usage should be undertaken. This will enable a more accurate recording of the water demand and allocation of water resources. An example was made of certain industries that are allocated certain volume of water and only utilise about half of the allocation. While it is good practice for businesses to apply for more than current usage, so as to enable future growth, on the other hand, it distorts the picture of the actual water demand by the stakeholders.

4.4.3 Water scarcity affects customer service

The researcher investigated whether there is a relationship between water scarcity and customer service, so as to gain insight into what the role of water scarcity is in the supplier-customer relationship between Mhlathuze Water and their bulk water customers. This theme further gave insight into the identification of whether there is a relationship between the two variables or not, as well as the details of what that relationship is, noting that all participants agreed that there is a relationship.

Based on the participants' understanding of water scarcity as well as its challenges, the participants were then asked to indicate whether, in their view, there is there a relationship between water scarcity and customer service. There was a consensus from the majority of the participants that there is a direct relationship between water scarcity and customer service, hence a conclusion can be made that water scarcity affects customers.

Participant #5 mentioned:

“Directly related. If there’s too much water and we are giving customers what they want then customer service becomes easier. If it is scarce, then it’s difficult and customers will be affected...”

Participant #6 also mentioned that:

“There’s a certain level of service expected by customers, which is that when they open the tap, water must come out. If there’s water scarcity and issues like that then there are community unrests.”

Customer service can be referred to as the combination of activities undertaken in order to ensure customer satisfaction with a product or service. Customer service is an important part of maintaining on-going client relationships, which is key to continuing revenue. In the water services provision sector, water is a product that water services authorities and/or water services providers provide to end users. Therefore, the availability of water or lack thereof (scarcity of water) has a direct impact in the manner in which the service is provided, be it in terms of quantity or quality. This is especially relevant to Mhlathuze Water since water is supplied to different customers with different quality requirements. Some industries utilise raw water (water directly from the water source, untreated, clarified/ partially treated water and purified water for domestic consumption. Furthermore, as a consequence of factors such as climate change, population growth and discharge of waste water that is untreated, water quality is significantly affected. This has a direct bearing on customer service because should water quality change, or be perceived to have changed by the customers, then it directly affects Mhlathuze Water. One of the participants added that Mhlathuze Water ought to come up with research and development initiatives to address the challenges, so as to come up with innovative

methods of treating water. Furthermore, this would assist with having strategic partnerships with stakeholders.

4.5 Themes for objective 2: The challenges of water scarcity in Mhlathuze Water

4.5.1 Revenue

A majority of the participants referred to the decline in revenue as the top challenge that is faced by Mhlathuze Water. Some of the comments made were as follows:

“If water is scarce there are certain water restrictions that are imposed, it means Mhlathuze Water can no longer supply the contracted volumes and it will mean less revenue”.

“Remember that whatever we supply customers, we charge them, if we don’t provide that or it isn’t enough, our revenue as well is affected”.

“I think the biggest impact is revenue as well as bottom line profit.”

“It causes a problem in terms of revenue growth”, “...ultimately this limits revenue which is has a direct impact on the bottom line”,

“If we have less water, it means we will not get that revenue”, “If we can’t supply enough water, then it affects the revenue”,

“Because the business is to supply water it means revenue will decrease...”

“Also the company reported less profit because of that”.

Mhlathuze Water’s primary activity is the provision of water services as mandated by the Water Services Act (1997). This means that the core business activities of the entity is water supply, hence it is expected that should there be no water to supply, then it ultimately affects sales thereby decreasing the revenue as well. Although the entity, based on its mandate, is not profit driven, it is operated such that it is self-sustaining. In addition, the entity has surpluses so that these surpluses can be used by the government for water-related development projects, so as to be closer to meeting the visions and goals of the National Development Plan.

As a state owned entity, Mhlathuze Water also participates in Corporate Social Investment (CSI) activities for communities in its area of operation, so if revenue

declines it directly affects the amount of money that can be invested in such initiatives. Participant #5 stated that *“Remember Mhlathuze Water also does CSI activities for communities in need and if revenue is dwindling it means that the budget will be reduced”*.

Water scarcity has a wide range of implications for business. According to the Mhlathuze Water (2017) annual report, “the 2016/17 financial year continued to be dominated by the drought which started in 2014/15. This led to the implementation of level 4 restrictions which reduced the supplied volumes by 11%. Resulting from this, the expected growth in revenue did not materialise”. Similar entities, such as Umgeni Water, also reported similarly. Operating profits were 8% lower, gross profit margins further declined by 3% while the profit reduced by 4%. These were a direct consequence of the drought which has impacted negatively on both the volumes of water sold and some of the direct operating costs (Umgeni Water, 2017). This shows that water scarcity is a challenge for water services providers as it results in decline of revenues.

4.5.2 Inability to service customers

The inability to service current customers emerged as one of the challenges faced by Mhlathuze Water. The participants mentioned the following:

“If water scarcity is in such a way that we are no longer able to provide those volumes, then it means we can’t provide the service that we promised to provide”.

“The customers have expected volumes of water we need to supply them with and with water scarcity we can’t meet those demands”.

“Water scarcity threatens the ability to sustainably service the current clients”.

“Most of the businesses we provide water to are reliant on availability of bulk water so without water they can’t run”.

“If the volume is limited, it creates a perception that customer service is low”.

“If it’s scarce then it’s difficult to give customers what they want. Customer service becomes difficult to manage because you want to give customers the best that you can give them”,

“If water is scarce we can’t produce excellent customer service”,

“Mhlathuze Water has contracts with customers, for example Mondi, we are contracted for 100Ml/d so if we can’t supply that then it’s a problem”

“If there’s no water we can’t meet customer expectations of the product they buy from us”

Mhlathuze Water provides a product (water) to customers. One of the main features of their agreement with customers is the quantity (volume) of water to be supplied on a daily basis. In the water services provision sector, water is a product that water services authorities and/or water services providers provide to end users. Therefore, the availability of water or lack thereof has a direct impact on the manner in which the service is provided, be it in terms of quantity or quality.

4.5.3 Loss and no growth of business

This emerged from the previous sub-theme, inability to service customers, wherein a number of the participants explained that water scarcity affects the ability to service customers, and that it also affects the growth of the business. The comments made by the participants were as follows:

“As an organisation, since we purify water and sell to customers it will mean that we will not have business”.

“Water scarcity puts a cap on the ability to grow, i.e., it means we can’t grow the business and get more clients”.

“Water is important for growth and also for current business”.

“It will impact a lot on economic growth because the less water we have, the less the companies will be able to run their businesses”.

“The major biggest impact is inability to grow...”

“Will hamper the ability to produce saleable products” and business is restricted”.

Water is ranked as the first high impact risk to business development and continuity and is considered as a resource under stress, states the World Economic Forum (WEF).

4.5.4 Unemployment

Unemployment emerged as one of the main social challenges of water scarcity, with the participants mentioning other factors that result from unemployment, such as poverty and crime. A number of the participants mentioned that one of the issues of water scarcity is that it can potentially result in unemployment or loss of jobs, not just for Mhlathuze Water but also for their bulk water customers. This was evident from the following comments made by the participants:

“would also have to retrench because we cannot operate”,

“...have to lower production which means they either reduce the number of working hours for the people or send them home and they become unemployed”.

Miletto, Caretta, Burchi and Zanlucchi (2017) reported that a recent study by Mekonnen and Hoekstra (2016) estimates that 4 billion people around the globe live under conditions of severe water scarcity during some parts of the year, while another 500 million people live under severe water scarcity. It is expected that water scarcity will lead to significant employment cuts across the economy globally, which will have a heavy impact on water-dependent jobs. Therefore, there is a relationship between water availability and jobs, particularly jobs in the water sector particularly water resources management, infrastructure maintenance, water supply and sewerage treatment as well as jobs in water intensive industries.

4.6 Themes for objective 3: Approach to mitigate the challenges of water scarcity to Mhlathuze Water customers

There were 6 themes that emerged as the recommended approaches to mitigate the challenges of water scarcity to the customers of Mhlathuze Water. The main approach was awareness, followed by alternative water sources and the third and most frequently mentioned approach was planning. The other 3 were strategic partnerships, dams and water loss management. The six approaches are discussed in detail below.

4.6.1 Awareness

The majority of participants highlighted awareness of water scarcity as one of the main approaches towards water scarcity mitigation. This includes awareness campaigns, education, communication and for Mhlathuze Water to be actively involved in water related forums. This was observed from the participants' comments such as:

"The first thing that can be done is customer awareness campaigns".

"Awareness is very important because if everyone knows what the water situation is then they can change how they do things".

"I think we can start with educating communities and companies so that we can find ways to minimise water use".

"We can also equip them in terms of information and knowledge..."

"Constant engagement with our customers, and also involvement in water related issues in the various forums in the region..."

"The first thing that can be done is customer awareness campaigns".

"The most important is communication, including feedback to customers".

"Need awareness. Awareness campaigns to emphasize to users how critical water scarcity is"

"Awareness programmes because the local community also has a huge impact on water scarcity in the area".

"Communication and having open lines of communication with customers. Education."

According to DWS (2015), education and awareness pertaining to water use and climate change has become a basic necessity. This should be aimed mainly at affecting behavioural change among the population at large. Knowledge has the ability to influence people's actions or decisions (Ishak and Zabil, 2012). This source further highlights that the relationship between knowledge and consumer's behaviour can effectively be explained by Ajzen's theory of Planned Behaviour

which states that individual attitudes and beliefs are influenced by knowledge. van der Vyver (2016) agrees that even though awareness of the water crisis is on the increase on the global scale, there is still more to be implemented in order to ensure water supply in South Africa. Consumers in this research paper indicated enthusiasm to receive more information on responsible water use and conservation. It is this enthusiasm to learn more that should be acted upon by the people in authorities in the water sector.

Organisations similar to Mhlathuze Water have awareness programmes in their areas of operation, for example, Rand Water's "Water Wise" campaign which is aimed at increasing awareness regarding the value of water and why it should be used wisely. The only answer to the dilemma of water scarcity lies in changing people's attitudes and thus their behaviour (Rand Water, 2018). Similarly, Umgeni Water has water classrooms where learners are exposed to issues relating to water, from resources to tap. The above indicates that indeed awareness is one of the tools that can be utilised to mitigate the effects of water scarcity on customers.

4.6.2 Alternative water sources

4.6.2.1 Waste water re-use

A number of participants perceive waste water re-use as one of the solutions for water scarcity in Mhlathuze Water's area of operation. This is evident from the comments that were made such as:

"...either by ourselves or collaboration with other stakeholders like the City, look at water re-use".

"One of the biggest mitigation measures is to recycle the water and use it many times before calling it waste water".

"Waste water re-use of which is another great initiative in order to fight water scarcity in the future because currently we are disposing effluent but if we can treat the effluent and supply to industries we can save that water and supply it for domestic use".

"Also the municipality and Mhlathuze Water plays a key role in terms of prioritising water saving initiatives and even driving the reconciliation study as well in terms of what can be done such as effluent re-use"

This finding highlights the need for Mhlathuze Water to embark on waste water effluent re-use as one of the options to mitigate the challenges of water scarcity. Effluent re-use can take the “load off” fresh water resources, i.e., waste water can be treated to process water standards and be provided for industrial use, rather than utilising freshwater for that purpose. Sershen et al. (2016) found that water re-use is an essential strategy to overcome the imminent water scarcity in South Africa. As technology advances, the re-use of effluent is becoming more cost effective and is being used to supplement water supply and has a potential for expansion (DWS, 2015). The Mhlathuze Water (2017) annual report reported that Mhlathuze Water has been working together with the local municipality in the investigation of effluent re-use. One of the participants mentioned that Mhlathuze Water needs to be actively involved in such initiatives, especially because they own and operate a sea outfall where industrial effluent is discharged. Mhlathuze Water, therefore, should be at the forefront of this initiative as it would further highlight the organisation’s commitment to environmental protection and sustainability, particularly the marine life. A number of participants mentioned that water scarcity affects the marine environment. Another participant further elaborated by saying that Mhlathuze Water should provide solutions at a regional level on issues of alternative water sources and that they should be integral in bringing the relevant stakeholders together.

4.6.2.2 Desalination

Desalination was one of the words that were mentioned frequently by the participants.

“And then I think alternative sources of water need to be looked at, things like desalination”.

“Explore desalination economically”.

“Mhlathuze Water needs to embark on investigating and a large scale desalination”.

“Also the buzz word nowadays is desalination so we must also look into that, we are really next to the sea, surely there’s something we can do, you see”.

“...and also making sure that the desalination plant works properly”.

The above points raised by the participants indicate that the option of desalination should be seriously considered and explored by Mhlathuze Water since the organisation is located in a coastal town hence it is ideally located. Furthermore, although desalination has been found to be more expensive when compared to traditional water purification methods, as technology advances it may become more cost-effective.

Over the past 3-4 decades, desalination technology has evolved as a viable, albeit costly means of producing water, opening up non-traditional sources of water such as brackish water and seawater (Voutchkov, 2018). Desalination of seawater is most ideal for supply to coastal regions that are close to the sources. DWS (2015) concurs that desalinated water is becoming economically viable due to advances in technology and even more so in coastal areas and should be considered as it will free up surface and ground water inland. One of the participants mentioned that DWS had already communicated with Mhlathuze Water with regards to doing the necessary feasibility studies for a large scale desalination plant in Richards Bay. This shows that the water sector considers desalination as one of the key initiatives for mitigating water scarcity.

4.6.3 Strategic partnerships

A number of participants agreed that for the water scarcity issues to be handled correctly, all stakeholders are required to come together and come up with initiatives to resolve the crisis. The comments made were:

“...also we can have relations with other countries which are not as water scarce”, “Such partnerships in terms of sharing our strategic objectives or direction with the client so that collectively we can work towards enhancing water availability”.

“We can actually collaborate with industry and municipalities...”

“...need to have strategic partnership to resolve issues”.

“...have all customers together around the table to see how they can share views and strategic initiatives.

“...work together with local municipality and other beneficiaries of water (communities, industry and agriculture) so that when allocations are done we know how much is reserved”.

“For me in order to mitigate water scarcity, it’s not a Mhlathuze Water thing that we can do on our own or municipality thing however it’s a collaboration of different stakeholders that can come together”.

“All stakeholders need to come together to embark on projects”.

“The industries and the department and us need to work together. Most of the time there is a pointing of fingers and blaming”.

One of the participants emphasised that as a water board, Mhlathuze Water is at the centre of all the stakeholders in the water value chain and hence they can effectively help drive the water policy outcomes sustainably and equitably. This was seen in 2014 when the entity was asked by the Department of Water and Sanitation to enforce restrictions in the Richards Bay area and was made to account for it. One of the participants emphasised this saying that if there was no participation between the various stakeholders then the area would have run out of water. Also, it is because of these strategic partnerships in the water sector that a project was identified to upgrade the inter-basin transfer scheme.

Strategic partnerships are mostly established when companies need to acquire new capabilities within their existing business. This is therefore critical for Mhlathuze Water especially if the entity wants to tap into new technology and new processes such as desalination and effluent re-use as discussed in the previous section. From a technical and financial perspective collaboration with other stakeholders (such as government and private sector) is key. According to Isoraite (2009), one of the benefits of strategic partnerships is shared knowledge and expertise. This is because organisations have strengths and weaknesses and thus forming partnerships allows the organisation to have access to knowledge and expertise where it is lacking.

4.6.4 Planning

Planning was mentioned numerous times as one of the important approaches to mitigate the challenges of water scarcity, as evident from the comments made by the participants, such as:

“Proper planning can minimise the impact”,

“For me you can’t get away from the fact that there should be planning. Coordinated planning involving all key stakeholders”.

“Even there is the weather forecast they will tell us maybe about 2030 there will be drought so we can plan.

“Mhlathuze Water basically needs to go back to the drawing board with DWS”.

“Another thing is long range planning...and in the future we need to make sure that whatever needs to be done can be done to ensure that people have enough water”.

“...integrated planning...”

“The department needs to plan for the future”.

“There can be plans in place and we would not be impacted economically and socially”.

“There needs to be plans in place to have more water”.

Loucks and van Beek (2017) found that reducing the occurrence and/or severity of the negative outcomes such as droughts and floods, is as a result of many planning exercises. Other reasons for planning include the identification and evaluation of alternative strategies with the potential to increase the available water supplies. A number of the participants mentioned that the DWS should lead the water resources planning, such as the building of dams, while Mhlathuze Water as an organ of state need to also be involved in such infrastructure projects.

4.6.5 Dams

The recommendation of building more dams emerged as one of the mitigation measures for water scarcity. Some of the responses from the participants were:

“...and come up with plans to build more dams since a lot of water ends up in the sea”.

“The focus should be on DWS to have more dams to capture more water that is going to the sea”.

“Mhlathuze Water needs to embark on investigating a dam in Nseleni River”.

“The government also needs to come to the party and build more dams to store all that water that goes into the sea when it rains”.

“There needs to be plans in place to have more water, likeand building more dams”.

Water resources management, including dams, is a mandate of the DWS, however the participants mentioned this as one of the solutions, with few participants particularly pointing out that the government (i.e. DWS) should build more dams. It was further mentioned that since Mhlathuze Water is in the coast, that the area is severely affected since it receives the remainder of water flowing from inland. It is therefore critical that there is infrastructure in place to store the water and ensure that it does not run-off into the ocean. This also came up as one of the examples from the previous section (planning), i.e. planning specifically for more dams. Constructing more dams is one of the ways of increasing water availability and reducing water scarcity (Schyns et al., 2015). To meet the present and future challenges of water scarcity, policymakers need to build dams and reservoirs to store water. This was alluded to by Hoekstra (1999) when he reported that building dams is the dominant engineering solution to water scarcity.

4.6.6 Water loss management

Water loss management was highlighted as one of the other mitigation measures for water scarcity in the area, evident from the participants' responses such as:

“See how we can support the City in terms of minimising the amount of unaccounted for water”.

“Mhlathuze Water needs to identify leakages within the system and fix it on time, maybe come up with a system to identify leakages as they happen”.

“The main thing is water loss management and water demand management. It is extremely important in terms of reducing wasteful use of water”.

“Mhlathuze needs to look at infrastructure (leaks)”.

“There needs to be plans in place to have more water, like fixing all the leaks”.

Water losses on distribution and reticulation networks are a major issue in saving water. Charalambous, Foufeas and Petroulias (2014) concur that efficient and effective water loss control should be recognised as a first priority for improving potable water supply. Water utility companies need to comprehend that effective water loss control needs to be continuous and based on a long term strategy and should form part of the utility’s vision. The benefits of a water loss control include water saving; increased efficiency and delaying infrastructure investments. The quantification, detection, pressure management and monitoring alternatives to control water losses are preventive measures to manage water losses. These actions allow water service providers to take the necessary corrective action as and when losses are identified (Fontana and Morais, 2016).

4.7 Summary

Chapter 4 outlined a detailed presentation and discussion of the results of the study, in relation to the objectives and with reference to literature. The research indicates that water scarcity plays a role to Mhlathuze Water and its customers in that water scarcity affects customer service. The fact that there is a supplier-customer relationship means that if Mhlathuze Water is unable to supply water due to its scarcity, then the entity is unable to fully meet its contractual obligations which ultimately affects the service rendered. The challenges of water scarcity were also discussed, with the main ones being the decline in revenue, inability to service customers, loss of business and unemployment. This is because Mhlathuze Water’s core business operation, as a water board, is to supply water, hence if water is scarce then it poses economic and social challenges. Finally, based on the challenges that were highlighted, the recommended mitigation strategies were presented. These included awareness, alternative water sources, planning and infrastructure development. The next chapter, which is the last chapter, will present the conclusions made from the study as well as the recommendations.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This study investigated the impact of water scarcity on customer service, specifically for Mhlathuze Water. This chapter will therefore discuss the conclusions made from the study with emphasis on establishing whether the research questions have been answered. The implications of understanding the impact of water scarcity on customer service will be outlined. The limitations of the study will also be discussed. Practical recommendations by the researcher will then be highlighted in relation to the objectives and findings of the study. The researcher's recommendations for future research conclude this chapter.

5.2 Conclusion

This study was undertaken in order to understand the extent of the impact of water scarcity to Mhlathuze Water, specifically prompted by the challenges that the entity encountered following the drought that was declared in 2014, wherein there were challenges in meeting contractual obligations at times. Therefore, the researcher undertook to conduct an investigation of the role that water scarcity has for Mhlathuze Water and its customers as well as the challenges thereof. Chapter 4 highlighted in detail the challenges of water scarcity in Mhlathuze water, with the main findings being a decline in revenue, lack of growth and inability to service customers. The approaches/measures that can be undertaken to mitigate the effects of water scarcity were also discussed, with the main ones being customer awareness, exploring alternative water sources, planning, strategic relationships with stakeholders and building more dams. The research problem has therefore been addressed as presented in the previous chapter and the findings identified the challenges of water scarcity in Mhlathuze Water.

5.3 Implications of understanding the impact of water scarcity on customer service

The findings from the study have contributed to the body of knowledge regarding water scarcity and its challenges to water boards. Although water boards, as organs of state, are not profit making entities, however the revenue obtained plays a major role in assisting the government in its water provision mandate. This study was therefore able to identify the challenges of water scarcity as well as propose mitigation measures for the challenges.

5.4 Limitations of the study

The following limitations were identified:

- The scope of this research was limited to Mhlathuze Water hence the results are valid for Mhlathuze Water however, they can also be extended to similar organisations to confirm applicability.
- Although there are prior studies that have been conducted on water scarcity and its impacts, there is no study that was found to have been done on Mhlathuze Water or similar organisations.
- The interview skills of the researcher may have influenced the participants' responses.
- The English language was used to conduct the interviews, while the interviewees were not all native English speakers, hence the English speakers might have had an advantage in comprehending the questions.
- Due to the nature of the study (i.e. case study), only 15 managers were interviewed and this sample size may not represent similar views to the others. This was identified as a limitation.
- There was limited time to conduct the research, it is possible that more details regarding the subject matter were not tapped into which might need to be explored in future research.

5.5 Recommendations to mitigate the impact of water scarcity on customer service

The study highlighted a list of practical solutions. The following recommendations are therefore made:

- Awareness with regards to water scarcity was found to be lacking. It is recommended that all stakeholders in the water value chain should initiate awareness campaigns with practical water conservation and water demand management initiatives. The Department of Water and Sanitation (DWS) as the custodian of water resources in the country has a role to play with regards to sensitising citizens about the water scarcity situation from the water resources point of view. There are a number of entities that are an extension of the DWS such as water boards and catchment management agencies that can be delegated to implement this.

- Over and above awareness, these entities can also be appointed on an agency basis to implement projects on behalf of the DWS as well as the management of water resources. This will ensure more efficient and effective system water balance.
- Strategic partnerships between all stakeholders are the key to ensure that the issue of water scarcity is effectively managed, such as Public-Private-Partnerships for capital intensive infrastructure projects such as the building of dams.

5.6 Recommendations for future studies

The following is recommended for future studies:

- The study focused on the general concept of water scarcity, and it also focused on the participants' understanding of the phrase "water scarcity" and there were numerous references to the current drought. It would be enlightening for a similar study to be conducted with a focus on the challenges encountered by all stakeholders (irrigators; industries; domestic customers) during the drought period.
- The study focused on one water board. A study of more water boards could enable a more comparative analysis to be done as this study was only focused on Mhlathuze Water.
- A more diversified sample (including other employees, not just management) could assist with another perspective on the topic.

5.7 Summary

Water scarcity poses numerous challenges on economic development as well as a number of social challenges. Water is an enabler for growth and without it, no living matter can survive. It is therefore critical that measures be put in place to mitigate the challenges that result from water scarcity; this is particularly critical for Mhlathuze Water as it is one of the arms of government in water services provision

The study was conducted by interviewing managers so that the researcher could understand from their perspective what the role of water scarcity is and what challenges the entity faces as a result. The response from the participants highlighted a number of challenges that arise as a result of water scarcity, as well as their views on how these challenges could be mitigated. The details of these were

presented in Chapter 4. The findings from the study answered the research questions and the researcher also presented recommended actions in this chapter. The limitations of the study were immaterial with regards to the findings of the study. It can therefore be concluded that the results are meaningful and valid. Furthermore, the findings from this study were in line with the views of other scholars as per the literature thereby implying a successful research project.

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APPENDIX 1 Interview Schedule

QUESTIONS

- 1. How many years have you worked in the company?
.....
- 2. Tell me about your roles and responsibilities
.....
- 3. What is your understanding of water scarcity?
.....
- 4. What do you think are the impacts of water scarcity to you and the organisation you work for?
.....
- 5. In your view/ understanding, is there a relationship between water scarcity and customer service (i.e. the way that a water service provider serves its customers)?
.....
- 6. Based on the previous answer, what is the relationship?
.....
- 7. What are the economic impacts of water scarcity? What do you think can be done to mitigate such?
.....
- 8. What are the social impacts of water scarcity? What do you think can be done to mitigate such?
.....
- 9. What are the environmental impacts of water scarcity? What do you think can be done to mitigate such?
.....
- 10. In your view, in the midst of water scarcity, what can be done to minimise its impacts on good customer service?
.....

Before we conclude this interview, is there anything else you would like to share?

Thank you for your participation.

APPENDIX 2 Gatekeeper Letter

APPENDIX 3 Ethical Clearance Approval

APPENDIX 4 Turnitin Report