

Barriers to digital transformation in a South African water utility

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requirements for the degree of Master of Management in the field of Digital
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KEYWORDS

- **Culture**
- **Digital Strategy**
- **Digital transformation**
- **Knowledge Management System**
- **Management Information System**
- **Stakeholder management**

ABSTRACT

This study offers a qualitative examination of the barriers hindering a leading South African water utility, referred to here as Organisation X, from fully embracing digital transformation. The qualitative case study scrutinises the utility's attempts at digitalising its processes for better efficiency and the significant barriers that disrupt the realisation of its digital initiatives. Through interviews, this study captures the perspective of these challenges from individuals deeply engaged in the digital transformation journey.

The findings shed light on the intricate barriers that Organisation X faces, encompassing organisational culture, the integration of new digital tools with existing systems, governance, leadership, impacts on the value chain, and the overarching capacity for innovation.

The conceptual framework of this study delves into the relationship between the organisation's strategy and its business model, focusing on how digital transformation can drive value creation by refining business operations.

By investigating these factors, the study seeks to deeply understand the barriers that Organisation X faces in its quest to effectively implement digital strategies and advance its digital maturity. Furthermore, by evaluating the operational strategies of Organisation X, the research pinpoints congruencies, and disparities with its digital ambitions.

DECLARATION

I, Veshal Venesh Paima, declare that this research report is my own work except as indicated in the references and acknowledgements. It is submitted in partial fulfilment of the requirements for the degree of Master of Management in the field of Digital Business at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in this or any other university.

Name : Veshal Venesh Paima

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Date : 30 June 2023

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TABLE OF CONTENTS

LIST OF TABLES.....	v
LIST OF FIGURES	vi
LIST OF ACRONYMS	vii
CHAPTER 1. INTRODUCTION.....	8
1.1 STATEMENT OF PURPOSE	8
1.2 BACKGROUND OF THE STUDY	8
1.3 RESEARCH PROBLEM	10
1.4 RESEARCH QUESTIONS.....	11
1.5 DELIMITATIONS OF THE STUDY.....	12
1.6 DEFINITION OF TERMS	12
1.7 ASSUMPTIONS	13
1.8 RATIONALE.....	13
1.9 CHAPTER OUTLINE.....	14
CHAPTER 2. LITERATURE REVIEW AND ANALYTICAL FRAMEWORK 16	
2.1 INTRODUCTION	16
2.2 DEFINITION OF TOPIC.....	18
2.3 STRATEGY AND VISION	21
2.4 DIGITAL BUSINESS	23
2.5 DIGITAL TRANSFORMATION AND MATURITY	26
2.6 GOVERNANCE.....	29
2.7 ROLE OF INNOVATION.....	31
2.8 DIGITAL TRANSFORMATION JOURNEY	33
2.9 BUSINESS OPERATING MODEL	34
2.10 ASSETS AND CAPABILITIES	35
2.11 CORPORATE CULTURE.....	36
2.12 AN ANALYTICAL FRAMEWORK	36
2.12.1 THEORETICAL FRAMEWORK	36
2.12.2 CONCEPTUAL FRAMEWORK.....	46
2.13 CONCLUSION OF LITERATURE REVIEW.....	47

CHAPTER 3. RESEARCH METHODOLOGY.....48

3.1 RESEARCH APPROACH 48
3.2 RESEARCH DESIGN 49
3.3 DATA COLLECTION METHODS 49
3.4 POPULATION AND SAMPLE..... 50
 3.4.1 POPULATION 50
 3.4.2 SAMPLE AND SAMPLING METHOD 50
3.5 THE RESEARCH INSTRUMENT 51
3.6 PROCEDURE FOR DATA COLLECTION 52
3.7 DATA ANALYSIS STRATEGIES AND INTERPRETATION..... 52
3.8 QUALITY ASSURANCE 54
 3.8.1 TRANSFERABILITY 54
 3.8.2 CREDIBILITY 54
 3.8.3 DEPENDABILITY AND CONFIRMABILITY 55
3.9 ETHICAL CONSIDERATIONS..... 55

CHAPTER 4. RESEARCH FINDINGS56

4.1 INTRODUCTION 56
4.2 PARTICIPANTS RESPONSES PERTAINING TO RESEARCH QUESTION 1 ... 56
4.3 PARTICIPANTS' RESPONSES PERTAINING TO RESEARCH QUESTION 2 ... 61
4.4 SUMMARY OF THE FINDINGS 68

**CHAPTER 5. ANALYSIS AND INTERPRETATION OF FINDINGS
69**

5.1 INTRODUCTION 69
5.2 DEMOGRAPHIC PROFILE OF RESPONDENTS 69
5.3 ANALYSIS OF RESEARCH QUESTION 1 (PROPOSITIONS I AND II) 74
 5.3.1 THEMES IDENTIFIED FOR RESEARCH QUESTION 1 74
 5.3.2 DISCUSSION AND ANALYSIS OF RESULTS FOR RESEARCH QUESTION 1 77
 5.3.3 SUMMARY OF RESULTS FROM RESEARCH QUESTION 1 90
5.4 ANALYSIS OF RESEARCH QUESTION 2 (PROPOSITION III) 92
 5.4.1 THEMES IDENTIFIED FOR RESEARCH QUESTION 2 92
 5.4.2 DISCUSSION OF RESULTS FOR RESEARCH QUESTION 2 95
 5.4.3 SUMMARY OF RESULTS FROM RESEARCH QUESTION 2 114

CHAPTER 6. CONCLUSION AND RECOMMENDATIONS 116

6.1 INTRODUCTION 116
6.2 RESEARCH QUESTION 1 CONCLUDING REMARKS..... 117
6.3 RESEARCH QUESTION 2 CONCLUDING REMARKS..... 121
6.4 POSSIBLE LIMITATIONS AND CHALLENGES OF THE STUDY 123
6.5 RECOMMENDATIONS 123

6.6	SUGGESTIONS FOR FURTHER RESEARCH	128
REFERENCES	130
APPENDIX A: PARTICIPANT AGREEMENT AND CONSENT FORM	138
APPENDIX B: INTERVIEW GUIDE	139
APPENDIX C: EXTRACT OF PARTICIPANT INTERVIEW	142

LIST OF TABLES

Table 1: Research participants' profile	51
Table 2: Key responses from Participants for Research Question 1	61
Table 3: Key responses from Participants for Research Question 2	68
Table 4: Demographic profile of research participants	70
Table 5: Research Questions and related Research Propositions	73
Table 6: Business categories and key themes for Research Question 1..	76
Table 7: Business categories and key themes for Research Question 2..	94

LIST OF FIGURES

Figure 1: World Resources Institute Country-level Water Stress by 2040..	8
Figure 2: Digital Transformation Conceptual Framework	20
Figure 3: Facets of digital transformation.....	21
Figure 4: Digital Transformation ` and Organisational Strategies	22
Figure 5: Four Dimensions of Digital Transformation	23
Figure 6: Six steps to a Digital Business	25
Figure 7: Phases of Digital Transformation	27
Figure 8: The Digital Compass.....	28
Figure 9: Digital Transformation Framework.....	29
Figure 10: Digital Transformation Journey	34
Figure 11: Technology Adoption	38
Figure 12: Strategic Alignment Model.....	44
Figure 13: Conceptual Framework of the case study	46
Figure 14: Six-Phrase Framework of Thematic Analysis.....	53
Figure 15: Research participants management level.....	72
Figure 16: Gender of research participants	72
Figure 17: Coding results for Research Objective 1	75
Figure 18: Coding results for Research Objective 2	93
Figure 19: Organisation X's Governance Structure	117

LIST OF ACRONYMS

4IR	–	Fourth Industrial Revolution
COBIT	–	Control Objectives for Information and Related Technology
DOI	–	Diffusion of Innovation
DPSA	–	Department of Public Service and Administration
DWS	–	Department of Water and Sanitation
EWRM	–	Enterprise-Wide Risk Management
EXCO	–	Executive Committee
ICT	–	Information and Communications Technology
IEC	–	International Electrotechnical Commission
IRMSA	–	Institute of Risk Management
ISO	–	International Organisation for Standardisation
IT	–	Information Technology
ML	–	Machine Learning
PFMA	–	Public Finance Management Act
RPA	–	Robotic Process Automation
SAM	–	Strategic Alignment Model
SCM	–	Supply Chain Management
SOE	–	State Owned Entity
WSA	–	Water Service Act

CHAPTER 1. INTRODUCTION

1.1 Statement of purpose

This qualitative research study is a case study to explore the **barriers** a leading South African Water utility encounters in the **implementation of digital transformation**. The study focuses on exploring the **digital transformation journey** that the Water Utility has embarked upon to optimise its processes. It will highlight the organisation's endeavours as well as **key internal and external challenges** that have hindered the successful implementation of their digital transformation initiatives.

1.2 Background of the study

According to The Borgen Project (2021), South Africa is a water-scarce country that needs to continuously overcome challenges in its efforts to ensure sustainable socio-economic development. The South African government aims to tackle various challenges in the water sector, which include infrastructure degradation, supply capacity, undesirable raw water quality, and a shortage of skilled workforce (South African Government, 2022).

The World Resources Institute report (2015) ranks South Africa to be a highly water-stressed country by 2040, as shown in Figure 1 (Omotayo & Telukdarie, 2020; Maddocks et al., 2015).

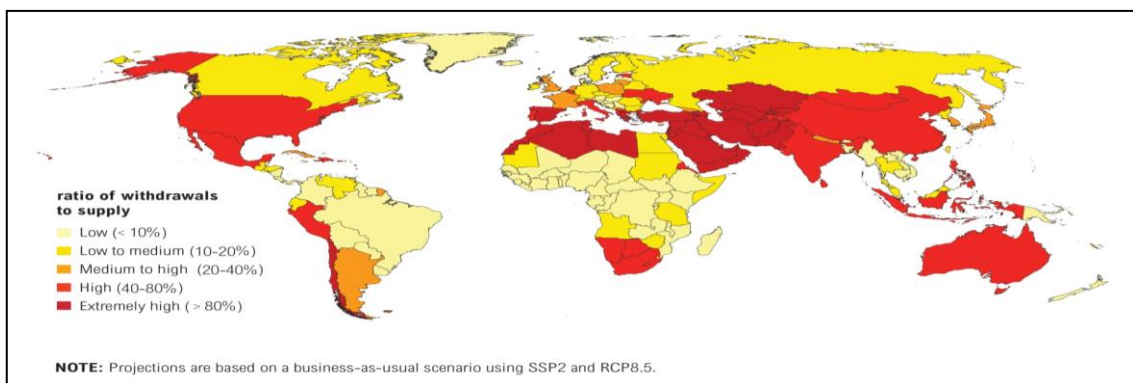


Figure 1: World Resources Institute Country-level Water Stress by 2040

The Department of Water and Sanitation (DWS) is responsible for ensuring that South Africa's water resources are continuously protected and developed through efficient and effective management, as outlined in the *National Water Act* 36 of 1998 and the *Water Services Act* 108 of 1997 (WSA). Water Boards in South Africa are charged with operating dams and bulk water infrastructure in compliance with relevant regulation and legislation. "Organisation X"¹ remains as one of the largest bulk water producers in South Africa and is mandated by DWS to provide bulk water services by means of efficient and effective management of water resources and related critical water infrastructure (Organisation X, 2022a). The organisation's operating model spans over complex systems that continuously undergo performance evaluation in line with changing business requirements, whilst maintaining compliance with legislation and regulation, and ensuring sustainability through continuous optimisation. To help achieve operational integrity, Organisation X's IT Business Unit is charged with facilitating the use of best fit technology to improve supply, transform Supply Chain Management (SCM), and drive proactive communication channels and stakeholder management.

The onset of the global Covid-19 pandemic prompted the organisation to accelerate its efforts in digital transformation, with a primary focus on ensuring business continuity. Furthermore, as a response to the pandemic, a significant number of staff members were provided the necessary tools, such as secure systems, to work remotely (Organisation X, 2021). However, it remains crucial to continually develop IT governance practices that emphasise agility and security in the organisation's Information and Communications Technology (ICT) infrastructure.

Critical to the implementation of digital technology is the assessment of legislative compliance with the Corporate Governance of ICT Policy Framework, set by the Department of Public Service and Administration [DPSA] (DPSA, 2012). The framework outlines the role of leadership within government departments in

¹ The term "Organisation X" is used to denote the specific organisation that was the subject of the case study. However, due to restrictions on disclosure, permission was not obtained to reveal the actual name of the organisation.

ensuring that the necessary strategies, architecture, policies, procedures, controls, and ethical culture are maintained and sustained (DPSA, 2012).

Organisation X's Enterprise-Wide Risk Management (EWRM) was established using the risk maturity frameworks set by the Institute of Risk Management (IRMSA) to create transparency of performance for better strategic decisions. The EWRM risk register indicates that the assessment, adoption and successful implementation of technologies and innovation are ranked as eleventh on the register (Organisation X, 2021). The introduction of digital technology within the sphere of its operations requires an IT governance policy that covers disciplines across the organisation and is aligned with principles of King IV (Giles, 2016).

While the organisation is actively exploring technological innovations to optimise processes across all functional areas of the business, there are several digital applications that have not been implemented successfully. This presents an opportunity to delve into the research topic at hand.

1.3 Research problem

With over 3 million people South Africans lacking access to clean water and a substantial projected increase in water demand by 2030, the effective management of water supply sources is of utmost importance (South African Government, 2018; Boccaletti et al., 2010). In this context, Organisation X, a South African water utility, must harness digital technology to optimise its processes. This study is dedicated to the identification and analysis of the overarching barriers that hinder Organisation X's efficient utilisation of digital technology. Addressing these challenges is imperative for fostering sustainable development and growth within the South African water utility sector.

The research delves into the alignment of Organisation X's operational activities with its digital transformation initiatives. Misalignment in this context results in a multitude of challenges, which can be attributed to the absence of a well-defined digital strategy, strong executive and leadership support, robust stakeholder management, and comprehensive skills development, among other factors. These challenges collectively hinder the organisation's ability to fully harness the

potential of digital technologies across its value chain, ultimately affecting its adaptability in the rapidly evolving technological landscape.

Moreover, the study seeks to evaluate the efficiency of Organisation X's Management Information System (MIS) and Knowledge Management System (KMS) by assessing their ability to seamlessly integrate vital information across diverse operating systems. System integration is a pivotal factor in sustaining uninterrupted operations and enhancing the overall value chain within the organisation (Shukraj, 2020).

The research methodology adheres to a qualitative approach, employing interviews to shed light on these challenges, enabling the formulation of recommendations to assist Organisation X in addressing these issues. This, in turn, will empower Organisation X to improve its digital transformation efforts and optimise its value chain activities in alignment with its overarching business objectives.

1.4 Research questions

The research questions are aimed at evaluating the digital transformation journey of Organisation X. The questions of the case study are to:

1. What factors influence the selection of an appropriate digital transformation journey at Organisation X, and to what extent does the alignment of Organisation X's operational activities with its digital transformation initiatives influence its ability to leverage digital technologies across its value chain?
2. What are the critical components and interdependencies within Organisation X that contribute to the organisation's digital maturity, with a focus on how growth through the digital transformation process leads to improved digital maturity levels and development?

1.5 Delimitations of the study

The qualitative case study is on Organisation X, a Water utility within South Africa. The organisation operates and supplies potable water to a number of areas in South Africa. The scope of the study will be limited to Executives, Senior-management, and Middle-management that are both directly and indirectly responsible for the execution of the digital strategy. Armstrong and Lee (2021) define digital transformation as the collective organisational response to technology change and owing to this, the research will assess the organisations conceptual digital solutions, digital transformation frameworks and mechanisms, and the role of leadership. Furthermore, the research will delve into the organisations culture, operations, and innovation strategy.

1.6 Definition of terms

Digital Transformation: Armstrong and Lee (2021) define digital transformation as the total organisational change response to technological disruption that results in a change of organisational form and nature with the aim of improvement. Deloitte (2017) describe digital transformation as the observable enhancement in new business models that emerges from the utilisation of technology. This transformation also encompasses cultural and personal aspects. Thus, digital transformation is described as the change in an organisation's operational processes and culture stemming from the integration of digital technologies with the aim of creating value (Dilmegani, 2022).

Digital Transformation Journey: A structured plan that indicates the various activities that will be optimised through the application of technological solutions. The start of the journey indicates the current business activities requiring change and subsequently charts the transformative path (Accenture, 2023).

Digital Maturity: Armstrong and Lee (2021) describe digital maturity as an organisations measurable ability to achieve intended strategic and operational outcomes through the adoption of technological change.

ICT Governance: The management framework that is established to enable the organisation to attain its strategic objectives. It forms part of the organisation's corporate governance to ensure alignment of strategy (IT Governance, n.d.).

Management Information Systems (MIS): A set of integrated computerised systems that are responsible for the collation of data from various data sources and transposes the data, through analytics, into readable reports that are used in decision making (Ingram, 2019).

Principle 12 of King Code IV: A corporate governance business principle that provides a set of practices on IT Governance aimed at supporting the organisation in achieving its strategic objectives (Giles, 2016). The practices outline the use of technology and compliance with applicable laws.

1.7 Assumptions

Information integrity: Interview participants will provide an honest answer without fear of undue prejudice. Subsequently, secondary information (supporting documentation) will be made available to clarify and justify some responses. All supporting information obtained from Organisation X is permissible for the study and is consistent, reliable, and true.

Stakeholder engagements: It is assumed that responses from the interview participants are honest to present a reliable means of analysis for the research problem. It is further assumed that participants are aware and always understand the research at hand during engagements.

1.8 Rationale

Organisation X, identified as one of the largest bulk water utilities in South Africa (Organisation X, 2022a), has been chosen as the subject of this case study to gain deeper insights into the challenges it faces when implementing digital transformation successfully. The study would provide valuable insights to Organisation X and possibly other South African public institutions that are governed by similar regulation and legislation and encountering comparable

challenges in their digital transformation efforts. The study's insights would be beneficial for academics, business analysts, local and global water institutions, as well as professionals seeking to gain a comprehensive understanding of digital transformation within the water sector, particularly within the context of a Water utility.

As the Executives of Organisation X are responsible for setting the strategy and determining its trajectory, the study would assist in understanding the importance of the elements that successfully drive digital transformation. Establishing a robust business operating model and implementing structural changes to support digital transformation should be prioritised within the digital strategy. Careful consideration should be given to resource allocation to enable this transformation (Ismail et al. 2017). It is the role of CIOs to establish the digital strategy and align it with the corporate strategy to ensure the achievement of strategic goals through the effective utilisation of digital technology. Their responsibilities extend beyond the IT, as they should facilitate the collaborative design of digital applications through cross-functional engagements (Mackiewicz, 2019).

Given that water is a vital resource and one of the SDGs listed by the UN, it becomes crucial for Water Boards to actively explore digital technologies that aid in the effective management of this life-sustaining natural resource.

1.9 Chapter Outline

The research study will be described within five chapters that indicate the thematic sections of the report. These chapters are:

Chapter 1: Introduction

The introduction of the research report provides an overview of the research subject and defines the scope and context of the research. This chapter includes the purpose of the research and the background of the study. The research problem and the objectives are clearly articulated in this section. The scope of the study is further expanded on in the description of the delimitations.

Chapter 2: Literature review and theoretical framework

This chapter provides a review of relevant literature in an attempt to answer research questions. Key concepts and theories are explored in detail, and definitions of relevant terminology are provided to enhance understanding and contextualise the study.

Chapter 3: Research methodology

This chapter presents the research approach and design, outlining the methodology for data collection and procedures used to sample from the population. It also includes a description of the data analysis techniques and strategies used. Additionally, the chapter discusses potential limitations of the study, addresses quality assurance measures, and considers ethical considerations.

Chapter 4: Research findings

This chapter outlines the findings obtained from the interview process. It provides distinct findings for Research Objective 1 as well as Research Objective 2. To succinctly display the findings', chosen responses are condensed in Tables that highlight the key insights from each participant.

Chapter 5: Analysis and interpretation of findings

This chapter focuses on addressing the research questions by analysing the findings derived from interviews and supplemented with secondary data. The analysis process involved cross-referencing the data against relevant theoretical frameworks to gain deeper insights. Furthermore, the chapter highlights key themes that have emerged from the collected data.

Chapter 6: Recommendation and conclusion

The chapter provides key takeaways and concluding statements derived from the research, which can serve as valuable insights for future studies on digital transformation in the water sector and other South African public entities.

CHAPTER 2. LITERATURE REVIEW AND ANALYTICAL FRAMEWORK

2.1 Introduction

The qualitative case study aims to understand the challenges involved in Organisation X's digital transformation and the factors that support digitalisation. Owing to the digital revolution, the Water Sector is steadily transforming through the adoption of Fourth Industrial Revolution (4IR) technologies and in turn has enabled a new paradigm for urban water management (Hee et al., 2020). The implementation of digital technologies in Organisation X has the potential to bring about a significant transformation in its operational landscape. However, several factors such as misaligned corporate culture, operational limitations, regulatory and legislative constraints, inadequate digital governance, and insufficient knowledge management hinder the organisation's digital transformation efforts. Consequently, this impedes the organisation's progress towards achieving systemic change and enhancing overall performance. The understanding of the complexity of the entire organisational system provides a good basis for understanding the organisation's digital maturity and the initiatives that need to be embarked upon to achieve digital transformation objectives. In the context of digital transformation, strategic planning plays a crucial role, and it is essential for leaders to establish a clear vision. This vision should encompass strategic goals such as promoting the conservation of natural resources, expanding access to reliable water, and enhancing the overall water supply. By ensuring a well-defined vision, leaders can effectively steer the digital transformation efforts toward achieving these objectives (South African Government, 2018).

Many organisations struggle to implement and embark on digital transformation and only a third succeed in their efforts (McKinsey & Company, 2018). Kane et al. (2015) define digital transformation as the deployment of digital technologies to establish a new digital business model that has the potential to create value. For larger organisations, the implementation of digital transformation is prone to numerous challenges depending on the scale of the transformation and the governance protocols that should be complied with. According to Sarni et al.

(2019) describes a utility as a complex organisation that is managed by multiple departments that each have their own objectives, network of physical assets and data systems. The operational landscape of Organisation X is influenced by a diverse range of internal and external factors, resulting in system complexity. The external environment introduces dynamic regulations and legislation that govern operational aspects, while internal factors such as culture, management, and governance structures play crucial roles in the organisation's digital transformation journey. Consequently, digital transformation necessitates strategic, tactical, and operational responses from Organisation X to effectively navigate these complexities (Armstrong & Lee, 2021).

Mastering the skillset required for digital transformation is often a challenge that necessitates continuous training and employee retention efforts. Successfully operating a digitalised organisation demands a well-defined business strategy that effectively integrates enabling elements with the intricate structure of functional business activities, all aligned with overarching business objectives. The CEO's Playbook for Successful Digital Transformation identifies traits of organisations that have successfully implemented digital transformation and highlights aspects that lead to failure (Carey et al., 2021). It suggests that digital transformation is a complete business reinvention, and that the evolution requires large-scale investments, and results in permanent changes.

The automation of operational processes helps in making the organisation more cost effective and agile, in terms of responding to external and internal influences. In order to achieve new technical capabilities, Organisation X' is encouraged to drive innovation (Dilmegani, 2019). Embarking on a successful digital transformation journey is a complex undertaking that requires substantial investment and is typically associated with long-term benefits, as highlighted by Shahi and Sinha (2020). It is crucial for organisations to recognise that digital transformation is an evolving process, and to reap its benefits, they must be agile in responding to emerging developments and ensure efficient implementation. Public entities face challenges in funding initiatives due to their adherence to the *Public Finance Management Act 1 of 1999* (PFMA) and the need to comply with national treasury directives (Organisation X, 2021). The ability to generate surplus cash from both primary and secondary business activities plays a vital

role in funding digital transformation projects, as highlighted by Matt et al. (2015). In this context, innovation becomes crucial, as management encourages a culture of innovation to optimise business processes, leading to reduced operating costs, as emphasised by Shahi and Sinha (2020). Culture plays a pivotal role in the success of digital transformation initiatives. The cultivation of a culture that supports continuous growth is paramount to a sustained digital state, due to the exponential rate of technological change and its impact on the business ecosystem (Shahi & Sinha, 2020; Titko & Verina, 2019).

This case study will unveil the key elements of a digital transformation journey and explore the impact of previous and ongoing initiatives. The literature review incorporates existing research and adopts a theoretical framework to provide a comprehensive understanding. Stemming from this, relevant propositions have been formulated to further contribute to the discourse on digital transformation.

2.2 Definition of topic

Digital transformation has fast become an undertaking by organisations across various industries in efforts to reshape customer value and transform business operations, leading to enhanced operational performance and strengthened collaboration among stakeholders (Fischer et al., 2020). The public sector functions with the same underlying business principles as private companies, and the consideration of digital transformation is now a necessity so as to reduce operational costs, increase revenue and improve service delivery. Through digitalisation of Organisation X's operational processes, the utility would further solidify its position as a leader on the African continent and globally.

The Covid-19 pandemic has acted as a catalyst, prompting organisations to quickly embrace and adjust to various digital communication solutions in order to ensure business continuity and long-term sustainability. The effective use of communication technology plays a pivotal role in optimising business processes, strengthening stakeholder engagements, and delivering quality services (McKinsey & Company, 2018).

The successful digitalisation of government services is estimated to contribute R2 trillion to society, making it the highest value in terms of economic impact, productivity, and service delivery (Accenture, 2019). The framework developed by Accenture and the World Economic Forum (WEF) for assessing the impact of digital technology on government services highlights that public infrastructure maintenance, public administration, and healthcare are significant contributors to this digital transformation (Accenture, 2019). In line with the National Development Plan for South Africa, the digitisation of services by 2030 is a priority within the public sector. The e-Government strategy serves as a guide for digital transformation, with successful initiatives such as SARS e-filing, the Department of Home Affairs' Smart Identification Card System, and the integrated National Transport Information System [NATIS] (Department of Telecommunications and Postal Services: South Africa, 2017).

The adoption of technological solutions is driving societal shifts through its impact on business operations and the external environment in which it operates (Ismail et al., 2017; Titko & Verina, 2019). The rise of 4IR brings about innovative opportunities that enable faster and more efficient access to products and services (Omotayo & Telukdarie, 2020). With the opportunities of harnessing technological solutions, there are risks that need to be effectively managed and controlled to ensure that the enabled environment continuously functions in a manner that drives the strategic intent. Governance frameworks, policy and process management, stakeholder management, internal collaboration and support are fundamental in implementation and successful operation (Ismail et al., 2017). The South African Water sector has in recent years experienced the impact of climate change, resulting in extreme rain (Tandon, 2022), water restrictions due to water stress (Heggie, 2021) and restrictions in Gauteng due to low reservoir levels (South African Government, 2021). Globally, regions such as Michigan, Bangalore, Brazil, and India face the similar challenges (World Economic Forum, 2018). The dire need for new business strategies and public policies presents the consideration of integration of technologies to help achieve targets. Water Boards stand to benefit from the exploration of digital technologies, as it would lead to improved quality of product and service offering; data analytics

help make better informed decisions pertaining to operations and finances (Omotayo & Telukdarie, 2020).

According to Titko and Verina (2019), digital transformation requires fundamental organisational change with a focus on results, and essentially the customer. For South African Water Boards, fulfilling their public mandate and ensuring the provision of potable water to citizens, primarily through municipalities, should be the central focus of their undertaken initiatives. The three core elements (i.e., Drivers, Digital Transformation and Results) shown in Figure 2 provide an understanding and awareness of factors within the digital transformation journey (Titko & Verina, 2019).

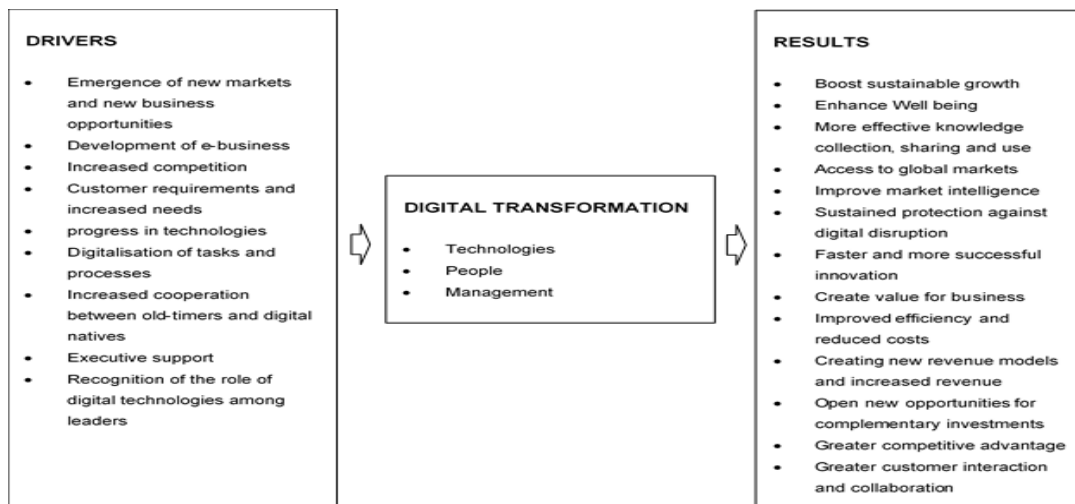


Figure 2: Digital Transformation Conceptual Framework (Titko & Verina, 2019)

Similarly, Armstrong and Lee (2021) provide an overview of the business results that occur from digital transformation. The overlapping aspects in the conceptual model by Titko & Verina (2019), suggest that the digital transformation allows for a gradual redesign of an organisation’s operating system, which should be understood upon conceptualisation of the digital transformation journey.



Figure 3: Facets of digital transformation (Armstrong & Lee, 2021)

Given the complex challenges faced by South Africa, the utilisation of digital technologies is anticipated to assist Water Boards in addressing some of the tasks assigned to them (Omotayo & Telukdarie, 2020). Currently, Organisation X has ventured into the implementation of remote sensor technology, specifically satellite leak detection, which enables the identification of pipe leaks through real-time monitoring of water volumes. This technological advancement enhances predictive maintenance, optimises asset utilisation, and brings about financial benefits (Organisation X, 2021). Digital solutions that are designed, typically involve an array of key stakeholders to ensure that scope solution effectively caters for desired outcome (Ismail et al., 2017). Due to the magnitude of Organisation X's operational activities, it has the opportunity to explore various other technical advancements of 4IR applications with the aim of optimising its business processes in both core and support activities. This would allow the organisation to globally pioneer capabilities and solutions for overcoming some of the water sector challenges.

2.3 Strategy and Vision

To effectively address the challenges that arise during the digital transformation journey, a clear and well-executed digital transformation strategy is crucial (Matt et al., 2015). However, Executives responsible for driving the strategy often face conflicts regarding how emerging digital technologies can be utilised to achieve the desired transformation objectives. According to Von Leipzig et al. (2017), experts believe that the ability to digitalise business operations is not solely

dependent on the technologies themselves but also relies on strategic and cultural changes within the organisation. To fully grasp the impact of digital transformation initiatives, it is important that it is comprehensively understood across the entire organisation. The digital transformation strategy plays a crucial role in providing an integrated overview of these initiatives and the tools that will be utilised to achieve the stated objectives (Matt et al., 2015).

The digital transformation strategy provides a guide for an organisation's journey towards digital transformation. It encompasses a range of opportunities that can be explored, as well as the risks associated with adopting and not adopting digital technologies (Fitzgerald et al., 2013).

It is paramount that the organisation's digital strategy is aligned to the business and operational strategy (Matt et al., 2015), shown in Figure 4.

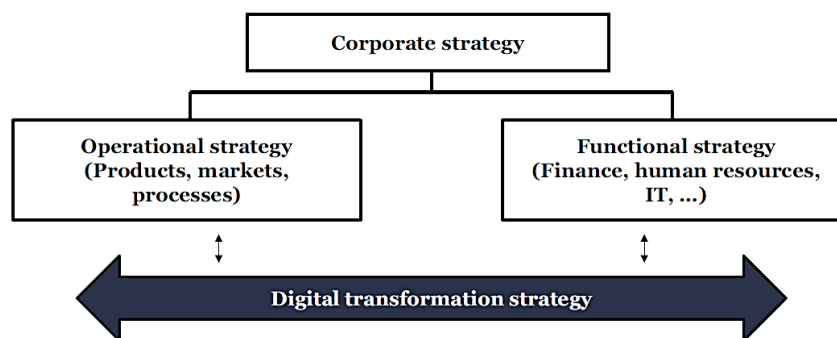


Figure 4: Digital Transformation Strategy and Organisational Strategies (Matt et al., 2015)

The digital transformation strategy should encompass all business activities throughout the organisation's value chain and undergo continuous reassessment and evaluation (Matt et al., 2015). It is a combination of the digital business strategy, which involves formulating and executing business strategies using digital technologies, and the IT strategy, which focuses on the efficient management, implementation of IT plans, and governance of IT infrastructure and application systems (Bharadwaj et al., 2013; Juneja, n.d). However, it is important to note that the digital strategy alone does not provide a comprehensive framework for the specific transformation steps required to achieve the desired state (Matt et al., 2015).

Organisations should prioritise on long-term objectives, as opposed to quick gains. Change readiness is crucial in the transformation process as it allows for a comprehensive assessment of an organisation's current state in relation to the implications of digital technology. Furthermore, the alignment of core values with the integration needs to be considered. Matt et al. (2015) provides four distinct aspects that a Digital Transformation Strategy should be established on, which include:

- **Technologies:** The exploitation of new technologies to fulfil operational activities and possibly position the organisation as a forerunner in the market.
- **Financial aspects:** The consideration of an organisation's ability to finance a digital transformation initiative.
- **Value creation:** The impact of digital transformation on the value chain and the related additional resources, skills and competencies required to sustain the change.
- **Structural views:** A thorough assessment of changes in the organisation's structure.

The interconnection of digital transformation aspects is shown in Figure 5.

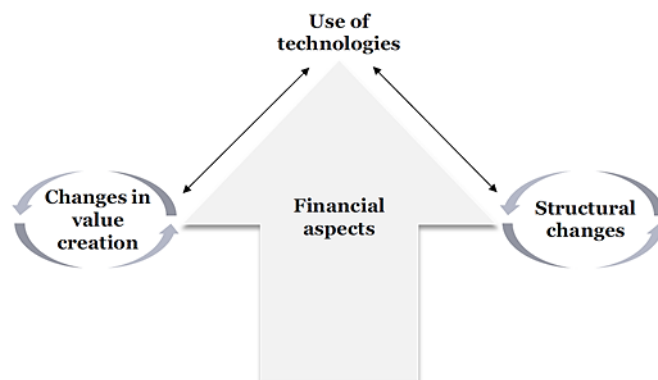


Figure 5: Four Dimensions of Digital Transformation (Matt et al., 2015)

2.4 Digital Business

The business landscape continues to evolve necessitating organisations to continuously embrace and adjust to changes, particularly those driven by

technology. Digital business is an organisation-wide set of expertise and skills fulfilled by various roles and is primarily focussed on businesses affixed in IT (Gartner, Inc.,2014). According to Anderson and Lanzolla (as cited by Ismail et al., 2017), digital transformation involves a fundamental shift in a business that is propelled by digital technologies. Bharadwaj et al. (2013) highlight that significant advancements in technology have given rise to new functionalities and have fundamentally altered business strategies by enabling various capabilities suitable for the volatile business environment.

In the South African water sector, the delegation of responsibility from the DWS to Water Boards facilitates effective management as they strive to address sector-specific challenges. Organisation X recognises that achieving uninterrupted and reliable water supply relies on leveraging a broad infrastructure base (Organisation X, 2022a). Given the scale of Organisation X, the application of technologies presents a wide range of solutions. Digital transformation, enabled by digital technologies, should encompass the entire value chain, spanning from physical infrastructure to business services (Sarni et al., 2019). Consequently, digital technology can be implemented across Organisation X's primary and support services within its value chain. Omotayo and Telukdarie (2020) highlight that South Africa lags in applying appropriate digital technologies to address water challenges, specifically infrastructure technologies, such as smart metering, cloud computing and data analytics. However, Organisation X seems to be making strides in addressing this issue, as indicated in its 2021 Annual Report, where the organisation explores remote sensor technology for real-time monitoring of water volumes to detect pipe leaks (Organisation X, 2021). While this technology is initially deployed at the operational level, the application of digital technologies can be extended to various support business units within Organisation X's value chain. Adopting a holistic approach to the conceptualisation of a digital business is crucial for redesigning interconnected systems with optimisation in mind. Sarni et al. (2019) emphasise that, for a digital business, deploying digital technologies solely at the operational level may be insufficient. Instead, digital technologies should be integrated throughout the entire value chain and woven into all levels of the organisation.

Gartner Inc. (2014) has identified six key steps to build a successful digital business, which is shown in Figure 6. Gartner Inc. mentions that a digital business is an organisation wide undertaking and responsibility does not merely reside with IT. Technology and information usage are considered key components of a digital business. To ensure success, business leaders and the CIO should ensure that there is alignment with all functional roles and the digital strategy (Gartner, 2014). Furthermore, Mackiewicz (2019) writes that CIO's need to take on responsibilities that stretch beyond IT, a perspective that aligns with Bharadwaj et al.'s (2013) emphasis on the CIO's role in spearheading the organisational change associated with digital transformation. It can therefore be deduced that the capability of the CIO is critical to the digital transformation journey and is regarded as the lead implementor that must maintain a service provider role in the digital transformation journey with Executive Committee (EXCO) members and their respective teams (Research Proposition 1).

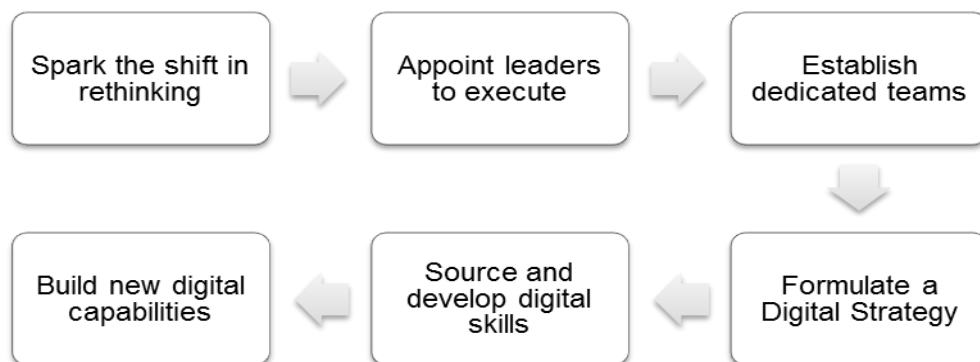


Figure 6: Six steps to a Digital Business (Gartner Inc., 2014)

The model suggests that a proactive approach to digital transformation is achieved by driving innovation using digital technology to create new business models and exploit the network of organisational resources. The commitment of leadership, particularly Executives, is necessary to help fast-track digital transformation initiatives to ensure appropriate management principles are established. The formulation of the digital strategy provides the direction and should present the following key elements:

- **Digital business models** that will be impacted by the digital strategy.
- **Information** that is critical, considering legal and regulatory requirements.
- **Technology** that supports the digital strategy.
- **Communication channels** that will provide insight and understanding.

In the evolving landscape of digital business, it is crucial to prioritise adequate preparation. Organisations should continuously assess channels for improving digital business capabilities (Gartner Inc., 2014). This includes facilitating training and workshops to educate the current staff and ensure necessary steps are taken to align the workforce with the organisation's vision.

2.5 Digital Transformation and Maturity

With digital transformation, the concepts of digitalisation and digitisation are often used interchangeably (Malak, 2021). Bumann and Peter (2019) provide three distinct processes of digital transformation, shown in Figure 7. The first phase is termed digitisation, which is the conversion of data and processes. The second phase is digitalisation which Gartner Inc. (2014) defines as the change in the business model owing to adoption of digital technologies such new value producing opportunities. Brennen and Kreiss (2014) have considered digitalisation in a social context and define it as the manner in which people digitally interact in all aspects of their lives.

Digital transformation represents the final stage of a process and essentially entails the integration of new business models and processes (Alisic, 2018). Berghaus and Back (2016) provide a definition of digital transformation as the process of digitisation aimed at enhancing efficiency and driving innovation through the integration of digital capabilities into existing products. Hess et al. (2016) also supports this perspective, describing digital transformation as a change in an organisation's business model triggered by digital technology. The change is initiated by the need to optimise processes with the aim of improving economic value throughout the value chain.

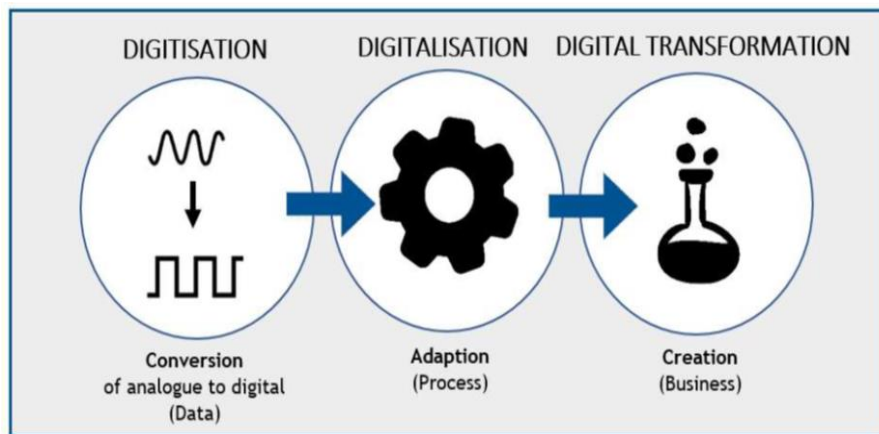


Figure 7: Phases of Digital Transformation (Bumann & Peter, 2019)

With digital transformation comes risks that the organisation needs to manage. An organisation's reaction to digital transformation determines where it positions itself within the economy and failure to react, results in lost opportunities (Bumann & Peter, 2019). The digital transformation strategy should strategically position the organisation to benefit from implementation of digital technologies, as well as leverage on the organisations digital resources to drive new value (Hess et al., 2016).

The primary reason why organisations embark on digital transformation is to improve growth of profit and operational performance (Al Siyabi, 2020). Westerman et al. (2014) introduced the Digital Compass framework, illustrated by Figure 8, which consists of four key components of digital transformation, including challenges (Al Siyabi, 2020). The challenges identified by Westerman revolve around increasing awareness of digitalisation, understanding the organisation's current state, and formulating a vision driven by Executives. According to Kotter's change model, the creation of a sense of urgency is paramount in the digital transformation journey (Kotter, 2007). The water sector has recognised the need for digital transformation within the public arena and as such, Organisation X has embarked on its own digital transformation journey to fulfil its public mandate and optimise operations to meet its strategic objectives (South African Government, 2022).

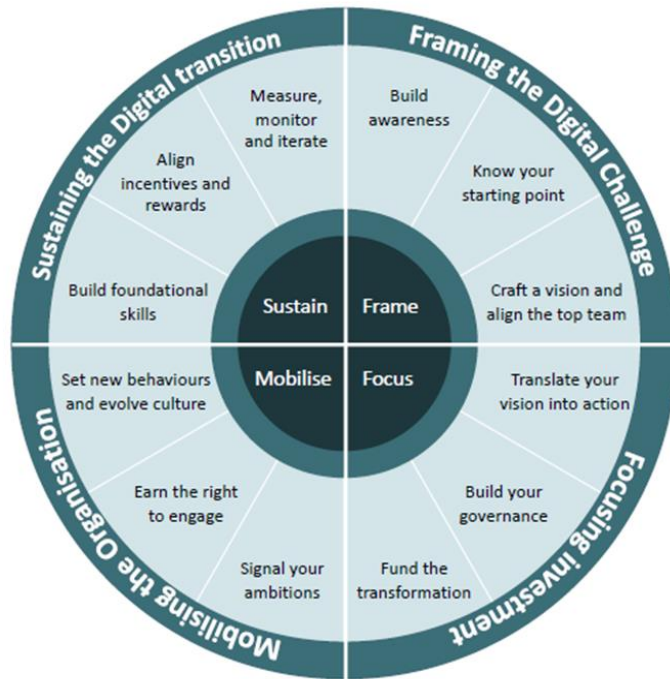


Figure 8: The Digital Compass (Westerman et al., 2014)

The second component considers the aspects of the investments by turning the vision into reality. This is achieved by the establishment of a digital transformation journey that clearly articulates the various digital initiatives that will be embarked upon (Westerman et al., 2014). It further indicates the need to establish appropriate governance structures to ensure that the changes in operating activities comply with regulatory and legislative requirements without compromising the operating activity. When introducing project initiatives, the Water Board should ensure that they do not hinder service delivery, in accordance with the Water Services Act 108 of 1997.

The third component of the model is to mobilise the organisation through engagement with all internal stakeholders to communicate the vision and the change that is required (Westerman et al., 2014). Sarni et al., (2019) emphasise it is crucial to foster a culture embedded in innovation which is initiated by the change in new behaviours at all levels.

The sustainment of the digital transition is achieved through the development skills needed to sustain and improve the digital transformation and is represented as the fourth component. Westerman et al. (2014) suggest that the various

digital transition activities and undertakings should be monitored and evaluated to ensure efficient use of resources and for related decision making.

According to Hess et al. (2016), the corporate strategy sets the foundation of the digital strategy. Expanding on this, the key to driving a successful digital transformation lies with the incorporation of digital strategies that result in significant positive business change (Matt et al., 2015). Consequently, the digital strategy supports the digital transformation process as it provides guidance on coordination and management of the various activities. Ismail et al. (2017) therefore suggest that digital transformation should be formulated at the business strategy level, due to the overarching impact on the corporate strategy. The Digital Transformation Framework provided by Bumann and Peter (2019), shown in Figure 9, further illustrates the elements that support the digital strategy.

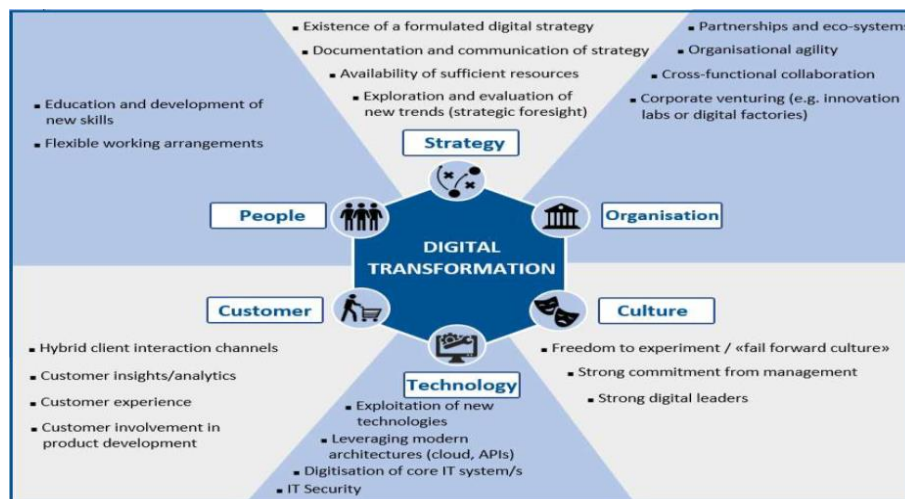


Figure 9: Digital Transformation Framework (Bumann & Peter, 2019)

2.6 Governance

Organisation X has been in existence since the 1900's and the scope of its operating activities would undoubtedly be interesting and challenging (Organisation X, 2022a). As the provider of an essential resource, water, the organisation must prioritise the implementation and maintenance of robust governance frameworks to ensure effective management and control. The Water utility's operations are governed by a range of acts and legislation that have been officially approved and adopted by the Government through parliament. One such

significant legislation that governs the existence and operations of Organisation X is the *Water Services Act 108 of 1997*, which provides guidance and approval for the organisations mandate and activities (*Water Services Act 108 of 1997*).

In terms of technology utilisation, Organisation X must adhere to the Policy Framework established by the DPSA, which is responsible for the governance and management of electronic government (DPSA, 2012). The Policy Framework devised by the DPSA aims to institutionalise the corporate governance of information and communication technology (ICT) within government departments. Government transformation is a strategic endeavour driven by prioritised governmental goals and the principles of equal access to services, enhanced productivity, and cost reduction. By establishing ICT, government institutions enable efficient public service delivery, thereby creating value for stakeholders. It is worth emphasising that executive management plays a crucial role in extending corporate governance principles to ICT. They achieve this by evaluating strategic objectives considering ICT plans, ensuring that ICT effectively facilitates goal achievement, and its performance can be effectively monitored. The frameworks for implementing ICT governance include, but are not limited to, the following:

- **King IV, principle 12:** The King Report is the most common Corporate Governance Framework in South Africa that is used within Public Sector. The Governance Framework covers governance ICT principles and practices to be considered in an organisation's overall governance structure (DPSA, 2012).
- **ISO/IEC 38500:** A Corporate Governance of ICT standard that outlines international governance principles (DPSA, 2012).
- **COBIT:** The process framework supported by King IV and ISO/IEC 35800 used for implementation of Governance of ICT that is recognised globally (DPSA, 2012).

According to Organisation X's Integrated Annual Report (IAR) for 2021, the Board has expressed its support for governance that emphasises effective leadership, ethical standards, and the maintenance of financial imperatives (Organisation X, 2021). The report also highlights that Organisation X has successfully established

a culture of sound governance by adopting policies (Organisation X, 2021). Within its governance structure, financial management assumes a critical role, and the implementation of effective controls is consistently ensured through the utilisation of various policies. To uphold these principles, Organisation X adheres to the PFMA. This legislation provides a comprehensive framework that necessitates the implementation of robust management practices to avoid potential negative consequences associated with non-compliance. Furthermore, given the mandate provided by DWS, which requires the Water utility to efficiently manage and develop water resources while ensuring the supply of water, the organisation must remain committed to prioritising service delivery within its budgetary limits (South African Government, 2022).

Moreover, as the demand for water and urbanisation continues to grow in South Africa, Organisation X must prioritise capital expenditure related to infrastructure renewal. According to the Development Bank of Southern Africa (DBSA, 2020), the country is currently lagging in terms of digital transformation and the necessary infrastructure to support digitalisation compared to other countries. The investment in digital infrastructure helps the country's economy by improving accessibility of information, promoting job creation, and boosting social inclusion to the population at large (DBSA, 2020). However, Hee et al. (2020) point out that despite the abundance of available systems and technologies in the market, making investment decisions in this area can be challenging due to the associated uncertainty and risks. Therefore, when considering the allocation of resources between non-digital initiatives and digital initiatives, a thorough assessment is required to ensure sound financial management and corporate governance is maintained.

2.7 Role of Innovation

Digital transformation is a journey that requires careful attention. Allocating resources effectively between digital initiatives and existing operations necessitates efficient project scoping to maximise value and growth opportunities. Accenture (2019) highlights that the implementation of digital

technologies, supported by skilled personnel and well-defined organisational structures, fosters organisational agility, and helps instil a culture of innovation. In the digital era, organisations need to build capabilities that embrace change, enhance efficiency, and accelerate innovation (Ismail et al., 2017; Sebastian et al., 2017). Fostering an innovation culture across the entire value chain emerges as a crucial element in driving the digital transformation strategy, as emphasised by Sarni et al. (2019). Moreover, Matt et al. (2015) asserts that while technology strategy has minimal impact on innovation, the organisation's culture plays a significant part. It can be deduced that the catalyst for change and the initiation of innovation stem from a curiosity about technological developments. Therefore, it can be argued that a culture of experimentation drives the exploration of technology within a business (Kane et al., 2017).

The adoption and utilisation of enabling technologies in the water sector enhance an organisation's capabilities and foster a culture conducive to ongoing innovation (Sarni et al., 2019). According to Kaltenecker et al. (as cited by Ismail et al., 2017), organisations that have relied on outdated technology for an extended period may lack the necessary capabilities to effectively manage digital technologies. Organisation X, which has been in operation since the early 1900s and operates on legacy systems, may encounter challenges in embracing digital transformation due to resistance to change (Shahi and Sinha, 2020). Given Organisation X's public mandate, it is crucial for the organisation to prioritise compatible technologies that can be seamlessly integrated into its existing operations without causing significant disruptions. As highlighted by Sarni et al. (2019), organisations must acknowledge the significance of innovation arising from changes in business processes, as it ultimately leads to improved business outcomes.

Rogers (1983) proposed the Diffusion of Innovation Theory, which emphasises the continuous creation of innovation diffusion through various network channels. Within an organisation, the perception of innovation characteristics by individuals often influences organisational structural changes. Therefore, as highlighted by Westerman et al. (2014), engaging with all internal stakeholders is a vital component of digital transformation to initiate the necessary change within the value chain.

2.8 Digital Transformation Journey

The digital transformation presents how the value chain and a company's business model might change (Catlin et al., 2017). The systematic change requires time and effort that is led by Executives through efficient management and coordination of activities (Fitzgerald et al., 2013). However, many Executives recognise that the transformation cannot be solely accomplished under their oversight, considering the scope of change required (Catlin et al., 2017). To successfully execute the digital transformation strategy, it is essential to have a wide range of enabling tools and align it with the organisation's objectives, as emphasised by Kane et al. (2015). Furthermore, Catlin et al. (2017) stresses that the strategy must be endorsed by the CEO to ensure the undertaking receives the necessary commitment.

During the initiation phase of digital transformation, challenges will undoubtedly occur, and it is important to avoid solely focusing on technology, as highlighted by Kane et al. (2015) and Catlin et al. According to Bharadwaj et al. (2013), the digital transformation strategy should be based on the organisational strategy, with the goal of value creation through the effective utilisation of digital technology. This perspective is also supported by Fitzgerald et al. (2013), who emphasise that transformation outcomes in the context of digital transformation are often unsuccessful due to a lack of both technological and managerial expertise. Catlin et.al (2017) provide guiding principles for digital transformation:

- The scope of digital transformation must remain at the fore of business strategy. Therefore, the level of investment should indicate the scope of digital technology solutions and the expected returns. Successfully achieving the goals outlined in the digital strategy requires commitment management.
- Resources should be adequately assigned for several initiatives executed concurrently and it should be managed within the organisation's capabilities.
- Continuous transformation ensures that adequate capabilities are maintained. The allocation of resources should be well managed to ensure that digital initiatives do not adversely affect the performance of core business.

Collaboration is key to promoting the reinvention of a new operating business model.

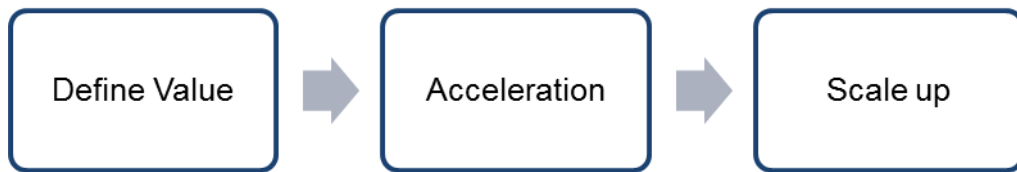


Figure 10: Digital Transformation Journey adopted from Catlin et al., (2017)

Although digital transformation is concerned with technological change, the primary focus of an organisation is to reinvent the business model by leveraging digital technology as a catalyst. Through continuous learning from digital projects, organisations gain valuable insights into technology that ultimately lead to improved returns and performance (Catlin et al., 2017).

2.9 Business Operating Model

The business model provides insight into why business is done and the ways in which value is created and distributed (Armstrong & Lee, 2021). The changes in the business model, in the context of digital transformation, require an assessment of the organisation's digital capabilities to ensure that digital solutions can be successfully implemented and effectively operated (Ismail et al., 2017). Digital transformation is predominantly driven by innovation, which results in new operating business models (Kane et al., 2015) that allow the organisation to exploit infinite opportunities due the exponential rate of technological disruption. It can thus be viewed that the digital transformation journey must align to the business operating model and is a prerequisite, delivering key business outcomes at Organisation X (Research Proposition 2).

As businesses transition to 4IR models, the establishment of a robust Knowledge Management System (KMS) becomes crucial for disseminating information and creating value (Buntak et al., 2020). However, implementing KMS in businesses has often been faced challenges arising from cultural barriers and rethinking failures (Kane et al., 2015). Murugesan (2021) expresses that to drive innovation,

facilitate change management, and support decision-making, it is essential to capture and disseminate data effectively. Therefore, the establishment of a well-defined KMS becomes paramount in the journey of digital transformation, ensuring the effective sustenance of the business model. In light of these considerations, it can be argued that the Knowledge Management System (KMS) of Organisation X is critical to controlling and managing the flow of information to meet business core requirements (Research Proposition 3).

2.10 Assets and capabilities

Digital transformation is highly dependent on the adoption and integration of digital technologies (Hess et al., 2016). The technology deployed should allow the organisation to capitalise on flexibility, speed, and collaboration due to modern architectures. Subsequently, functional teams must maintain the necessary skills to facilitate the efficient and effective use of digital solutions. Considering SOE's, many operate with legacy systems that span across its broad infrastructure base. The integration of digital technology in such operations often poses a myriad of challenges that impede on the organisations performance and dampen its drive to embark on further transformational initiatives (Rosner, 2018). The increase in urbanisation and climate change continue to negatively impact water infrastructure. Thus, the water sector needs to embrace digital technologies to effectively manage uninterrupted bulk water supply.

At the same time, with the benefits of technology, organisations need to consider the risks and thus implement relative control measures. The rate of digitalisation gives rise to organisations having to continuously protect their systems. The Covid-19 pandemic has sparked an increase in cybercrime and systems that maintain sensitive and confidential data are continuously compromised by hackers (Deloitte, 2020). Shahi and Sinha (2020) write that an organisation should invest in data management and system security to protect its data and its people to ensure business continuity. Organisations should therefore ensure that the scope of their digital assets and capabilities cover control measures posed by digital transformation.

2.11 Corporate culture

Culture is an element of measure for digital maturity and is a key to the digital transformation journey. Ismail et al. (2017) write that the increase in knowledge sharing presented with digital transformation stimulates a cultural shift within organisations. Consequently, organisations are faced with the choice of adapting to a new culture that supports the evolving business environment in the context of digital transformation (Shahi & Sinha, 2020). Mackiewicz (2019) affirms that successful digital transformation requires providing the necessary tools to foster a digital culture.

A digital culture involves experimentation and continuous collaboration (Dilmegani, 2022). According to Kane et al. (2015), digitally mature organisations are experimental and have a higher appetite for risk. Fostering a culture that embraces risk-taking serves as a bases for innovation and provides opportunities to learn from the complexities encountered with various activities (Hartl & Hess, 2020). The exploration and experimentation must be supported by Executives who are ultimately responsible for determining the organisation's operations. Digital transformation thus requires leaders who can manage the complexity of transformation initiatives and concurrently provide continuous support while fostering a culture of innovation, learning and development (Kane et al., 2016).

2.12 An Analytical Framework

The analytical framework provides an integrated overview of the theoretical and conceptual frameworks of the study.

2.12.1 Theoretical Framework

The theoretical framework provides the structure of the study and is established on a theory that has been previously devised and tested. It primarily aims to contextualise the theory, supported by relevant frameworks, that will set the focus of the study.

The key elements discussed in the literature review will be further assessed using the **Diffusion of Innovation (DOI) Theory and applicable frameworks.**

Everett Rogers developed the DOI Theory in 1962 to explain the diffusion of new ideas and technology. Rogers (1983) defined the term diffusion as the process by which innovation (new ideas) is communicated within a social system using certain communication channels over time. Digital innovation involves the diffusion of digital technologies that contributes to organisational improvement and is an inherent aspect of the diffusion of a new idea (Nambisan et al., 2017). Rogers (1983) explained that the diffusion of innovation involves a social change that results in a structural change. Therefore, digital transformation can be seen as a sociotechnical phenomenon (Nambisan et al., 2017).

Rogers (1983) indicates that with the communication of “new” ideas, there is a degree of uncertainty, particularly pertaining to the probability of occurrence. The theory identifies the four main elements of diffusion of innovation which are explained in terms of their relevance to the study:

- **Innovation:** Represents a perceived new idea, practice, or object by an individual. Sebastian et al. (2017) state that building on capabilities amplifies the rate of innovation within an organisation. Considering the complexity of Organisation X, the quest for continuous innovation is vital in ensuring achievement of strategic objectives as stated in its corporate strategy (Organisation X, 2021). As the deployment of technology results in systematic organisational change, it is considered an integral aspect within the business model (Sarni et al., 2019).
- **Communication channels:** Refers to the means used for messages to be transferred from one individual to another. In the context of digital transformation, a digital Water utility promotes engagement and collaboration that is enabled through ICT (Sarni et al., 2019).
- **Time:** Relates to the time dimension for (1) the communication of innovation, (2) the relative adoption or rejection, after which innovation has been communicated, and (3) rate of adoption within the system. Although

Organisation X has adopted leak detection technology to aid in the challenges experienced on its pipeline network (Organisation X, 2021), the failure to explore other applicable technologies across its value chain, could result in setbacks due to the changing business landscape.

- **Social system:** The interrelated units that are engaged in joint problem solving to accomplish a common goal. Catlin et al. (2017) state that cross-functional teams promote continuous development, which in turn improve aspects in the entire value chain.

The technology adoption lifecycle, represented by the bell-shaped curve presented in Figure 11, shows the category of users that are involved in the adoption of digital technology.

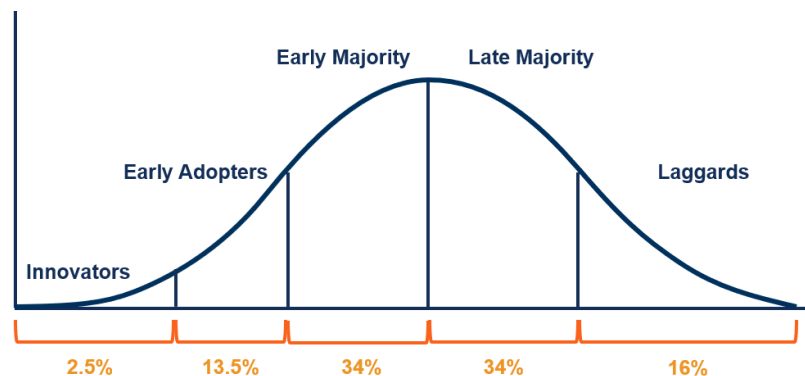


Figure 11: Technology Adoption (Rogers, 1983)

- **Innovators:** These represent individuals who are willing to take risks and try new technology. They belong to a select group with the willingness to accept potential setbacks if an innovative idea fails.
- **Early adopters:** These represent individuals who are open to change and selective in the adoption of innovation.
- **Early majority:** This group consists of people who adopt innovation after careful evaluation of its suitability for practical use. They tend to be thoughtful and deliberate in their approach to embracing new technologies and ideas.

- **Late majority:** These individuals are typically sceptical and only embrace innovation once uncertainties have been resolved by earlier adopters. They approach adoption with caution.
- **Laggards:** These individuals are resistant to change and are often the last to embrace any new developments.

The DOI theory suggests that innovation should not be measured equivalently as the realisation of returns varies with each innovative idea. Individuals' perception of innovations characteristics that determines the different rates of adoption are discussed below:

- **Relative advantage:** Innovation that is perceived as advantageous, results in a rapid rate of adoption. Data analytics that assist operational managers in controlling deployed systems that are convenient are often well received (Sarni et al., 2019).
- **Compatibility:** Innovation that is perceived as compatible i.e., consistent with accepted values of a social system, results in a rapid rate of adoption. An example of compatible innovation is the use of trusted online meeting platforms such as Microsoft Teams that was adopted by many organisations arising from the Covid-19 pandemic.
- **Complexity:** Innovation that is perceived as simple, results in a rapid rate of adoption. Innovation that requires minimal skills development, such as enhancements to the organisation's Enterprise Resource Planning System that is interfaced with the network of digital technologies across the organisation. Real-time flow of information using various communication channels and interconnected computer systems presents opportunities. The exploration of satellite pipeline leak detection software is a great example of a simple solution. The ability of Organisation X to access information of its pipeline network results in improved operational efficiency as issues can be timeously resolved (Organisation X, 2021).

- **Trialability:** Innovation that is perceived as experimental results in a rapid rate of adoption. Reducing water loss is paramount within the water sector (Omotayo & Telukdarie, 2020) and experimentation in this regard would be recommended.
- **Desirability:** Innovation that is perceived as visible results in a rapid rate of adoption. The reduction in costs and improved performance can be associated with the implementation of digital technology (Sarni et al., 2019). Technology, such as hydropower for Organisation X could reduce costs and reposition the organisation as self-sufficient in this regard (Loots et al., 2014).

Steiber et al. (2020) expresses that large organisations' concurrently face the challenge of exploiting digital technologies and affecting organisational changes. Given that Organisation X was established in the 1900s and its subsequent growth over the years, the process of digital transformation poses large scale organisational change due to the interrelated network of operating activities.

When considering the role of innovation in the transformation process, it becomes evident that several influential factors play a crucial role in exploring and leveraging digital technologies. In the case of Organisation X, the innovation strategy should be aligned with the scope of its operational activities and business model. Therefore, it is vital to evaluate barriers and influential factors that can impact the transformation journey. The DOI theory is a suitable framework as it emphasises the significance of understanding these elements. The DOI theory assists in identifying the factors that hinder or contribute to the organisation's digital transformation process. To further understand the challenges that Organisation X encounters within its digital transformation journey, the following relevant frameworks are used to guide understanding.

a. *Strategic Alignment Model*

According to Issa et al. (2018), the success of digital transformation is impacted by the scope of organisational changes. An organisation cannot merely define digital transformation as a single large project as it would render no feasible benefits of digital transformation and essentially lead to a failure (Issa et al.,

2018). The entire organisation needs to be considered at all levels to assess the degree of changes and the anticipated outcome. Furthermore, achieving evolutionary and dynamic alignment requires support from Senior-management and strong leadership (Luftman, 2000).

The introduction of digital technology within the organisation's value chain presents an organisation-wide change that requires the alignment of the organisation's strategy. The growth through the digital transformation process leads to improved digital maturity levels and development. The integration digital technology should drive the alignment of IT with the objectives and structure of the organisation (Issa et al., 2018).

The Strategic Alignment Model (SAM) was developed, by Henderson and Venkatraman, to assist organisations in capitalising on the benefits of new technologies, provided that there is alignment between business strategies, processes, and associated infrastructure (Shamekh, 2008). The model is based on strategic and functional integration components. According to Luftman (2000), the strategic elements encompass four domains:

a) Business strategy

- **Business scope** defines the business arena in which the organisation operates. Organisation X's business scope includes external, internal, and connected stakeholders that all play a vital role in determining strategy. The operating environment thus require sustainable solutions achieved by innovative thinking and application (Organisation X, 2021).
- **Business Governance** refers to the system of rules and processes by which an organisation is directed and controlled. It covers the effective and efficient management of the organisation, legislation, and regulation, as well as relationship management within its network of stakeholders. In the context of digital transformation, corporate governance should be a key element with changes stemming from Organisation X's Innovation Hub (Organisation X, 2021),
- **Distinctive competencies** outline the critical capabilities that keep the organisation afloat and drive its long-term sustainability. In the case of Organisation X, these would include elements such as the pipeline

network and the interconnected subsystems that enable its operation, including the provision of support services.

b) IT strategy

- **Technology scope** considers the array of technologies and software applications within the organisation's operating model. Deloitte (as cited by Bharadwaj et al., 2013) states that the use of ICT infrastructure helps organisations deliver the increasing power of digital technology.
- **Systematic competencies** are associated with the capabilities that facilitate IT services, which encompass aspects such as real-time access to information. Furthermore, it is crucial to identify the staffing requirements from the outset to ensure proper support for the business infrastructure.
- **IT governance** entails the authorisation of resources and the responsibility of IT management in ensuring that risks are minimised, and resolutions are timeously presented.

c) Organisational infrastructure and processes

- **Administrative structure** considers the functional design of business administration and typically refers to the organisation's hierarchy. The operations of Organisation X comprise a network of distribution and treatment sites, as well as support services with interrelated functions. It is thus imperative that the organisation structure is aligned as this is fundamentally where the overall change occurs.
- **Processes** are the various processing activities within the organisation.
- **Skills** focus on the deployment of human resources and the creation of a shared innovation culture.

d) IT infrastructure and processes

- **Architecture** of the various technologies, applications and data that are cohesively managed through policies.
- **Process** management of IT activities required to maintain the system architecture.

- **Skills** pertain to the human resources that are deployed with the IT functional business area.

As the business landscape continues to change, organisations are required to facilitate the necessary changes to ensure they can operate in the dynamic business environment. The deployment of Information Technology (IT) should essentially support the overall business and processes (Shamekh, 2008). The strategic use of best-fit technology repositions an organisation in terms of performance delivery and, essentially, contribution of value creation.

The model derives value from the various relationships depicted in all four domains shown in Figure 12. The cross-domain relationships are critical to organisational transformation and has therefore been selected as an appropriate model to be used.

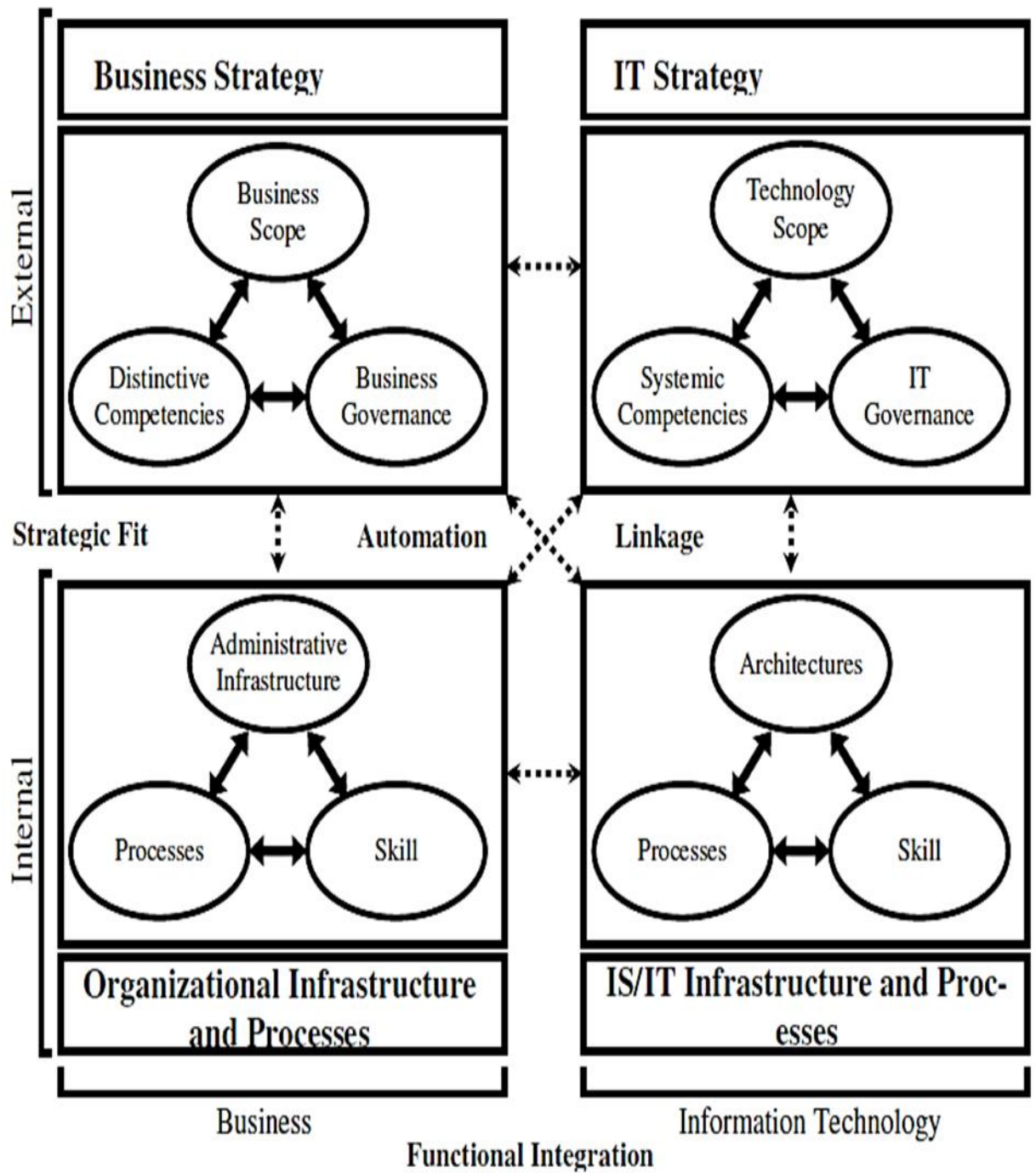


Figure 12: Strategic Alignment Model (Shamekh, 2008).

b. The Digitalisation Piano

Michael Wade defined digital business transformation as an organisational change that is initiated using digital technologies and business models to drive improved performance (Wade, 2015). Wade further highlights that digital technology is the foundation of a digital business and varies over times. In 2015, Wade introduced the Digitisation Piano Framework as a tool to aid in the decision-making process of transformation. The framework categorises the most important elements of an organisation's value chain in relation to digital transformation journey, specifically:

- **Business model:** The varying operating activities and the expected outcome.
- **Structure:** The organisational structure and the impact of digitalisation.
- **People:** The skills and competencies of all staff across all levels within the organisation.
- **Processes:** The extent to which processes can and will be automated and the related adaptability to change.
- **IT Capability:** The effectiveness of the organisation's core systems and the linkage between IT Strategy and the Corporate Strategy.
- **Offering:** The transition towards digital product and service offering.
- **Engagement model:** Degree of engagement with end-users and relationship thereof.

The framework will be used in the study as it provides a guide to assess an organisation's readiness for digital transformation and identify the specific elements that require attention to achieve the desired state of transformation.

2.12.2 Conceptual Framework

The research model depicted in Figure 11 illustrates the conceptualisation of the study. The constructs that are depicted are established from the review of appropriate theoretical frameworks outlined in 2.12.1.

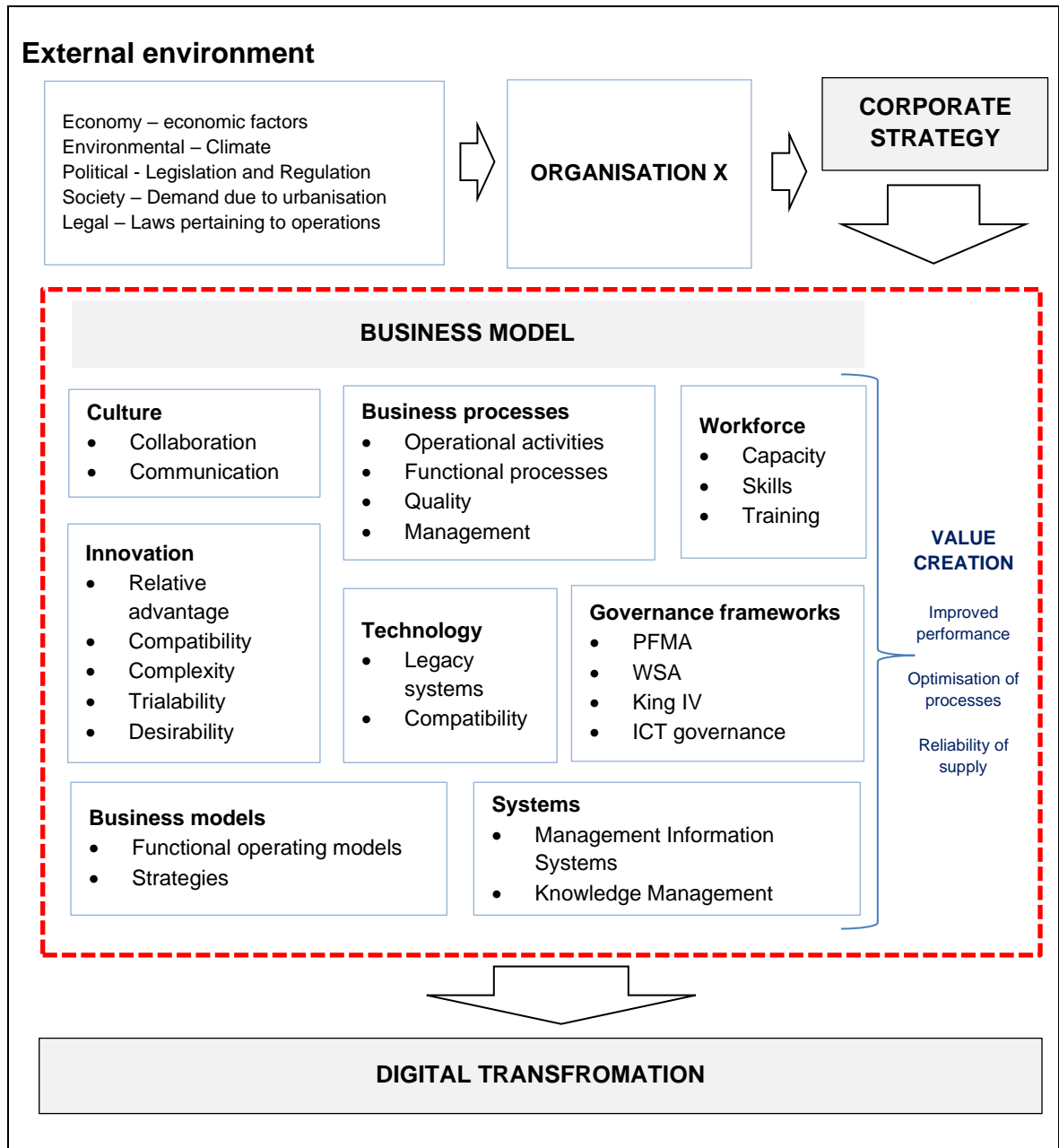


Figure 13: Conceptual Framework of the case study

2.13 Conclusion of Literature Review

Digital transformation is a systematic organisational change that requires the commitment of Executives and Senior-management. The digitalisation process requires a strong set of technical and soft skills to transform current business processes. This is supported by the digital strategy which aims to clearly identify the various elements needed for the digital transformation journey.

While changes in the operating model resulting from digital transformation require the guidance of business process owners, the CIO assumes a pivotal role in ensuring the successful implementation of the digital transformation journey. With the advent of digitalisation, data emerges as a crucial asset throughout the process, highlighting the importance of maintaining robust KMSs.

As digital technologies continue to advance in the water sector, it is crucial for Water Boards to equip themselves with the appropriate tools and mechanisms to adapt to the evolving business landscape. In this context, the digital maturity of Organisation X plays a pivotal role in determining the success of its digital transformation strategy and achieving the desired business outcomes. Conducting a thorough digital maturity assessment is imperative as it ensures the formulation of a robust strategy, preventing the risk of inadequate performance and weak business performance.

CHAPTER 3. RESEARCH METHODOLOGY

3.1 Research approach

The digital transformation journey is a comprehensive digital transformation plan to ensure a seamless transition of the digitalisation initiatives a company embarks on (Jain, 2021). Jain (2021) describes digital transformation as a plan that moves the organisation from point A to point B, with point B representing either improved digital processes or the transition to digitalised processes. The digital transformation journey serves as a framework for organising initiatives and addressing all the essential requirements needed to successfully implement digital solutions and achieve transformation. Dilmegani (2022) supports this definition by describing the digital transformation journey as the digital strategies that guide an organisation's evolving business lanscape. That being said, the absence of a comprehensive journey will inevitability result in failure.

The research adopted a qualitative approach to comprehensively assess the research objectives, as advocated by Jamshed (2014). The research paradigm focused on the methodology, denoting the structured approach and techniques used to examine the barriers to digital transformation. The exploration of the barriers to digital transformation primarily involved engaging in a methodology research process. While guided by epistemological theories, the identification and analysis of these barriers constituted a methodological endeavour (Ulz, 2023). This methodology was considered appropriate for gaining insights into the current and desired organisational state within the context of digital transformation. In terms of the research method, an inductive approach was followed to identify common themes, facilitate the analysis of explicit data content, and understand participants' expressed opinions (Caulfield, 2019).

To truly understand and describe Organisation X's digital transformation journey and the impact of the digitalisation on the organisation's operating model, it was imperative that key stakeholders' perspectives and experiences were evaluated.

The research was focused on a specific group of participants, namely Executives, Senior-management, and Middle-management that are charged or impacted by

digital transformation. Participants were engaged by interviews to generate relevant qualitative data to the research question.

3.2 Research design

The research is a case study on a leading Water utility in South Africa. The case study is on the organisation's digital transformation journey challenges and the value of digital technologies that have been implemented. The research approach was feasible as it involved an assessment of the organisation's current standpoint regarding its digital transformation journey and, in turn, provided valuable insight for future strategies aimed at overcoming such challenges. According to Crowe et al. (2011), the use of a case study research design is often associated with the discipline of social science. Given that this discipline is related to organisational change, it is closely linked to the digital transformation journey.

The research was conducted by the collection of information through interviews from Executive, Senior and Middle management of Organisation X. The objective was to gain a deeper understanding of Organisation X's digital transformation journey, assess its effectiveness, and uncover any challenges the organisation may be facing. Furthermore, the research aimed to establish guiding principles for digital transformation that can be valuable to other Water Boards and SOEs, regardless of their scale of operations. Through the knowledge acquired, the research may also contribute to the development and application of new theories in the industry.

3.3 Data collection methods

The research was conducted using data obtained primarily from interviews and available source documents. The qualitative case study research design guided the data collection process, which involved conducting semi-structured interviews. These interviews allowed for a deeper understanding of the research problem from the participants' perspectives and facilitated the establishment of trust between the researcher and participants. The interviews also provided an opportunity for participants to reflect on their experiences and validate their

knowledge. The researcher maintained ongoing communication with participants to seek clarification. Participants were contacted directly, and interview arrangements were made accordingly.

3.4 Population and sample

3.4.1 Population

The Water utility that was selected for the case study is Organisation X. Organisation X is one of the main water utilities in South Africa and has been in operation since the early 1900s (Organisation X, 2022a). The organisation has augmented its operations since inception and has steadily embarked on change initiatives. Amis and Lugogo (2018) suggest that the future of water supply and security in South Africa requires ICT and Artificial Intelligence (AI) tools for effective water management system. With water scarcity being a concern, Organisation X continues to explore various technologies to help optimise its network of processes and help elevate some of the concerns South Africa faces.

3.4.2 Sample and sampling method

The research was conducted using a purposive sampling technique which is widely used in exploratory research. Additionally, the technique is used for the most effective use of limited resources (Patton, 2014). This method was chosen based on the researcher's familiarity with the management structure of the organisation and experience within the water sector, encompassing both operational and strategic levels. By specifically selecting participants who could provide valuable and in-depth insights, this sampling technique proved suitable for the study.

The sample for this research was limited to Executives, Senior-management and Middle-management who are charged with driving the corporate and digital business strategy. The choice of a sample size of 10 for the study was a carefully considered decision, grounded in the specific context and constraints of the research. Given the sensitive nature of the subject matter, which pertains to an

SOE, there was an anticipated constraint on the willingness of individuals to participate openly in the research interviews. Data collection was carried out through scheduled meetings, which took place online using MS Teams. Any necessary clarification or additional information from participants was addressed on an as-needed basis.

Table 1 shows the profile of participants that were interviewed:

<i>Management Tier</i>	<i>Description of participant</i>	<i>Number of participants</i>
Executive Management	Organisation leaders – Professionals responsible for key business decisions	2
Senior Management	General Managers and Divisional Managers of Business units	3
Middle Management	Department Business Managers	5
<i>Total number of participants</i>		10

Table 1: Research participants' profile

3.5 The Research Instrument

The research instrument was interviews conducted with participants that are listed in Table 1 mentioned in section 3.4 above. According to Jamshed (2014), interviews is a commonly used instrument in qualitative research. By utilising in-depth interviews, participants were provided with the opportunity to freely express their perspectives (Boyce & Neale, 2006). The interview consisted of open-ended questions that was aligned with the research questions outlined in Chapter 1, which enabled participants to share their viewpoints. These interviews were conducted online. Boyce and Neale (2006) write that interviews are appropriate when insights on the exploration of issues are sought, as it provides greater

detailed information as opposed to methods, such as surveys. However, it should be acknowledged that participant responses may have been influenced by their positions within the organisation, potentially introducing bias.

3.6 Procedure for data collection

Semi-structured interviews are commonly used within qualitative research for data collection, to gain in-depth understanding of the research questions. The flexibility of this approach allowed for the elaboration of information by the participants that may not have been otherwise known by the research (Gill et al. 2008)

3.7 Data analysis strategies and interpretation

An inductive thematic analysis method was used to analyse the data set collected from interviews. Caulfield (2019) indicates that this is typically used to examine common themes identified in interviews. Additionally, Caulfield (2019) mentions that the method allows for an understanding of participants experiences, perceptions, and knowledge.

The DOI theory outlined in Chapter 2 was used as a basis for understanding the social science of reality that undergo continuous change. This theory informed the examination of epistemological and ontological philosophical aspects. According to Bryman (2012), epistemological considerations pertain to the field of social science, while ontological considerations relate to the nature of social entities. Bryman (2012) further explains that constructivist ontology is concerned with social phenomena that undergo continuous revision. Cresswell (2009) highlights that, in qualitative research, epistemology aims to generate knowledge about specific questions by testing theories within the context of reality.

According to Braun and Clarke (2006), the thematic analysis method involves identifying, analysing, and establishing themes within a dataset. This structured and flexible approach was employed to group extensive data sets into common themes, enabling a comprehensive understanding of the subject matter. The

interpretation of the responses was approached with a focus on objectivity to minimise the potential obscuring of results.

The Six-Phrase Framework of Thematic Analysis, developed by Braun and Clarke (2006) and illustrated in Figure 14, was adopted to provide support for the interpretation and analysis of the data.



Figure 14: Six-Phrase Framework of Thematic Analysis (Braun & Clarke, 2006)

The results obtained from interviews were thoroughly read and reviewed to familiarise the researcher with the data. The results were crosschecked with the researcher's notes to ensure accuracy. The data was then coded and organised to identify patterns and generate key themes. Key words and phrases from the participants' responses were highlighted and labelled based on their content. During this process, we carefully identified and examined similarities and differences to establish meaningful business categories. This approach ensured the presentation of a cohesive analysis.

The themes were defined in a way that prioritised understandability and distinctiveness, ensuring comprehensive coverage of the research topics. According to Attride-Stirling (2001), thematic networks are used to structure and represent themes. As a result, a thematic network analysis was formulated to illustrate the significant themes uncovered during the analysis process.

3.8 Quality Assurance

Ensuring the quality of research is crucial to maintaining the integrity, transparency, and reliability of the collected data (Emerson, 2020). According to Emerson (2020), it is essential to employ various strategies for managing data to prevent any alterations and to ensure the use of reliable procedures. Patton (2002) highlights that credible qualitative research demonstrates trustworthy data analysis, which is achieved through diligent data collection and thorough analysis. To assess the quality of the research, the quality assurance constructs developed by Lincoln and Guba (as cited in Nowell et al., 2017) was utilised.

3.8.1 Transferability

Although the research primarily focuses on digital transformation within a specific SOE, Organisation X, the findings may have relevance and applicability to other similar entities. Detailed interviews with three managerial levels at Organisation X, all of whom influence digital transformation, are presumed to offer substantial understanding. These stakeholders offer a wealth of knowledge and firsthand perspectives on the digital transformation process.

To strengthen the external validity of the findings, the study employs triangulation by integrating insights from published articles and business reports relevant to the research subject (Bryman, 2012). The analysis is structured around fundamental business categories that hold relevance across a broad range of organisations. Themes identified within these categories are used as a basis to argue the potential wider applicability of the study's conclusions to other organisational contexts.

3.8.2 Credibility

Credibility refers to the level of confidence in the data obtained, which is established through validity and reliability. According to Nowell et al. (2017), credibility in a study is achieved through continued engagement with research participants, persistent observations, peer debriefing, and data triangulation. To identify significant aspects in the collected data, a comprehensive analysis was

conducted to examine variations and patterns relevant to the research topic. This process included organising identified themes within fundamental business categories that are widely applicable across various organisations.

Corresponding to the aspects mentioned under Transferability, conducting detailed interviews with managers at three different levels in Organisation X, all instrumental in shaping the digital transformation, is believed to provide valuable insights. These individuals contribute first-hand experiences of digital transformation at Organisation X.

3.8.3 Dependability and Confirmability

The methodology of this study describes the data analysis strategies that were adopted and the data analyses that were performed. The semi-structured interviews were developed based on the key themes derived from the case study research and the research questions. According to Bryman (2012), dependability is closely related to trustworthiness. As such, the analysis section of the report includes significant responses from the interviews, and a complete interview is included in the appendices section for result verification. Sufficient time was allocated for participants to respond to ensure that unanswered questions were not influenced by time constraints.

3.9 Ethical considerations

Ethical considerations are an important aspect of research and as such, it was considered throughout the research. The following key ethical considerations were addressed:

- Permission was requested by the researcher from Organisation X to conduct the case study on the organisation's digital transformation journey.
- The purpose of the study was affirmed with participants throughout the research.
- Fairness was maintained throughout the research process.
- The interview guideline was adhered to throughout the interview process.

CHAPTER 4. RESEARCH FINDINGS

4.1 Introduction

Chapter 4 presents the research findings. It lays out the data obtained from a series of interviews with various tiers of management at Organisation X, ranging from Executive to Middle-management. The methodology behind the data collection involved engaging with individuals who are instrumental in the decision-making processes and the operational execution within the organisation. These participants were selected based on specific criteria outlined in Section 3.4.2, ensuring a comprehensive perspective.

The participants were chosen based on their roles and potential to provide a comprehensive understanding of the research questions:

- **Executives:** Professionals responsible for key business decisions
- **Senior-management:** General Managers and Divisional Managers of Business Units
- **Middle-management:** Departmental Managers

To concisely illustrate the findings', selected responses are presented in Tables 2 and 3. These tables serve as a condensed representation of the key insights. Furthermore, this chapter forms the basis for the detailed discussion and analysis in Chapter 5

4.2 Participants responses pertaining to Research Question 1

The key responses from participants are outlined in Table 2 below. It provides an overview of the overall perspectives expressed by the research participants for interview questions 1 to 5.

<p>Participant 1</p>	<p>It seems to me that the Finance Budget System is not properly implemented. I don't know if it's not properly developed, but the implementation is, at this point in time, a concern. There are so many initiatives that Organisation starts, and it falls flat at the end, and it's not rocket science or I'm perhaps I'm not on the right track.</p> <p>I think to start with, we should have the appropriate skills. People should be trained in an appropriate manner. With the implementation of SAP and I think that was in 2007 or 2008, the implementation was done haphazardly, and the people really battled as the training wasn't on standard.</p> <p>I think the time frames are not always realistic.</p> <p>I think that age of staff members really plays a role in this. The youngsters embrace technology whereas older people really battle with it.</p>
<p>Participant 2</p>	<p>During the COVID-19 pandemic, the organisation tried to make a lot of processes digital, however we still paper based.</p> <p>It is essential to set up the infrastructure with the foresight of where you want to go. When I say infrastructure, that means being able to have the kind of service, bandwidths, technology, server rooms to hold a massive data and necessary security to be able to contain that data to mitigate hacks, breaches, and uncontrolled access.</p> <p>I still maintain that trying to retro fix our systems is I think our biggest problem. We must transition holistically.</p> <p>You must transform the minds and the thinking of the users before you transform the system.</p> <p>Finance is quite an example to follow in terms of trying to transform any area.</p> <p>It's sometimes not how good the system is or how well it's been rolled out, but the boldness of the leadership.</p> <p>In Human Resources (HR), we've delivered on some systems like the current recruitment system which is working very well for the organisation.</p>

<p>Participant 3</p>	<p>Digital transformation is bringing operational processes online.</p> <p>It's factors such as communication, change management and competencies that you need to have in place if you want to transform an organisation.</p> <p>You need a good project management team. Our IT projects always fall out because we don't have a strong project management implementation team.</p> <p>I don't think that we are having any revolutionary change at all. There might be some aspects of change, but not revolutionary change.</p> <p>The promise of technology can only be fulfilled if the project could be implemented correctly, the people utilise it as intended, and their targets are fulfilled.</p>
<p>Participant 4</p>	<p>The company's strategy process should be planned quite carefully through use of a project plan to monitor achievement of deliverables and timeously attended to hiccups.</p> <p>A realistic timeline and cost associated with this, should be managed carefully because a lot of projects fail due to overruns and the problem statement not properly defined.</p> <p>Within Operations, you get the AMR system that has been partially put in place.</p> <p>Within the SCM environment, proper systems should be adopted so that business unit can be effectively managed.</p> <p>Transformation requires an integrated approach, that is driven by a certain business unit within the organisation and buy-in of internal stakeholders in which you can demonstrate to them the outcome and related benefits.</p>
<p>Participant 5</p>	<p>I believe that we are a bit behind as the organisation in establishing our transformation. Culture is an aspect of transformation, and the culture that I've picked up here, is very, very slow.</p> <p>We put a lot of focus on the mistakes we've made as opposed to getting to the nitty gritty in terms of what is holding up the process, engaging the</p>

	<p>relevant people, hiring of people, upskilling our current workforce, and enhancing reporting.</p> <p>Must have very strong leadership and is not just from an IT perspective.</p> <p>One of our business challenges at the moment is water losses. The Satellite Leak Detection system allows for remote monitoring of pipeline leakages and encroachment management. It positively impacts with our financial planning with OPEX and capital expenditure (CAPEX).</p>
<p>Participant 6</p>	<p>If you look at our current landscape, a lot of our operations are manual. We're using different systems, which means that you have to get all the different systems together to retrieve information which always needs manual intervention.</p> <p>We do have great ideas to take the business forward in terms of innovation, but not implementing it. You need to have the right culture to move forward.</p> <p>We are governed by National Treasury, and everything is bureaucratic. We try to bring in automation, bring in technology where we can within the limitations of our budgets and processes.</p> <p>Our plant is very old, it's considered aging infrastructure. It's the same plant that was built in the 1900's. The plant has automated a few old processes.</p> <p>We are often not sure what we want as we end up having a consultant tell us what is needed and then buy the off the shelf product.</p>
<p>Participant 7</p>	<p>Digital transformation is a process that could enable data management and data analytics, and through the entire value chain.</p> <p>I believe we are very much in our infancy as far as digitisation is concerned.</p> <p>We need specialist knowledge of what it takes to move to being a digitised institution or digitally transformed institution. This is apart from the work that our Innovation team is doing.</p> <p>With our current Supply Chain, it takes forever to get something done. We go through the process of providing the specification of what we want and</p>

	<p>by the time we have approval and are sourcing in the market, the spec is already outdated.</p> <p>The organisation needs to be agile enough as technology and digital transformation go hand in hand.</p> <p>If you have technology embedded in your organisation, you need to have the people who understand how to utilise it and how to make the most out of it.</p>
<p>Participant 8</p>	<p>At our purification plants, you find the guys reading meters, they still using manual log sheets.</p> <p>You find that people are just trained for the system that they're using. For them to move across and try and familiarise themselves with something new, brings about reluctance in terms of learning something new.</p> <p>IT needs to be onboard and prepared to support the system once the consultants have left.</p> <p>The introduction of BPC allows for the automating of the processes that is required to produce reports.</p> <p>Leadership is important to make sure that they support the transformation.</p> <p>They must be fully on board and acknowledge that some of the things that the workforce is proposing are necessary.</p>
<p>Participant /9</p>	<p>In my 12 years of managing the P plant. we haven't had as many emergencies as we have had in the last two years. The plant is aging, and this is going to be a lot more frequent.</p> <p>We manage our contracts based on Excel spreadsheets. We certainly need to move to a more sort of integrated system.</p> <p>Change management is a very important aspect in terms of digital transformation because there will be an area that decides that this will be an optimal solution.</p> <p>I think everybody needs to be taken along and the timelines need to be reasonable as well.</p>

	<p>BPC is pretty revolutionary, I would say. It is a very important system to implement to safeguard the organisations finances, especially our big-ticket items like electricity and chemicals and so forth.</p> <p>There must be SMEs that you can go to at any point in time and say, OK, I'm struggling here.</p>
Participant 10	<p>Utilisation of technology to improve the way we do things processes in order to unlock efficiencies and being able to do more with less effort.</p> <p>The first key element would be Executive buy-in because they've adopted the strategy and the tone should be set from the top.</p> <p>To implement some of the solutions you need to have a strong IT team that would be able to learn, adapt faster and be able to run with any of the solutions that would be implemented internally.</p> <p>As an organisation, we are not that easy or understanding of failure. Staff members should be exposed, either through training or play a lot with technological systems and not be left behind.</p>

Table 2: Key responses from Participants for Research Question 1

4.3 Participants’ responses pertaining to Research Question 2

The key responses from participants are outlined in Table 3 below. It provides an overview of the overall perspectives expressed by the research participants for interview questions 6 to 14.

Participant 1	<p>I don't think there's enough consultation with the stakeholders when it comes to all these transformational initiatives.</p> <p>You first need to get the buy-in from people, and you need to respect the time. With the recent BPC implementation, they were not respectful of peoples’ time. My experience with INTENDA and BPC, is that once you raise your concerns, you are accused of opposing change.</p> <p>Communication happens mostly through meetings and emails.</p>
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	<p>From a Finance perspective, everything I worked with felt flat at the end, apart from SAP. SAP was implemented already in 2007 or 2008.</p> <p>Innovation is so important at this moment in time that they are forgetting about the core business.</p> <p>Hacking of systems is one of the biggest risks at this moment in time. I am also concerned about the skills in our IT department.</p> <p>The CIO is responsible for Digital Transformation. It was first the General Manager of IT (GMIT)</p> <p>The Laboratory Information Management System (LIMS) and Supervisory Control and Data Acquisition (SCADA) are critical in sustaining operational activity. If you lose the information of LIMS, you lose many years of information on the quality of water.</p>
<p>Participant 2</p>	<p>Finance had a planned and phased approach with the BPC training sessions and the design. The project had some very strong points. However, the culture of the organisation needs to change.</p> <p>You better off going slow and getting at least 90% on board, then trying to go fast.</p> <p>We are using the SMS system, but some people don't necessarily read them.</p> <p>HR at site piloted the first interviews using MS Teams and I'm happy to say it works.</p> <p>Younger, more savvy users have been able to do some phenomenal things like create shared folders and use the tool optimally.</p> <p>The most notable change in terms of automation would be the way we optimised Microsoft Teams. A time and money saver.</p> <p>Innovation should be fluid. It should be throughout the organisation and then it can be concentrated and synthesised in a particular area.</p>

	<p>You have good digital projects running in different areas of the business doing different things. I don't think it's the best way. IT should be ultimately responsible for digital transformation.</p> <p>Knowledge and information here needs to be maintained similarly to a Business School.</p>
<p>Participant 3</p>	<p>What tends to happen is as a project runs out of time and money, then it just sort of falls out, and people just try to finish up.</p> <p>E-mail and meetings are used to communicate. WhatsApp groups as well.</p> <p>I have not experienced any notable change in terms of automation. However, from a plant perspective, automation of processes is being looked into.</p> <p>Pilot studies are being conducted to assess better ways of doing business, treating water, sourcing water, and ensuring sustainability.</p> <p>We find ourselves only great in demonstrating and starting an IT project. This is a waste of time, money, and effort as we are going nowhere.</p>
<p>Participant 4</p>	<p>Too many initiatives are happening at the same time and you're looking at the same stakeholder base. So, these guys are sometimes overstretched.</p> <p>With the adoption of digital technology, everybody must be clear about the problem statement.</p> <p>In the past there's been that silo type of approach. Integrating everything is sometimes a challenge.</p> <p>We haven't been that successful in the integration of these different systems you've got, e.g., Maximo running on the one side that needs to be linked to SAP, our main reporting tool. We need a very strong IT leg within the organisation that can bring all these links together.</p> <p>Apart from Finance, the AMR system being deployed throughout the company, and the automation of salary package restructure within HR.</p>

	<p>We are testing pipeline infrastructure technology that aid in obtaining insight of the condition of assets to ensure that we plan properly.</p> <p>Within our environment we probably quite slow to react to changes</p> <p>Within the water sector, they encourage collaboration, the sharing of technologies that's probably working.</p> <p>The KMS needs to be strongly managed and improved because it cuts across the whole operations of the company. Making sure that the structural infrastructure is in place, working properly, and there is proper alignment and integration between different systems is important.</p>
<p>Participant 5</p>	<p>Our strategic customer partnership division manage relationships with external stakeholders and holds monthly workshops.</p> <p>The IT Business Unit is assessing the system and we see frequent emergency shutdowns. The system network is broad due to the size and complexity of the organisation, and it needs to be managed. SAP is working but system applications are failing us, like the drives, software etc.</p> <p>Financial Shared Services (FSS) help desk is an example of an ineffective porcess. For me to resolve a matter with the Inventory Manager, I need to send an email to FSS helpdesk to request to have a discussion. It's easier for me to either walk, call, or email the Manager.</p> <p>Digital transformation is not just to a specific area.</p> <p>When I was in Debtors, we improved the billing system to such an extent that we broke away from the old Walker system and moved over to SAP. Some information was never caried over so historical info resides in our archives as hardcopies. A KMS is critical for a Water Utility. We need to ensure that when we draw reports from a system, there is consistency.</p>
<p>Participant 6</p>	<p>The Inventory System was brought in, without engaging expected users. Everything was signed and the contract was awarded. Communication or involvement of stakeholders is very important.</p>

	<p>Show the positive outcome of this new change and providing training is very important. The use of fancy words helps for management reporting, but not understood by all. It needs to be simplified.</p> <p>We do have an MIS; however, it is just to get through. We have various data sources, very much financial. Currently you've got different systems integrating data, however it's always requiring manual intervention.</p> <p>You have notable changes, but they always in isolation. SAP system has been the biggest change.</p> <p>At site level, innovation resides within everyone's space. Innovation Hub explores new technology and ideas from a bottom-up perspective.</p> <p>COVID-19 brought in something completely new, and we had to adapt with the way of working. Reliance on digitalisation meant working from home, having meetings on a digital platform, etc.</p> <p>Facilitating Digital Transformation ultimately resides with the CEO and key role players, such Supply Chain, End-users etc.</p> <p>We rely on the system; however, the system network instability is an ongoing issue which presents a risk. We also don't have the infrastructure.</p>
<p>Participant 7</p>	<p>The MIS of Organisation X is quite disjointed, and we don't have a central MIS. We have multiple systems which are not linked to each other, hence there is this silo effect and lack of information sharing across the business because information is scattered all over the place.</p> <p>We have started getting meter readings in automatically, so the meters send through readings on a weekly basis via e-mail every Monday.</p> <p>Part of innovation is also to look at ways of making the organisation more resilient within the current changing environment that we find ourselves operating in. Our infrastructures are aging so we need to make sure that we have access to all these things at our fingertips.</p> <p>Group Strategy is charged with facilitating Digital Transformation as they determine the organisational strategy and direction.</p>

<p>Participant 8</p>	<p>You ensure that you involve key people and do not leave them out. So essentially a task team needs to be formed to manage initiatives with all stakeholders.</p> <p>MS Teams meetings are more effective than the physical meetings. For project meetings it necessitates a physical meeting, where hardcopies of some sort are shared.</p> <p>We often find that additional funds are needed for better integration, or we must resort to a degree of implementation, something in the middle.</p> <p>As a leading water entity in Africa, we need to jack up our systems to align to the best in the world.</p> <p>The IT division is charged with the responsibility of facilitating transformation but in consultation with SMEs in different functional areas.</p> <p>Communication between stations, currently requires physically driving out to obtain data and then communicating such via email a day later. There is no central portal. It thus critical to have a KMS.</p>
<p>Participant 9</p>	<p>There has to be better change management from the onset. When an organisation undertakes this kind of journey, it's additional work for the stakeholders involved. It can't just be bombarded, on people.</p> <p>Commitment to the program to see the benefits through the process. Also, putting a little bit of pressure on our staff to make that transformation.</p> <p>The various information management systems are very assertively silo operated. There isn't a lot of integration between one system and another and that's where artificial intelligence comes in.</p> <p>The most notable change in terms of automation has been the virtual meetings.</p> <p>Sometimes you'd find something that is particularly required, does not necessitate innovation. With Supply Chain, if you work with them on a daily basis, which I do, you will realise it's a very process driven application and all they actually require is for that to be optimised.</p>

	<p>We are so people based and dependent.</p> <p>So, you have different areas of your plant and your distribution system that ages at different rates. If you don't have the kind of intelligence and the kind of knowledge where you are collating this information in terms of what happens, then you don't proactively know which areas of your plant you are required to manage.</p> <p>A lot of the information currently sits in tacit knowledge. Without that kind of critical mass of knowledge that is properly maintained and constantly cleaned, you can't really sustain this operational activity much longer into the future.</p>
<p>Participant 10</p>	<p>Change management is also normally outsourced as the internal team is not coping.</p> <p>With the current MIS, the biggest challenge is that the strategy was initially established on utilising SAP, but throughout the years I've seen a slight change in terms of not keeping up with the adopted solution being SAP. Now there are several other systems that the business tried to bring onboard which is not SAP related.</p> <p>I have seen when Organisation X implements some solutions, there is no integration. It becomes even difficult to integrate afterwards which creates challenges for people who are utilising those systems as they are unable</p>

	<p>to do end-to-end, such as analytics and generate reports from one system.</p> <p>The automation of pay slips and automating some of the manual spreadsheets for big cost drivers, such as chemicals and energy, is a notable automation change.</p> <p>The challenge within Organisation X is the fear of failure. We stress test ideas before we implement them and fail at them. Innovation is a collective responsibility where ideas come from the floor upwards.</p> <p>If Organisation X does not improve on efficiencies and manage some of their costs, especially the cost of operations, we are going to have issues.</p> <p>The KMS in the water sector is a necessity because we are in the water space and some skills and knowledge that we have cannot be bought from the market</p>
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Table 3: Key responses from Participants for Research Question 2

4.4 Summary of the findings

The results suggest that the participants were forthcoming with their answers. A few of them took moments to reflect on the questions posed, and some expressed uncertainty regarding specific details about Organisation X. Interviews generally spanned an hour, with participants being informed at the outset that extending the discussion, if needed, would be accommodated without issue.

Regarding Research Objective 1, the areas of Corporate Culture, Procedures and Policies and Digital Strategy emerged as significant themes in the responses. These appear to be strong factors that influence the direction of digital transformation initiatives at Organisation X.

Pertaining to Research Objective 2, the themes of Digital Capability, Innovation, and Strategy were highlighted as significant in the responses. These themes are seen as critical elements in examining the interrelationships within Organisation X's framework that strengthen the organisation's digital maturity.

CHAPTER 5. ANALYSIS AND INTERPRETATION OF FINDINGS

5.1 Introduction

Chapter 5 of the research presents the interpretation and analysis of the research findings. The data collection process entailed interviewing and obtaining responses from management of Organisation X. Stemming from these responses, themes were identified and clustered into key business categories to present a cohesive analysis of the findings in relation to the research questions. By organising the data into business categories and themes, meaningful insights and conclusions were drawn based on the responses obtained from the participants.

5.2 Demographic profile of respondents

The participants in the study were selected based on their perceived involvement in driving the corporate and digital business strategy of Organisation X. Participants' positions within the organisation and their years of professional experience were considered to determine their suitability for the case study. By selecting participants who have relevant experience and knowledge in the areas of corporate strategy and transformation, the researcher aimed to gather valuable insights and perspectives from individuals who have a sound understanding of the organisation's strategic initiatives and its transformation efforts within their respective functional areas and the organisation at large. Table 2 below provides an overview of each participant's profile.

No.	Role	Management Level	Gender	Age range	Years of professional experience
1	Site Administration Manager	Middle	Female	50 - 60	35
2	Human Resources Manager	Middle	Female	50 - 60	37
3	Finance Portfolio Analyst	Middle	Male	40 - 50	24
4	Assets and Inventory Manager	Middle	Male	50 - 60	33

No.	Role	Management Level	Gender	Age range	Years of professional experience
5	Operations Business Analyst	Senior	Male	50 - 60	35
6	Site Administration Manager	Middle	Female	30 - 40	21
7	Project Manager - Water Demand Management	Senior	Male	40 - 50	20
8	Portfolio Analyst - Operations Process Engineer	Middle	Male	50 - 60	30
9	Chief Operations Engineer	Executive	Female	40 - 50	19
10	Financial Planner	Executive	Male	30 - 40	16

Table 4: Demographic profile of research participants

The purpose of the research was to investigate the obstacles that hinder the successful implementation of digital transformation of the water utility. The research aimed to assess the organisation’s current level of digital maturity and its progress in its journey towards digital transformation. The interpretation and analysis provided valuable insights into the participants’ perspectives and allowed for a greater understanding of the challenges and barriers faced in achieving digital transformation goals. Furthermore, this analysis aimed to highlight both areas of strength and areas requiring improvement.

According to Armstrong and Lee (2021), digital transformation encompasses an organisation’s holistic response to technological advancements. Building upon this concept, the research explored the conceptual digital solutions adopted by the organisation, the frameworks employed for digital transformation, and the role of leadership in driving transformative processes. Moreover, the research delves into the organisation’s cultural dynamics, operational practices, and innovation strategy – all of which are vital elements in the pursuit of successful digital transformation.

To familiarise participants with the research, the term “digital transformation” was introduced at the onset of the interviews, which aimed to gauge their comprehension and perceptions regarding its implications for Organisation X. Subsequently, a

series of questions were posed to assess the organisation's progress in its digital transformation journey. These inquiries encompassed various aspects, including the necessary elements for successful transformation, ongoing initiatives pursued by the organisation, measures taken to ensure desired outcomes, stakeholder management practices, and identification of existing systems that require enhancements. Based on the information gathered through these inquiries, the organisation's level of digital maturity was evaluated, considering key business elements that underpin its digital strategy.

The primary objective of this research was to identify and analyse the barriers that hinder the successful implementation of digital solutions aimed at optimising business processes. Through the responses obtained from participants, a practical perspective was gained, which allowed for the assessment of barriers specific to Organisation X. The theoretical framework, as indicated in Chapter 3 of the report, served as a guide for interpreting the research findings and enabled a comparison between the relevant theory and the insights gathered from the interviews. Through the analysis of each research question, the examination of the barriers and challenges faced by Organisation X are presented. Subsequently, the research provides recommendations that can be effectively implemented by Organisation X and other SOEs for fostering a culture of informed decision-making associated with digital transformation initiatives.

Figure 15 below shows the number of participants categorised according to their Management Level within Organisation X.

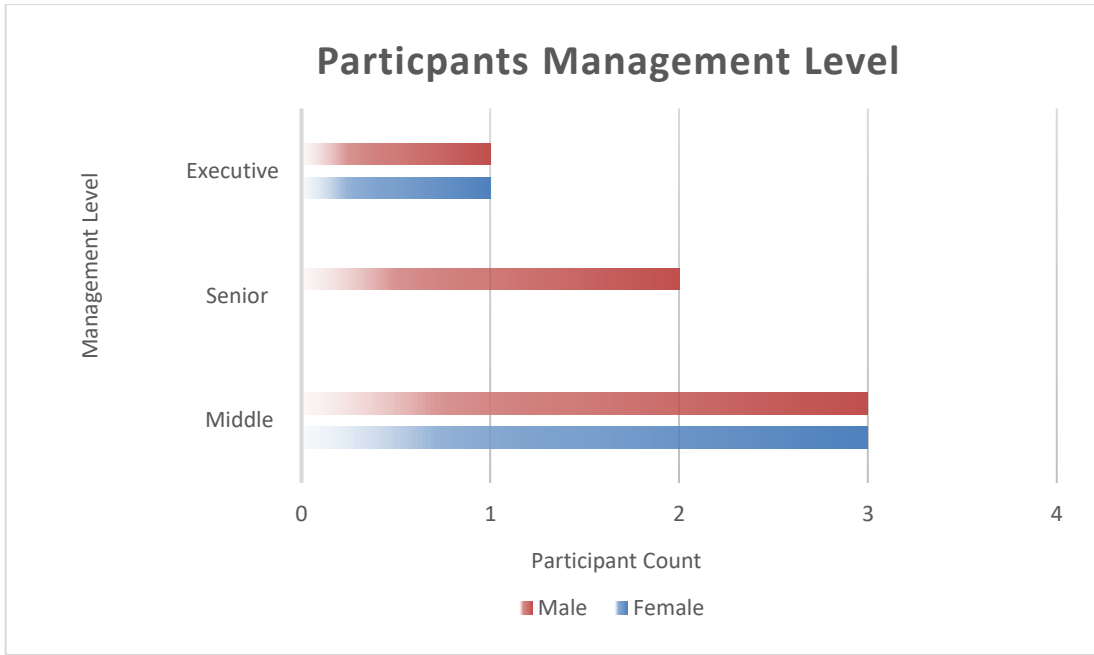


Figure 15: Research participants management level

Figure 16 shows the gender split of the research participants. Sixty percent of the participants are male, and forty percent are female.

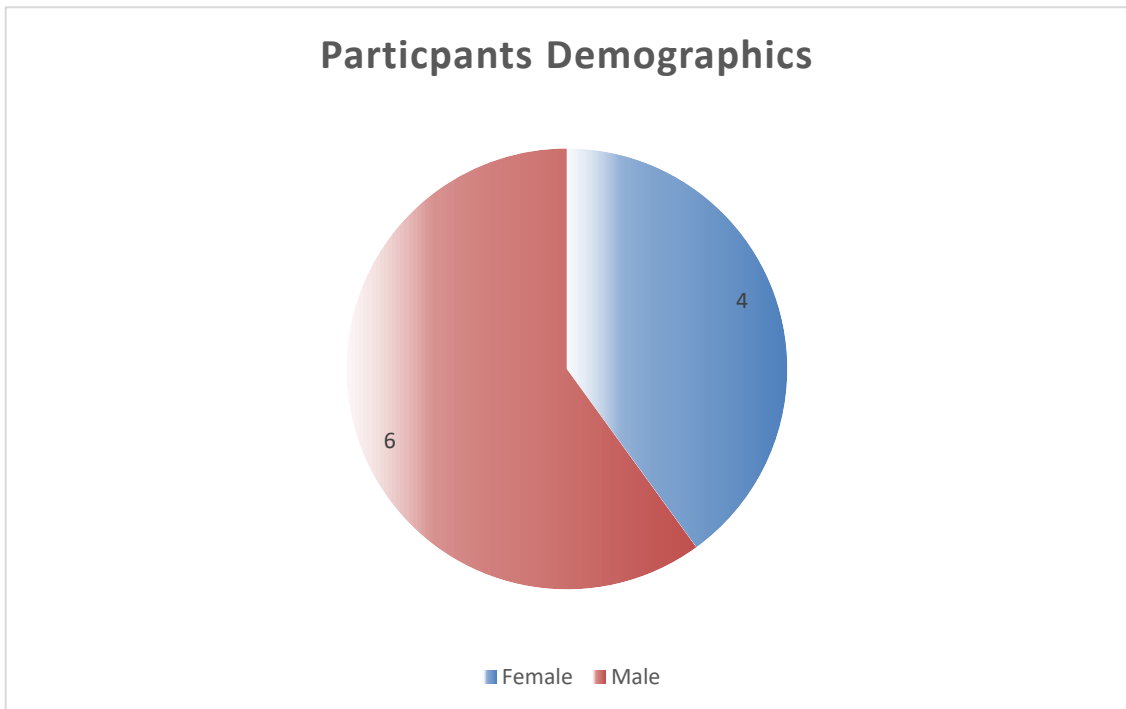


Figure 16: Gender of research participants

The analysis contained within section 5.3 relates to Research Question 1, while section 5.4 corresponds to Research Question 2. The research propositions will be discussed within the respective research question it relates to. In this case, Propositions (i) and (ii) correspond to Research Question 1, while Proposition (iii) corresponds to Research Question 2.

Table 5 shows the Research Questions and the related Research Propositions:

Research Question	Research Proposition
<p>1. What factors influence the selection of an appropriate digital transformation journey at Organisation X, and to what extent does the alignment of Organisation X's operational activities with its digital transformation initiatives influence its ability to leverage digital technologies across its value chain?</p>	<ul style="list-style-type: none"> i. The digital transformation journey must align to the business operating model and is a prerequisite, delivering key business outcomes at Organisation X. ii. The capability of the CIO is critical to the digital transformation journey and is regarded as the lead implementor that must maintain a service provider role in the digital transformation journey with EXCO members and their respective teams.
<p>2. What are the critical components and interdependencies within Organisation X that contribute to the organisation's digital maturity, with a focus on how growth through the digital transformation process leads to improved digital maturity levels and development?</p>	<ul style="list-style-type: none"> iii. The KMS of Organisation X is critical to controlling and managing the flow of information to meet business core requirements.

Table 5: Research Questions and related Research Propositions

5.3 Analysis of Research Question 1 (Propositions i and ii)

The research question stated in Chapter 1 of the report aim to identify and analyse the obstacles that hinder the transformation process of Organisation X. With the ever-changing business landscape, it becomes necessary for organisations to initiate changes in their operating models. These changes often require additional investments in financial, human, and social resources. However, organisations frequently encounter barriers that impede their readiness to achieve digital transformation objectives, necessitating a change. To effectively address these barriers, it is vital to grasp the fundamental concepts of digital transformation. In the context of this research, understanding these concepts enabled an evaluation of the specific barriers that hinder Organisation X, as they directly impact the digital transformation strategy. Since digital transformation is a strategic process, typically initiated at the Executive level, it was crucial to strategically assess the organisation's current state.

Research Question 1 aimed to assess the digital transformation journey of Organisation X and the process of selecting an appropriate digital transformation journey. The assessment was based on participants responses pertaining to questions 1 to 5 of the interview guide and is discussed hereunder. Furthermore, the findings provided support in assessing the alignment of the organisation's digital transformation journey with its business operating model to achieve key business outcomes. They also helped evaluate the criticality of the CIO's capability in leading the digital transformation journey as the primary implementer.

5.3.1 Themes identified for Research Question 1

In the process of determining the themes, the responses from each participant were carefully analysed to identify common patterns, which were then coded. Following coding, refined themes were identified for interview questions 1 to 5, and further aggregated and categorised into key business categories that are vital for the digital transformation journey.

Business categories	Key Themes
Digital Strategy	Corporate Strategy Executive buy-in Decision-making
Assets and Capabilities	Data management & analytics Infrastructure and system Intelligent systems System Security
Procedures and processes	Operational systems Monitoring and evaluation Supply Chain Automation
Corporate Culture	Culture dynamics Agility
Human Resources	Human Resources capacitation levels Leadership boldness Stakeholder engagement
Learning and Development	Skills and training Communication Collaboration and synergies Innovation

Table 6: Business categories and key themes for Research Question 1

The descriptions for each of the business categories are as follows:

Digital Strategy

This category is primarily concerned with the digital strategy, executive support, making informed decisions, and ensuring adherence to relevant regulations.

Assets and Capability

This category relates to IT and data management, encompassing activities involving technology infrastructure, data analytics, system security, and intelligent systems.

Procedures and Processes

This category is focused on operational efficiency achieved through process optimisation, system improvements, and the effective management and monitoring of operations.

Corporate Culture

Within this category, it encompasses the planning and execution of organisational changes, considering its impact on the organisation's culture and agility.

Human Resources

This category focuses on the development of the workforce. It also involves engaging and maintaining relationships with various individuals who have a vested interest in the organisation.

Learning and Development

This category involves activities related to training, skills development, and innovation. Effective communication and collaboration are key aspects.

5.3.2 Discussion and analysis of results for Research Question 1

The research question seeks to understand the transformation and change process of Organisations X's digital transformation journey and the elements required to successfully transform the organisation.

The literature reviews revealed the fundamental theoretical constructs that underpin the importance of establishing a clear digital strategy that is founded on a thorough assessment of the organisation's current situation and capabilities. Bharadwaj et al., 2013 believe that the establishment of a sophisticated digital transformation strategy requires an organisations IT strategy to be merged with the business strategy to ensure

common goal and alignment. However, Ismail et al. (2017) suggest that digital transformation is to be viewed as a separate strategy that does not encompass the merge of functional organisational strategies as digital transformation has independent strategic drivers. Although there are varying theoretical frameworks, each with a separate view, the prevailing elements remain that a digital transformations strategy that is concise and effectively communicated to all affected stakeholders must be established. Subsequently, the related awareness and training campaigns embarked upon should ensure that stakeholders are committed to achieving the desired state as set out by the strategy. The discussion and analysis of results for Research Question 1 are structured in accordance with the business categories and are presented hereunder.

a. Digital strategy

The literature review in Chapter 3 highlights the importance of establishing a digital transformation strategy for the successful implementation of digital transformation. Ismail et al. (2017) indicate that the corporate strategy sets out the intent of the organisation and is followed by the business strategy which assesses options for how to sustain the organisation. Bharadwaj et al. (2013) write that the digital business strategy is founded on the organisation's corporate strategy and is executed by the leveraging of digital resources. This is similar to what Participant 4 stated, in that the organisations strategic and overarching business should set the basis for the digital transformation strategy, and that collaboration amongst various functional areas is vital to ensure that synergies are created and that the vision is fulfilled.

The digital strategy, aligned to the business strategy, is an organisation-wide strategy that addresses opportunities and risks associated with the adoption of digital technologies (Ismail et al., 2017; Fitzgerald et al., 2013). Hess et al. (2016) state that it is often assumed that the digital strategy is formulated within an organisations IT strategy. However, the conventional IT strategy was established by an organisation's functional strategy which is subordinate to the corporate strategy.

Participants 4 and 7 stated that the digital transformation at Organisation X is believed to be in its infancy stage as the strategy is undefined; the desired state and objectives of the journey is not understood, and there are unrealistic timelines considering the

entire process. Sebastian et al. (2017) defines digital strategy as a framework that provides the guide for the establishment of new value propositions that enable the development of new capabilities using digital technologies. It was clear from several participants' responses that digital transformation at Organisation X is unsystematic, not carefully planned, and has no timeframe. Participant 2 expressed that the organisation needs more structural strategic plans for its initiatives as adequate training and realistic timelines are often neglected.

You have an undefined scope in terms of what the transformation will entail for different business units within the organisation. It might happen in one area but cannot be collectively measured as an organisation. This term that is now being coined digital transformation, doesn't have parameters (Participant 2).

Several participants expressed uncertainty regarding the responsibility for digital transformation, as their responses indicated that it is cascaded down from the CEO and is a cross-functional initiative. Based on the overall responses, it can be inferred that Organisation X has implemented its Innovation business unit to facilitate the cross-functional approach in exploring and evaluating digital solutions.

Participants emphasised the significance of adequate funding for digital transformation initiatives, noting that project overruns and unforeseen costs often lead to unsuccessful outcomes. It is crucial to allocate and earmark funds appropriately for a project's successful implementation. Simultaneously, continuous assessment of the initiative is necessary to ensure it remains on track and to identify any potential funding shortfalls.

Participant 6 emphasised that apart from the time-consuming nature of technology implementation, the organisation faces challenges in training individuals, which also varies in terms of duration. This lag in training leads to delayed implementation, and by the time training is effectively delivered, new technological advancements have emerged. This sentiment was affirmed by Participant 2 and Participant 10, who highlighted that the current strategy being implemented has remained unchanged for the past 10 years.

Fitzgerald et al. (2013) state that the challenge most organisations encounter with any digital transformation initiatives is the lack of management temperament and the technical skills to successfully drive transformation. Participant 10 expressed that while

the organisation's strategy acknowledges and promotes innovation, there is a prevalent fear of failure that makes the organisation risk averse. Kane et al. (2016) states that the deployment of adequate resources enables the strategy, and that once the strategy is established, it requires continuous review and necessary updates. Expanding on this, it is important to prioritise the further development of internal skills and consider the utilisation of external services when necessary. Participants 4 and 5 mentioned that apart from keeping abreast of market developments, the organisation lacks strong leadership, good communication, efficient systems, and trained staff to improve its current position. Van der Bel (2018) states that although organisations are eager to onboard the best technology to optimise their business process, a strong digital culture is required to manage and sustain the adoption.

b. Assets and capabilities

In an everchanging operating environment, organisations are continuously assessing their strategic assets and capabilities through a digital lens to determine what can be done to fulfil the benefits of digital technology. As a long-standing SOE, Organisation X is impacted by its continuously changing environment. Owing to 4IR, Sebastian et al. (2017) state that leaders in older organisations have since recognised opportunities stemming from the incorporation of digital technologies that redefine their business strategy. This is evident in the Water sector, as technical advancements and the development of new capabilities which emerged from 4IR have disrupted the status quo of the value chain (World Economic Forum, 2018).

Many of the participants have been with the organisation for several years and have seen many processes change over time. Participant 1 indicated that the Management Information System (MIS) previously allowed management access to reports that provided useful information for decision making. The INTENDA2 system, which was introduced to drive efficiencies in the Organisation's Supply Chain, was mentioned by Participants 1, 2 and 3. The system was discarded due to the belief that the implementation was ineffective, and the application did not align with the changing business requirements of Organisation X. Similarly, such failure occurred with the

² The INTENDA system is an end-to-end procurement system.

Asset Management System (BAUD) by PricewaterhouseCoopers (PWC), which was adopted for the effective management of assets. On the other hand, the SAP system, the organisation's Enterprise Resource Planning (ERP) system, was introduced in the organisation in 2005 and initially presented a host of challenges but is now considered a significant improvement compared to the previous Walker system. Hess et al. (2016) emphasises that digital transformation is highly dependent on the adoption and integration of digital technologies. In the case of Organisation X, Participants 2 and 8 stated that the organisations use of different systems that are incompatible for integration is the reason why some new solutions fail. It was also assumed, by Participant 1, that the appointment of consultants based on low costs often result in a lack of subject-matter knowledge, particularly when it comes to identifying and implementing best-fit technology.

It was gathered from participants' responses that Organisation X tends to initiate various IT projects of which most are ineffectively implemented, and as such no value is derived within the value chain. Participants conveyed that some functional areas operate in silos, as they explore digital solutions for their functional areas. Participant 6 believes that digital technology requires proper technology to collate data that can be used for effective reporting. Unfortunately, a large portion of the organisation's operations still rely on manual processes and different systems that lack integration, leading to manual interventions and inconsistent reporting outcomes. Hess et al. (2016) indicate that the technology deployed by an organisation should allow the organisation to capitalise on flexibility, speed, and collaboration. The disintegration of digital technology often poses a myriad of challenges that impeded on an organisation's performance and dampen its drive to embark on further transformational initiatives (Rosner, 2018). Participant 7 suggested that using intelligent business instruments that encapsulate data management and data analytics for real-time information throughout the value chain has not been explored. According to Participant 9, it is crucial to migrate to a more electronic system considering the organisation's aging infrastructure. This is necessary to address the growing number and frequency of emergencies that demand timely responses. Furthermore, Participant 9 stated that the complexity of the organisation should warrant the investigation of neural networks' applicability to assess data processing, using machine learning capabilities. With this type of functionality, the

chemical engineers within the operations division would be able to use information to determine the chemical's dosage requirements and the variations that result from this.

It is essential to set up the infrastructure with the foresight of where you want to go. When I say infrastructure, that means being able to have the kind of service, bandwidths, technology, server rooms to hold a massive data and necessary security to be able to contain that data to mitigate hacks, breaches, and uncontrolled access (Participant 6).

Participants 1, 2, 9, and 10 expressed the importance of establishing essential infrastructure and ensuring effective onboarding of all stakeholders for the digital transformation journey. They emphasised the need for this process to align with the organisation's vision. With the setup of IT infrastructure comes the aspects of data storage, use of servers, security, and related skills, therefore users of the system should be equipped with the basic technical expertise to manoeuvre and navigate through the system. This was also supported by Participant 7 who believed that skillset is important and should be embedded in the organisation. Moreover, the organisation's IT unit needs to maintain core internal IT skills that are continuously updated to ensure that they are able to adapt to and sustain digital solutions.

Agility is another key capability that the organisation unfortunately does not possess, as the organisation does not move with market developments and is slow in its responses in technological developments. Agility permits flexibility and adaptability, which results in value creation following the IT investment (Jonathan, 2020). Kane et al. (2015) affirm that agility is a key capability, having referenced the Chief Digital Officer of Harvard University. According to the World Economic Forum (2019) report, the inability of an organisation to be agile hinders its ability to respond promptly to technological advancements and establish a leaner organisational structure that enables individuals to make faster decisions. Digital transformation impacts the entire value chain of an organisation; therefore, management must concurrently manage its resources to explore and exploit its resources to achieve agility, which is a necessary element for digital transformation (Hess et al., 2016).

Participant 4 suggested that a gap analysis and problem statement need to be defined so that the organisation can assess its current capabilities that support the digital strategy. Khin & Ho (2018) states that it is important for organisations to assess their capability to manage and make use of digital technology, which is mobilised through

use of human and technology resources. Given the significance of the human element in the transformation journey, it is crucial to ensure its effective management. However, in the case of Organisation X, several participants noted that the organisation lacks commitment to effective collaboration, including establishing relationships with stakeholders.

c. Procedures and policies

Many participants perceived digital transformation as the automation of business processes facilitated by IT, with the objective of enhancing efficiency and accelerating output generation. When the operational benefits of digital technology are clearly defined, it enables improved decision-making regarding the exchange of internal and external information through digital platforms for enhanced connectivity (Mackiewicz, 2019; Bharadwaj et al., 2013). Furthermore, the improvement of an organisations technological capability enables the development of new processes (Khin & Ho, 2018). Participants 5 and 10 emphasised that digital transformation should guide the organisation's shift from traditional business processes to automated seamless reporting, resulting in improved efficiency and decision-making. They highlighted that this transformation would enhance accuracy, enable universal access to information through various devices, and support a transition towards a paperless environment. According to Participant 10, the organisation has well-established governance structures, but reliance on external support hinders approval and processing time.

According to Participant 5, the organisation is becoming more receptive to change, particularly in terms of digitalisation. The Covid-19 pandemic prompted a transition to digital platforms, such as MS Teams or Zoom, for stakeholder engagement. However, despite the initial adoption of digital platforms during the pandemic, Organisation X continues to rely on manual processes for several aspects of its operations.

If you look at our current landscape, a lot of our operations are manual. We're using different systems, which means that you have to get all the different systems together to retrieve information which always needs manual intervention (Participant 6).

Participant 9 confirmed that digitalisation efforts were initiated during the pandemic, evidenced by the introduction of electronic logbooks at sites. However, this progress was impeded on by a workforce that lacked technological proficiency. Administrative

staff (support structures) are more inclined to embrace advanced technology when they have the capacity to learn and perceive a need for process optimisation. McKinsey's Global Survey revealed that many organisations' Executives have accelerated digitalisation to meet business needs, prioritising investments in digital technology with long-term objectives in mind, as technology improves overall business processes (McKinsey & Company, 2020).

The adoption of new technology typically necessitates the formulation of new regulations and policies. Collaborative policymaking is therefore crucial to ensure clear direction, consistency, and accountability pertaining to the functional changes resulting from the implementation of digital initiatives. As stated in Organisation X's IAR for 2022, the Board Risk Committee is responsible for overseeing the implementation of corporate policies and risk management (Organisation X, 2022b).

Participant 2 described the scope of digital transformation as undefined, encompassing various business units such as Finance, SCM, Asset Management, and Operations. According to Ismail et al. (2017), the extent of digital transformation is broad and should be continuously managed within an organisation (Ismail et al., 2017). In line with this understanding, several initiatives aimed at process optimisation within different functional areas are outlined below:

Group Operations

The Operations department is currently implementing Supervisory Control and Data Acquisition (SCADA) systems to remotely manage some of the plants, along with an Automated Meter Reading (AMR) system for real-time meter readings, aligned with the organisation's billing system. However, at the water purification plant, manual meter readings and logbooks are still used due to the ongoing delays in completing the implementation of the AMR project. Currently, the manual transfer of information to computerised systems leads to reporting delays and poses a risk of skewed results, due to incorrect data captured or anomalies. With AMR, data would be transmitted through radio frequency towers, which would then send the information to the organisation's server system. It is believed that once AMR is implemented, it would eliminate the need for physical meter readings, reduce labour costs, enhance efficiency through real-time information for data analysis by administrative staff, and

minimise human errors. Participants 7 and 8 mentioned that the AMR project, originally scheduled for completion in 2019, is currently 50% complete, due to challenges in SCM and inadequate infrastructure. Participants highlighted that the organisation relies heavily on the Supply Chain department for most operational activities. Furthermore, the organisation is governed by the National Treasury which leads to a bureaucratic, time-consuming, and lengthy procurement process.

Participant 9 noted an increase in emergencies on sites, prompting the need for a standard operating procedure supported by digital technology. Since the organisation's plant is over 100 years old, automating processes requires integrating new systems with legacy systems. While Participant 6 acknowledged the significant achievement of certain Operational Technology (OT) systems, many participants expressed that the adoption of technology across the entire organisation is hindered by factors such as the nature of the business, existing processes, budget constraints, and reliance on internal support services. Participant 6 highlighted that the tablets procured for operators during the Covid-19 pandemic, intended for data handling and monitoring, are currently inoperable due to the absence of necessary software. Participant 5 expressed optimism about the upcoming implementation of the Satellite Leak Detection system, highlighting its significant benefit of enabling remote monitoring of pipeline leakages. This advanced technology is anticipated to reduce the reliance on manual labour, minimise errors, streamline data processing, help manage encroachment issues, and contribute to improved decision-making.

Support service – Finance

According to the participants, there is a notable concern that IT projects face delays in approval, resulting in outdated technology upon implementation. For instance, the introduction of robotics in the Trade Payables department was proposed and approved several years ago and is only now being recognised as a revolutionary change within the organisation. Most participants stated that revolutionary advancements are primarily concentrated within the Finance Group, although Participant 3 expressed scepticism regarding any significant transformative changes. The Finance Group's Business Planning and Consolidation (BPC) initiative, although still in its early stages, is seen as problematic due to technical challenges. Participant 9 highlighted the importance of the BPC system in effectively managing critical aspects such as

electricity and chemicals. However, unresolved challenges faced by end-users have prompted Participants 2 and 6 to emphasise the need for improvements in change management, communication, culture, and processes.

Participant 9 further noted a recurring pattern within Organisation X of reverting to older methodologies after implementing digital initiatives. For instance, contract management within Organisation X has reverted to primarily using Excel spreadsheets instead of a dedicated system. This is due to limited understanding among business process owners regarding other contract management tools. Furthermore, the reliance on tacit knowledge poses a risk to business continuity and underscores the need for better knowledge sharing and system utilisation.

d. Corporate culture

A key capability in an organisation's corporate culture is proactive error management, concerted support following failure from digital initiatives and motivation to take risks (Berghaus & Back, 2016). Participant 5 expressed that the organisation's culture underpins any transformation initiative; however, Organisation X is slow in reacting, and tends to focus on failures rather than being more risk tolerant.

I believe that we are a bit behind as the organisation in establishing our transformation. Culture is an aspect of transformation, and the culture that I've picked up here, is very, very slow (Participant 5).

As the workforce of the organisation undergoes continuous changes, some participants have observed that new staff members initially have a desire to make a difference. However, they often become discouraged over time, leading to speculation that this may be indicative of the organisation's culture. As a monopoly operating in South Africa, the organisation's attitudes may be rooted in the perception that there is no competition and that it will continue to thrive. Participant 10 emphasised the importance of Executive buy-in, as they are responsible for leading the strategy. It is believed that leadership should demonstrate greater boldness in their approach to drive meaningful change within the organisation.

Corporate culture within Organisation X undoubtedly plays a pivotal role in the implementation and success of digital transformation. Based on the responses, its

employees do not actively pursue ideas with a degree of autonomy that promotes a change in the cultural dynamics of which the organisation is in dire need. Participants indicated that there is seemingly a lack of willingness to learn and a fear of failure and risk taking. As innovation is centralised with the innovation hub, the degree and rate of experimentation is limited within functional teams. Although innovation must be limited within the bounds of the organisation's risk appetite (Kane et al., 2016), leadership needs to foster a culture of support, risk taking, experimentation and learning. According to Rogers (1983), the diffusion of innovation leads to social and structural changes. Therefore, Organisation X's culture should focus on shifting the mindset of individuals who are key in revising and updating policies related to the business operating model. Nambisan et al. (2017) also supports this view, considering digital transformation as a sociotechnical phenomenon.

e. Human Resources

Ensuring the organisation's operability requires a widespread organisational need for hiring individuals with the right skills and providing continuous training. Participant 5 stated that this improves the organisation's competitive advantage as the organisation is better positioned to compete both locally and internationally. Participant 1 stated that digitalisation at Organisation X fails, due to unstructured implementation and unrealistic timeframes which are critical for success.

Participant 3 stated that good communication and understanding of the outcomes aid in the buy-in of stakeholders. Additionally, change management should be understood to ensure that the necessary aspects of change are addressed, and stakeholders are aligned to the vision.

We put a lot of focus on the mistakes we've made as opposed to getting to the nitty gritty in terms of what is holding up the process, engaging the relevant people, hiring of people, upskilling our current workforce, and enhancing reporting (Participant 11).

Participant 9 stated that change management was not effectively conducted with the BPC project. There was no consultation with end-users, and most were onboarded as the project was underway. They were required to forgo their contracted key performance tasks and actively partake in the projects' implementation.

Many participants stated that staff at the organisation are perceived to be resistant to change, primarily due to fears of being unable to adapt and manage a new system. They tend to avoid dealing with complications and complexities. Participants 3 and 8 believe that being well capacitated in terms of staff and empowering skills development through training are key capabilities that are needed for digital transformation initiatives at Organisation X. This includes having a good IT team that is able to provide the necessary support and sustain systems. Furthermore, Participant 4 highlighted the necessity of a project management team to efficiently handle initiatives, both during and post implementation phase.

f. Learning and Development

Innovation is a key driving force for digital transformation and represents a perceived new idea. Sebastian et al. (2017) state that building on capabilities amplifies the rate of innovation within an organisation. In the context of this study, innovation represents the innovative IT solutions that integrate emerging digital technologies to support the digitalisation of Organisation X (Khin & Ho, 2018). According to Participant 2, Organisation X forgoes adequately embracing learning needs for its digital transformation initiatives. Most participants expressed that the organisation lacks extensive research on projects, leading to a lack of alignment with its current capabilities. Participant 4 stated that research of the drawbacks and successes of solutions that have been implemented is not considered during due diligence assessments, and potentially possesses the risk of fruitless and wasteful expenditure that is reported to the National Treasury of South Africa. This reactive approach is seen as a weakness, with participants emphasising the need for a more proactive approach. Participants also indicated that digital transformation projects undertaken at the organisation are perceived as a “tick box” exercise, as the appropriate in-depth testing and confirmation of the design are not fulfilled by users.

Although participants stated that funding and infrastructure are enabling factors, they believe that appropriate training and upskilling of staff remain a concern with many projects undertaken. For an organisation to digitally mature, they are required to build on their capabilities to amplify the rate of innovation (Sebastian et al., 2017). Participants disclosed that system users are required to run parallel systems during testing, resulting in a time-consuming process that subjects them to undue pressure

and additional workload. Additionally, participants highlighted that the timelines for testing were considered unreasonable.

Participants 4 and 7 indicated that there is the Innovation Division that focuses on driving innovation that continues to address changes within the entire value chain, for example, the exploration of an AMR system that aids in monitoring water usage. However, some participants noted that Subject Matter Experts (SMEs) are not involved in Innovation Division's endeavours, despite their knowledge of the processes within their respective functional areas.

There must be SMEs that you can go to at any point in time and say, OK, I'm struggling here (Participant 9).

Catlin et al. (2017) emphasise the importance of cross-functional teams in promoting continuous development and improving the entire value chain, suggesting that the organisation's Innovation Division should prioritise effective collaboration. Furthermore, the DOI theory, by Roger (1983), recognises the significance of innovation elements, namely relative advantage, compatibility, complexity, trialability, and desirability, in the transformation process. Therefore, the innovation strategy of Organisation X should factor in these fundamental elements in relation to the organisation's operational activities.

Based on responses, Organisation X can be categorised as a Late Majority adopter according to the technology adoption lifecycle framework. This classification is supported by the organisation's preference for adopting technology after rigorous testing and confirmation of its value, reflecting a lower risk tolerance. Moreover, according to Steiber et al. (2020), large organisations, like Organisation X, encounter difficulties in leveraging digital technologies and implementing organisational changes. Given the long history and significant growth of Organisation X's business model since the early 1900s, the complexities of digital transformation require substantial organisational changes throughout its interconnected network of operations.

5.3.3 Summary of results from Research Question 1

The interviews began by exploring participants' views on digital transformation. Many participants expressed uncertainty about its exact meaning and referred to it as the integration of technology of operational processes to replace manual tasks, resulting in faster generation of useful information. Overall, responses indicated that digital transformation involves the use of systems that enhance processing, reduce time, and improve accuracy, which leads to enhanced efficiencies. It was also deduced that digital transformation is an ongoing process that continuously adds value across the entire value chain. The research findings emphasise the notable impact of digital transformation on Organisation X's business processes, evident in the various initiatives undertaken across different business units within the organisation. According to Shamekh (2008), it is crucial to ensure that the deployment of technology aligns with and supports the overall business objectives and processes. As highlighted by Issa et al. (2018), digital transformation should be viewed as a comprehensive assessment of the entire organisation, considering all levels and evaluating the extent of changes and expected outcomes. Therefore, given the significance of business processes within the business operating model, aligning digital transformation efforts with these processes becomes imperative.

The evaluation of Organisation X's digital transformation journey involved analysing key themes identified from interview coding. These themes encompass Strategy, Human Resources, Assets and Capabilities, Culture, Learning and Innovation, and Policies and Procedures. It is crucial for Organisation X to acknowledge the strategic and functional integration aspects that are essential in digital transformation. The Strategic Alignment Model (SAM), outlined in the theoretical framework, emphasises the importance of aligning business strategies, processes, and associated infrastructure to fully leverage the benefits of new technologies (Shamekh, 2008).

However, the findings indicate that there is room for improvement in Organisation X's current processes. Insufficient user involvement in process mapping, inadequate assessment of capabilities to effectively manage changes resulting from technological solutions, inadequate leadership support for optimisation changes, ineffective communication, limited collaboration, inadequate IT skills to support adopted digital

solutions, insufficient end-user training, and inadequate IT infrastructure were identified as areas requiring attention.

Moreover, due to the organisation's longevity, many processes have evolved over time. Participants highlighted that current delays in processes hinder timely resolution of critical matters. While the onset of Covid-19 forced certain processes to transition to digital platforms, many of the organisation's processes remain manual.

Currently, it appears that digital transformation at Organisation X is in its initial and development stages. The digital strategy is not well-known among the workforce, resulting in a lack of understanding regarding its objectives. Additionally, new initiatives are implemented without structured planning and enforced with unrealistic timelines. The absence of awareness campaigns led by the CIO, suggests a lack of the CIOs involvement in spearheading the digital transformation journey. Many participants expressed uncertainty regarding the responsibility for executing the digital transformation journey.

Although the organisation's Board has approved an "innovation risk-based strategy" (Organisation X, 2022b), there is a general fear of failure and risk aversion. Embracing digital transformation requires fostering a culture that encourages innovation and learning, which the organisation currently struggles to achieve. As a result, valuable opportunities for optimising activities within the value chain are missed. The organisation's culture is perceived as laid back, with a focus on failures rather than learning opportunities. The organisation's Executives are viewed as disengaged and ineffective in providing leadership to steer the digital strategy in the intended direction.

Furthermore, the absence of effective change management and inadequate communication weighs down initiatives, leaving employees feeling frustrated, uncertain, and disengaged. In some cases, initiatives are enforced on staff without consultation or consideration of their key responsibilities.

5.4 Analysis of Research Question 2 (Proposition iii)

Research question 2 of the case study seeks to unpack the value chain of the operating model regarding the Management Information System (MIS) and digital maturity model. Hess et al. (2016) describes digital transformation as the change in an organisation's business model that is triggered by digital technology. Michael Porter founded the term "Value Chain" in which he described it as the ability of a organisation to understand and capitalise on its own capabilities that impacts value adding activities, in order to drive sustainable competitive advantage (as cited by Kumar & Rajeev, 2016). It is crucial to understand the value chain to understand and assess the business model, and essentially the various organisational activities and processes that are required to deliver on the organisation's core mandate within its current operating environment. The responses gathered for questions 6 to 14 in the interview offer insights into the organisation's value chain and provide a basis for assessing its digital maturity. Furthermore, the findings supported the assessment of Organisation X's KMS to determine its criticality in controlling and managing the flow of information to meet the organisation's core requirements.

5.4.1 Themes identified for Research Question 2

In the process of determining the themes, the responses from each participant were carefully analysed to identify common patterns, which were then coded. Following coding, refined themes were identified for interview questions 6 to 14, and further aggregated and categorised into key business categories that are vital for the digital transformation journey. The graphical depiction of the coding for the Research Question 1 is illustrated in Figure 18. Based on the analysis of the coded data, Table 7 presents the identified business categories and corresponding key themes.



Figure 18: Coding results for Research Question 2

Business categories	Key themes
Strategy	Value Chain analysis Strategic clarity Digital transformation Decision making
Operating environment	Monitoring and Evaluation Real-time information Operational automation
Digital Capability	Digital infrastructure and integration Data integrity & analysis Knowledge Management Management Information System
Organisational Culture	End-user assurance Strategic leadership alignment Benefits realisation
Innovation	Internal standards and best practice Trialability Process optimisation

Business categories	Key themes
Governance	Complexity of the organisation Governance structure Technology oversight and accountability
Human Resources	Training Tacit knowledge Change management
Stakeholder engagement	Diverse communication channels Buy-in and consultation Impact and resistance

Table 7: Business categories and key themes for Research Question 2

The descriptions for each of the business categories are as follows:

Strategy

This category refers to the strategic endeavours and highlights the critical factors that impact the business value chain, including the adoption of agile processes that are essential for the effective execution and management of digital transformation efforts.

Operating Environment

This category focuses on the factors that influence the organisation's performance. It examines the processes for monitoring and evaluating operational activities, the availability of real-time data for informed decision-making, and the efforts being made to achieve operational automation.

Digital Capability

This category encompasses the organisation's proficiency in employing digital technologies to enhance its operations and achieve desired business results. It includes assessing the organisation's digital maturity, which includes the effectiveness of Knowledge Management systems, and the performance of the organisation's Management Information System.

Organisational Culture

This category focuses on the shared values and practices that characterises the organisation. It explores the extent to which end-users feel confident and supported, and the degree of coherence between strategic leadership and organisational actions.

Innovation

This category pertains to the pursuit and application of solutions and processes improvement. It examines the congruence between established internal standards and industry best practices, the opportunities provided for experimentation, and the extent of process optimisation efforts.

Governance

This category focuses on the structures and procedures used to steer the organisation. It entails homing in on the organisation's structural complexity, its governance of technology and information, and the mechanisms for technology oversight and accountability.

Human Resources

This category evaluates the sufficiency of employee training programs, the distribution and utilisation of knowledge, and the methodologies employed for managing and adapting to organisational change.

Stakeholder Engagement

This category examines the relationship with individuals who have an interest in the organisation. It assesses the variety and effectiveness of communication methods, the level of involvement from those who use the systems, and the influence and opposition to new technological implementations among stakeholders.

5.4.2 Discussion of results for Research Question 2

The research question seeks to unpack Organisation X's value chain of the operating model regarding the MIS and digital maturity model. In the context of digital transformation, understanding the value chain of the organisation's interrelated

activities within its business operating model helps gauge the level of digital maturity that essentially underpins the success of its digital strategy. Kumar and Rajeev (2016) assert that the value chain is influenced by various internal and external factors and is thus managed by information and relationship management systems to sustain the operating activities and structure of an organisation. The discussion and analysis of results for Research Question 2 are structured in accordance with the business categories and are presented hereunder.

a. Strategy

Drawing from Michael Porter's framework, the formulation of an organisation's corporate strategy revolves around the concept of sustainable competitiveness. It underscores the significance of the forces that influence the business value chain, which encompasses the inputs, transformation processes, and outputs of an organisation's system (Straková et al., 2020). Therefore, to assess the value chain of Organisation X, it is essential to gain an understanding of the organisation's strategy. This understanding provides a foundation for evaluating how the various components of the value chain contribute to the organisation's overall performance and competitive advantage.

Participant 1 highlighted that Organisation X has an Innovation Driven Risk Based-Strategy that aims to optimise organisation-wide processes. However, the scope of innovation within the organisation lacks clarity. Some participants perceive that the organisation's current strategy gives higher priority to areas other than the organisation's core business, which involves maintenance, infrastructure renewals and augmentation. Participant 5 emphasised the importance of achieving corporate KPIs', particularly related to capital expenditure (CAPEX) and maintenance spending. As an SOE, Organisation X is significantly influenced by changes in regulations and legislation, which often necessitate adjustments in its operations, processes, and procedures.

Participant 7 indicated that the initiatives proposed by the IT department lack realistic timelines and the presence of steering committees. Additionally, these initiatives have been long-standing without clear documentation or sufficient budget allocation. Participant 10 further supports this viewpoint by highlighting the absence of established

steering committees responsible for monitoring and evaluating digital transformation initiatives. These observations point to the need for a well-defined strategy within the organisation. The lack of clear project documentation and budget management suggests a need for more structured project governance. Additionally, the organisation's business processes are not agile enough to adapt to the rapidly changing operating environment, as expressed by Participant 7.

According to Third Stage Consulting Group (2021), the specification of a new system, which includes defining the project scope, is a critical component that should be thoroughly addressed before commencing any project. This highlights the importance of having a clear understanding of project objectives, deliverables, and the resources required to achieve them. Overall, the research findings emphasise the need for a more defined strategy, improved project governance, and agile business processes to effectively drive and manage digital transformation initiatives within the organisation.

Participants 3 and 4 expressed that there is a lack of awareness regarding the organisation's digital transformation problem statement, and the benefits of automation initiatives are not being effectively communicated. Specifically, there is a need to clearly explain how digital transformation initiatives will reduce manual workload, minimise errors, and improve turnaround time. Participant 2 further highlighted that the organisation has not thoroughly explored smarter approaches for its processes, indicating a potential oversight in seeking innovative solutions.

Participant 3 emphasised that digital transformation is crucial if the organisation aims to achieve financial health and sustainability, which aligns with its strategic objectives. However, Participant 3 also stated that the organisation's failure in executing the approved digital transformation initiatives is seen as a waste of time, money, and effort. This suggests a gap between planning and implementation, which needs to be addressed.

Participant 1 highlighted that the implementation of SAP in 2007 marked a significant change in terms of automation for the organisation. It was a major transition from the previous accounting system, Walker. Other participants also mentioned SAP and acknowledged that the initial implementation was challenging, mainly due to time constraints that required a quick implementation. Although the system provides readily

available information once processed, the organisation has not fully explored its functionality. Participants also mentioned other systems, such as BAUD and INTENDA, which did not meet the organisation's expectations. This suggests that the organisation may have focused on enhancing their systems without fully understanding the underlying concepts and constructs. Taking the time to seek advice and conduct thorough research can help organisations avoid potential setbacks and ensure more successful implementations (Third Stage Consulting, 2021).

Participant 4's perception that Organisation X is slow in responding to technological developments is supported by the challenges mentioned in the previous discussions. To harness the opportunities presented by digitalisation, it is crucial for Organisation X, as a leading water utility, to engage in active collaboration and knowledge-sharing with other organisations operating in the water sector. The World Economic Forum (2018) highlights the importance of creating such an enabling environment to fully exploit the potential of digitalisation. This includes establishing effective governance frameworks, developing suitable investment models, and fostering collaboration with various stakeholders.

Participants have highlighted that KPIs' linked to digital transformation are incorporated into the performance contracts of the IT team. However, there is a tendency by the IT team to make excuses for their inability to fully realise certain initiatives as initially planned. For example, the IT team is unable to provide a definite explanation as to why most of the organisation's Head Office lacks Wi-Fi connectivity. Participants 8 and 10 expressed the belief that enhanced leadership support for the digital transformation strategy would enable the organisation to streamline and effectively manage initiatives, leading to successful implementation. They also suggested that the organisation should be open to change proposals made by its workforce and to recognise the valuable insights that can come from within the organisation.

b. Operating environment

Participant 5 indicated that Organisation X has established an Operations Monitoring and Evaluation team that actively engages both internal and external stakeholders in the management of system volumes and reservoir levels. This reflects the organisation's commitment to stakeholder management and leveraging knowledge

sharing for improved operations. The mention of regular meetings as a platform for knowledge sharing suggests that Organisation X values collaboration and learning from various stakeholders. However, findings also indicated a lack of shared viewpoint among participants regarding stakeholder management and knowledge sharing across all operating activities within Organisation X's value chain. This suggests that there may be inconsistencies or gaps in the organisation's approach to stakeholder engagement and knowledge dissemination throughout its operations.

Participants 7, 8 and 9 emphasised the importance of Organisation X to stay updated with the changing operating environment. With aging infrastructure, real-time information becomes crucial for addressing challenges promptly. The implementation of the Satellite Leak Detection initiative, mentioned in section 4.2.3, demonstrates the organisation's commitment to investing in innovative solutions to address operational challenges. Furthermore, Participant 7 highlighted the organisation's use of Telegram, where a bot is configured to reply with the current reservoir levels. According to Sebastian et al. (2017), older organisations often struggle to let go of legacy systems but must embark on an extensive journey to embrace new technologies. In the case of Organisation X, it is evident that they are making strides towards leveraging technology to enable convenient access to real-time information, to facilitate more informed decision-making.

Participants indicated that Organisation X is currently heavily reliant on its workforce for its processes and is facing challenges in retaining critical skills due to adverse changes in its workforce. Given the size and complexity of the organisation's operations, Participant 9 suggested that there should be an acceleration of digital technology adoption, particularly with an emphasis on data analytics. Extensive data can play a crucial role in decision-making processes, such as determining when to augment infrastructure, conduct maintenance activities, or make purchasing decisions. By leveraging data analytics, Organisation X can gain valuable insights and make informed decisions based on data-driven analyses.

Participant 10 strongly expressed that to achieve the organisation's strategic objectives, it is imperative that the organisation automates its business operations processes whilst considering the economic, social, and environmental pressures.

Participant 9 and 10 highlighted that many processes within the organisation's SCM department are currently manual. This manual approach is in contradiction to the organisation's digital strategy and leads to errors and inconsistencies in the processes. It is crucial for the organisation to address this issue by adopting technologies and implementing automated systems within SCM to improve efficiency, accuracy, and consistency. Furthermore, participants mentioned that the organisation has seen a substantial increase in the volumes of valuable internal and external data. It is thus essential that valuable data is viewed as a strategic asset and is effectively managed to ensure that the organisation remains self-sustaining.

Since the Covid-19 pandemic, Organisation X has increasingly relied on digital platforms to support its operating activities. Virtual meetings have been utilised to ensure uninterrupted operational functions. Participant 8 mentioned that while many meetings can be conducted virtually, there are instances where in-person meetings are necessary, especially when hardcopies of documents need to be shared. However, the organisation has made significant progress in adopting some digital solutions. For example, one of its sites piloted initial interviews using MS Teams, which proved successful and have now been incorporated into the organisation's processes to save costs and reduce time.

When BPC was implemented, MS Teams was used (Participant 8).

According to Participant 9, the Operations business unit of the organisation implemented an electronic logbook at its sites to ensure that real-time information is utilised for reporting purposes. However, the implementation of this logbook is currently delayed by the SCM department. This suggests that there may be some challenges in the coordination and alignment of SCM and other departments within the organisation. While the study by Third Stage Consulting Group (2021) suggests that larger organisations often avoid change due to operational disruptions, it appears that Organisation X is determined to undergo digital transformation. However, there is a need for systematic improvement in the organisation's processes to advance its digital maturity.

Participant 2 drew attention to additional systems, namely the outsourced Neptune system responsible for managing recruitment applications, and the Managed Integrity Evaluation (MIE) system utilised for verifying the qualifications and background of applicants. According to Participant 2, both of these systems have made a positive impact. However, there is a concern within the Human Resources department regarding the lack of technical skills to effectively use these systems, as well as concerns about system security controls.

A few participants also mentioned that when a project exceeds its allocated costs and/or time, Organisation X tends to discard the project regardless of the adverse impact. This suggests that there may be challenges in effectively managing project timelines and budgets within the organisation. It also indicates a need for improved project governance and controls to ensure the successful delivery of projects while considering the potential consequences of cost and time overruns.

c. Digital Capability

Participants 2, 3 and 6 highlighted the importance of infrastructure capability for successful digital transformation. They emphasised that Organisation X needs to ensure that its infrastructure can support and accommodate compatible technologies. Currently, the organisation faces challenges in fully understanding and utilising the functionality of its systems, such as SAP. This lack of understanding hampers the organisation's ability to effectively leverage these systems. Additionally, many participants expressed concerns about the lack of integration among the organisation's systems, which leads to delays in decision-making processes.

According to Participant 2, one of the organisation's concerns with its systems is data integrity. Anomalies can only be identified if data from the SAP is analysed, using Microsoft Office suite, as the SAP system itself does not automatically flag these anomalies. Participants 3 and 5 acknowledged the organisation's efforts to improve the MIS, particularly in terms of intelligence, but stated that progress in this area has been slow. While Operations is considered the core of the organisation, supported by divisions such as SCM, Strategic Asset Management, and Finance, there appears to be a siloed approach to process optimisation. Participant 4 pointed out that incompatible systems are being adopted, such as Maximo for infrastructure

maintenance, which cannot be integrated with SAP. This lack of integration hinders seamless data flow and information sharing across different systems. Participants emphasised the need for a stronger IT team to effectively manage and ensure the onboarding of compatible applications that can be integrated with the organisation's ERP system.

Considering the organisation functional business divisions, the following was revealed:

i. Finance

Many of the participants indicated that change in terms of automation is predominantly occurring within Finance. Participants 4 and 6 specifically mentioned the automation of payslips (e-payslip), vendor account reconciliation, and the implementation of BPC as notable examples of automation initiatives within the Finance department. These are initiatives aimed to streamline processes and improve efficiency. However, the implementation of these initiatives faced challenges and was not executed smoothly. Furthermore, Participant 8 expressed concerns about the effectiveness of the Financial Shared Services (FSS) help desk, which was introduced in 2018 to enhance the facilitation of financial information. According to the Participant, the process is viewed as cumbersome, suggesting that it has not achieved its intended goal of automating processes for faster query resolution.

For me to resolve a matter with the Inventory Manager, I need to send an email to FSS helpdesk to request to have a discussion (Participant 8).

ii. Operations

As per the insights provided by Participants 3, 4, and 6, the implementation of the AMR system is currently in progress within the Operations department. Additionally, these participants mentioned ongoing assessments for automation at treatment and distribution plants. However, Participant 6 observed that the organisation presently lacks a centralised information repository, apart from the ERP system. This adversely affects Operations' ability to promptly access data related to chemicals, water supply, and energy usage, which are crucial for managing related KPIs' and making informed decisions. The continuous occurrence of emergency shutdowns, as mentioned by

Participant 5, poses strain on the organisation's operations. This suggests the need for timely and reliable information to effectively address these challenges. Participant 8 highlighted the notable initiative of automating energy consumption and volumes pumped analysis, which was successfully implemented in 2001. This process used to take several days to complete manually by the Stats department, but with automation, it now takes only 30 minutes. This example demonstrates the potential benefits of automation in terms of time savings and improved efficiency. However, it also highlights that the organisation's instances of successful automation initiatives have been relatively limited, considering that this automation was implemented over two decades ago.

iii. Strategic Human Capital

The implementation of the digital recruitment system by the Human Resources business unit has yielded significant benefits according to Participant 2. It has improved the quality and integrity of data while optimising the overall recruitment process. By reducing manual workload and introducing efficiencies, the system has proven to be valuable in streamlining recruitment activities. The Human Resources business unit has also enhanced its capabilities by automating the salary packaging process and implementing the Employee Self Service (ESS) system, which empowers employees to manage their own HR-related tasks and inquiries. However, Participant 2 also conveyed that recent network instability and malfunctions across multiple systems have highlighted the need for improvement within the organisation's IT department. To maximise on the benefits of digital initiatives, Organisation X must ensure that it possesses the capability to effectively operate and maintain the stability of the adopted digital solutions.

Knowledge Management System (KMS)

The organisation's KMS plays a crucial role in supporting its operational activities. As the organisation intends on becoming a digital Water utility, it needs to promote engagement and collaboration that is enabled through ICT (Sarni et al., 2019). Many participants mentioned the need for proper digital systems that can effectively archive and manage information. Participants 2 and 10 stated that specialised skills and knowledge within the organisation may not be readily available in the market,

emphasising the importance of investing in technology that supports sound knowledge management practices.

For instance, systems like the Laboratory Information Management System (LIMS) and Supervisory Control and Data Acquisition (SCADA) contain critical information necessary for maintaining water supply and quality. It is essential to ensure system security and controls to protect against cybercrime, especially in light of SOE incidents, such as the Transnet ransomware attack in June 2021. The incident urged business leaders, particularly SOEs, to improve their cybersecurity due to their dependency on technology within their business operations (Singh, 2021). According to Singh (2021), the average downtime following a cyberattack is estimated to be 21 days. This statistic underscores the significant impact that cyberattacks can have on organisations, resulting in prolonged disruptions to their operations. Singh (2021) emphasises the importance of considering poorly designed systems, inadequate skills levels, and ineffective system management when formulating risk management strategies.

Participants 2, 4, 5, 7 and 8 stated that the loss of skilled personnel with valuable knowledge, the lack of information maintenance and protection, and the heavy reliance on individuals, underscore the necessity of an effective KMS across the entire value chain. Additionally, Participant 5 noted that during the transition from the Walker system to SAP, historical information was archived in hardcopy format. Given the organisation's century-old operations, proper collation and management of information are vital for sustaining critical state infrastructure. Therefore, safeguarding historical information and implementing softcopy backups are crucial measures that should be undertaken. Expanding on knowledge management, Participant 7 shared an example of the importance of tacit knowledge during a recent site emergency, where an employee with extensive experience possessed valuable tacit knowledge that was not documented. This lack of documented tacit knowledge hampers management's ability to make more informed business decisions.

Management Information System

Sebastian et al. (2017) writes that for organisations to function digitally, they must be able to transact and access operational data. To achieve this, organisations need to invest in technology and develop the necessary business capabilities to ensure

scalability, reliability, and quality. However, findings revealed that Organisation X faces challenges in this regard, specifically related to disjointed MIS and lack of integration among various systems. Additionally, functional teams operate in silos which hinder information accessibility and collaboration within the organisation. Kane et al. (2015) emphasise that many organisations struggle with their digital transformation initiatives due to insufficient investment in current and required capabilities, such as the development of ERP systems and KMS that are crucial for driving the necessary changes.

The organisation's ERP is considered a "digitised process platform", according to Sebastian et al. (2017), as it is designed to standardise and integrate systems and processes. For a complex organisation like Organisation X, it is essential to have a robust MIS that serves as a "single source of truth". This system collects operational data from across the organisation and consolidates it into a central repository (Roddewig, 2022). As the organisation expects continued growth, its use of inconsistent data sets poses a serious threat to decision-making and its agility within a volatile and everchanging business environment. Geared towards overcoming this, organisations must assess the resources and capabilities to identify its strengths relative to digital transformation initiatives that are required for its sustainability (Hess et al., 2016).

The reliance of the organisation on its operating systems is evident, but the frequent network instability and malfunctions significantly disrupt its operational activities. Some participants have expressed concerns about the outdated IT and OT infrastructure, emphasising the need for faster system maintenance and updates. Albukhitan (2020) writes that it is imperative that an organisation assesses its digital transformation capabilities, by assessing its infrastructure and systems in addressing both current and future business requirements. According to Participants 7 and 10, the organisation frequently accepts a certain level of system integration with its ERP system, leading to unnecessary expenses and complications. Furthermore, the current ERP system only records transactional data without any intelligence function. For example, there is a need for a neural network system capable of generating a variance analysis report by utilising chemical dosing information, raw water quality data, chemical pricing information extracted from invoices, and chemical budget information. The generation

of a variance analysis report currently requires input from multiple individuals, resulting in time-consuming processes, including occasional travel to sites to obtain necessary data.

There is often manual intervention in report generation. We must be bullish about it to the point of standing our ground by saying that we will only utilise solutions that are aligned to our base system, which is SAP. This should be a precursor (Participant 10).

Digital Maturity

Albukhitan (2020) proposed a framework for evaluating the digital maturity of an organisation, which encompasses key dimensions of business such as strategy, leadership, operations, culture, people, and technology. This framework outlines five distinct levels of digital maturity:

- **Unaware:** The organisation is unsure about where digital transformation can be implemented.
- **Conceptual:** The proof of concept for digital transformation initiatives is established.
- **Defined:** The digital transformation strategy and objectives are defined.
- **Integrated:** Business functions are fully integrated.
- **Transformed:** The digital transformation journey objective is successfully achieved.

Based on the responses from participants, it is evident that Organisation X has reached the conceptual stage of digital maturity, where their proof of concept for digitalisation has been established and the anticipated outcomes have been defined. However, several barriers and challenges, such as system disintegration, a siloed culture, skill shortages, poor leadership, and inadequate system infrastructure, prevent the organisation from progressing to higher levels of digital maturity.

d. Organisation Culture

A clear digital strategy is essential for driving successful digital transformation in an organisation. It requires robust leadership that provides direction and ensures

alignment with the overall organisational goals. Furthermore, fostering a conducive culture is crucial in promoting collaboration and innovation throughout the digital transformation journey (Kane et al., 2015).

Participants indicated that the organisation fails to adequately consult end-users of the expected transformational plans and their involvement. Jain (2021) writes that effective communication and engagement with end-users is necessary to ensure their understanding of how digitalisation will drive efficiencies. It is crucial to illustrate the benefits and practical applications of digitalisation to make it more hands-on. From the responses, it was deduced that the organisation's cultural transformation has been slow-moving and that there is a need for a culture shift to support the digital transformation initiatives. Participants 2 and 4 expressed the importance of changing the organisation's culture, as projects are currently viewed as mere tick-box exercises, leaving end-users frustrated with the process.

Finance had a planned and phased approach with the BPC training sessions and the design. The project had some very strong points. However, the culture of the organisation needs to change. Which then meant a large chunk of your stakeholders, who were your users, didn't mentally and emotionally come on board (Participant 2).

Participants 4, 5 and 7 have expressed the importance of understanding the benefits of digital technology in stimulating innovative thinking and driving improvements within functional areas. This awareness of the potential advantages of digital technology serves as a catalyst for exploring new possibilities and envisioning how different aspects of the organisation's operations can be enhanced through digitalisation.

Transformation occurs through leadership, people, and systems (Participant 5).

Many participants expressed their importance, as managers, in taking an active role in illustrating the benefits of digital technology to their teams. Jain (2021) states that it is important that everyone is on board and understands the value of the changes before initiating them to ensure that the desired outcomes are achieved. If staff do not understand the value of the changes resulting in automated or optimised processes using technological solutions, it becomes a challenge to involve them after

commencing with the change. Participants also stated the importance of increasing staff involvement in exploring and proposing digital solutions. This approach promotes bottom-up and cross-functional collaboration, empowering employees to contribute their insights and expertise in finding the most effective technological solutions. In some cases, managers set KPIs' related to digital transformation in their subordinates' performance contracts. This helps drive commitment and enablement of digital transformation, fostering a shift in mindset and addressing issues while identifying any necessary training requirements. Jain (2021) affirms the notion of managers getting more actively involved to alleviate frustrations amongst impacted parties where teams are provided a safe platform to raise concerns and express their opinions. This aspect should not be overlooked, as it directly impacts the process of implementing the changes. Failure to address these concerns may lead to increased resistance to change and make it difficult to manage.

e. Innovation

Organisation X has implemented an Innovation Driven Risk Based-Strategy that underlines futuristic thinking for the organisation's sustainability (Organisation X, 2022b). Participants highlighted the presence of an Innovation Hub within the organisation, which spearheads innovation to ensure that business processes are streamlined and aligned with international standards to address operational challenges. Participants also stated that the unit focuses on driving resilience considering the changing business environment and managing projects within the organisation risk tolerance ambit. Kane et al. (2015) state that as organisations digitally mature, they are more likely to build on a collaborative culture that is more risk taking. Participants 7, 8 and 9 expressed that innovation occurs organically and is a collective responsibility, bottom-up, where ideas are shared with the Innovation Hub to help them lead the idea. The DOI theory suggests that individuals' perception of innovation determines the rate of adoption (Rogers, 1983). The Innovation Hub is currently exploring several projects, including finding disposal options for sludge by-products at treatment sites, improving methods of sourcing and treating water, incorporating membrane technology in the purification process, exploring hydroelectric power as an alternative to reliance on Eskom energy utility, and utilising pipeline technology for enhanced pipeline condition monitoring and planning. According to Rogers (1983), innovation should focus on creating simplicity and desirability. For example, the

exploration of satellite pipeline leak detection software demonstrates a simple solution that can provide valuable information about the organisation's pipeline network, leading to improved operational efficiency. Additionally, the implementation of hydropower technology has the potential to reduce costs and position the organisation as self-sufficient, in terms of power generation (Loots et al., 2014).

According to the participants, the Innovation Hub plays a crucial role in the organisation by conducting feasibility studies for various technologies before presenting them to the leadership for approval. However, Participants 2 and 9 mentioned that although the division is responsible for assessing the best-fit solutions, they may lack the technical expertise. This highlights the importance of collaborating with subject matter experts to ensure the suitability and effectiveness of the proposed solutions. Furthermore, participants expressed that the organisation's fear of failure culture may discourage innovative ideas or risk-taking which potentially limits the organisation's ability to explore new possibilities and achieve optimal outcomes.

For some reason, we stress test ideas before we implement them and fail at them (Participant 10).

According to Rogers (1983), innovation that is viewed as experimental tends to be adopted more quickly, signifying the importance of trialability in the diffusion of innovation. By permitting trialability and experimentation of solutions, Organisation X can foster a climate that encourages the rapid adoption of innovative ideas. The organisation's culture should be embedded in acceptable levels of risk taking and experimentation which are drivers of innovation (Kane et al., 2015).

f. Governance

As an SOE, Organisation X adheres to relevant legislation and regulations, including the WSA and PFMA, to ensure compliance and ethical operation. The organisation's governance practices are guided by the principles outlined in the King IV Report on Corporate Governance, which highlights the importance of ethical conduct and diligent leadership (Organisation X, 2022b). To effectively manage risks associated with its business strategy, Organisation X has implemented a Risk Management Framework that enables the identification, assessment, and mitigation of risks within acceptable

tolerance levels. This framework ensures that risks are appropriately managed, while supporting the organisation's pursuit of its strategic objectives (Organisation X, 2022b).

Recognising the significance of technology and information governance, the organisation's Board has taken accountability for overseeing these areas. They have approved various policies, including those related to ICT, Information Management, and Digital Technology (DT), as well as a Charter for DT (Organisation X, 2022b). These governance measures are integrated into the overall governance framework of Organisation X, ensuring that the management of digital technology aligns with established principles and practices. The Board's subcommittees play a vital role in monitoring investments in significant digital technology. This oversight ensures that such investments are assessed from both a capital investment and risk perspective, to ensure its appropriateness and alignment with the organisation's strategic objectives.

According to most of the participants, the responsibility for digital transformation within Organisation X is primarily delegated to the CIO, as directed by the Chief Executive. However, Participant 6 believes that the Group Strategy Business Unit, which determines the organisation's strategy, should be responsible for digital transformation. While the CIO is ultimately accountable, participants stated that middle-to-senior management within the organisation are held responsible for identifying areas that require digital transformation. However, a few participants revealed that the IT department often fails to engage with SMEs in functional areas who possess valuable insights and expertise to advise on areas of improvement. This lack of collaboration and input from SMEs may impede on the effectiveness of the organisation's digital transformation initiatives. Additionally, participants highlighted that the Innovation Hub, responsible for extensive research and experimentation, also fails to regularly consult SMEs.

Participant 10 highlighted that the bureaucratic and rigid governance structure within Organisation X adversely affects its ability to effectively pursue digital transformation. This suggests that the organisation's current governance practices may be slowing down decision-making processes and impeding on agility in adopting innovative solutions. Furthermore, Participant 6 identified the supply chain as a major challenge for Organisation X. Given the importance of an efficient and resilient supply chain for

operational success, addressing these challenges becomes crucial for the organisation's digital transformation efforts.

According to Participant 1, the organisation has recently encountered several technical glitches and security threats which disrupted its operational activities. Shahi and Sinha (2020) write that an organisation should invest in data management and system security to safeguard an organisation's data and ensure business continuity. With the increasing prevalence of cybercrime, SOEs like Organisation X are at risk. Based on the responses, it can be inferred that the insufficient IT skills within Organisation X present a significant risk to effectively manage, protect, and sustain its operating systems. The presence of skilled IT professionals is essential for maintaining the integrity and security of the organisation's systems.

g. Human Resources

Participants 2 and 10 expressed that there are multiple digital initiatives taking place in different functional areas, often involving the same individuals. The generational gap was also discussed, with younger staff being perceived as more tech-savvy, while some participants noted biases or prejudices against older staff regarding their technological proficiency and willingness to learn. Participants expressed the need for effective change management in digital transformation initiatives, as the lack of such initiatives was a concern. Participants also expressed that impacted individuals are not kept adequately informed, which indicates low levels of communication within the organisation. Different systems require different management approaches, and underestimating the required change can overwhelm people (Third Stage Consulting Group, 2021). Training was identified by all participants as a crucial element in the change management process. However, some participants stated that the current training programs do not effectively address the comfort levels of individuals, as it is sometimes found to be complex and not easily understood. This lack of understanding and comfortability often leads to resistance to change and impedes the adoption of new processes.

Participant 1 highlighted that insufficient due diligence for projects like BAUD and INTENDA resulted in "fruitless and wasteful expenditure" as there was no value added. According to Participant 1, staff were not adequately informed, and the importance of

comprehensive user training manuals and SMEs was overlooked. The appointment of consultants was also questioned by some participants, as it takes time to acquire the necessary internal knowledge while implementing a system. According to Third Stage Consulting Group (2021), project complexity can be eased with the use of screened consultants that are able to deliver on the project's scope. Therefore, it is imperative for Organisation X to improve its due diligence when selecting consultants, ensuring they meet the necessary criteria.

Furthermore, some participants revealed that some individuals are left balancing their contractual deliverables and the organisation's project deliverables which leaves them overstretched. According to Participant 2, project management teams are not established at the onset to ensure that there are no clashes and conflicting initiatives. It is imperative that a project management team is established to ensure that tasks have defined timelines and factors in contingencies for all unplanned project elements (Third Stage Consulting Group, 2021).

h. Stakeholder engagement

Effective management of stakeholders within the digital strategy requires organisations to continuously develop and maintain relationships aligned with strategic objectives. It is crucial for organisations to identify their stakeholders, assess their level of involvement in the strategy, and establish mechanisms to effectively manage these stakeholders. Collaborating and forming partnerships with various stakeholders are important for fostering relationships and leveraging strengths to improve digital maturity (Bumann & Peter, 2019; Kane et al., 2015).

To achieve desired levels of buy-in for Organisation X's digital transformation strategy, it was concluded that consultation needs to be improved. Grossman (2020) emphasises that executives have a responsibility to advocate for the outcomes of the digital strategy through effective communication. Employees are more receptive to change when they receive support and understand the impact of the transformational process, which helps alleviate resistance and increase commitment levels.

In Organisation X, participants stated that digital transformation initiatives are often implemented without thorough discussions and agreement among impacted parties, while also failing to consider reasonable timelines. For example, Participant 6

mentioned that the Inventory System, TENDA, was introduced without engaging end-users, and attempts to configure the product for adaptation failed. Similar challenges were experienced with the BAUD system. Typically, a task team or steering committee should be established to manage and provide updates on transformational initiatives. Participant 10 stated that change management is often outsourced, due to the internal team's inability to cope, which can lead to delays in executing proposed initiatives.

Based on the feedback provided by participants, it is evident that not all stakeholders are involved from the beginning of transformational initiatives in Organisation X. This lack of early involvement hinders the gradual introduction of change and neglects the opportunity to address concerns, which leads to resistance to change and tension among impacted parties. A specific example is the recent implementation of the BPC project with Finance, where end users felt overwhelmed and ill-prepared. Participant 9 highlighted that stakeholders were not well managed during this project, citing unreasonable demands imposed on end-users, holding them accountable for unattainable timelines, and forcing them to conduct testing.

With the BPC project, a large portion of the stakeholders were not onboarded mentally and emotionally. The project was moving rapidly with no consideration of the impact to stakeholders (Participant 2).

On a positive note, Participant 2 positively highlighted the presentation of the BPC project, citing that the project team employed creative methods to engage and cater to everyone's receptiveness to learning. A similar approach was taken with the Road Map to Clean Audit (RMCA) project. According to Participant 2, it is important for the organisation to adapt its communication practices to accommodate the changing workforce as it progresses with system improvements. According to Grossman (2020), it is crucial for Executives and Senior-management to engage in regular communication with stakeholders through consistent and well-coordinated channels. These conversations should aim to assess the level of understanding and consider proposals for improvements. While formal communication within the organisation occurs through meetings, emails, and occasional use of the intranet, the organisation has recently embraced additional communication channels, namely WhatsApp groups, Short Message Services (SMS), news feeds displayed on staff computers, and the

updated internet. According to participants, effective communication should involve a two-way exchange, but expressed that constructive feedback in response to communication is not always well received, as it may be seen as opposing change. This often limits the extent of conversations stemming from such feedback. Furthermore, Participant 5 expressed doubt about the effectiveness of using SMS for communication, citing concerns that people may not always read them. However, a study conducted by Kallavus (2023) suggests that an SMS is more likely to be noticed and therefore a more effective delivery channel than emails for informative purposes.

5.4.3 Summary of results from Research Question 2

Research question 2 aimed to assess the alignment of Organisation X's value chain activities with its digital transformation efforts. Understanding the relationship between the value chain activities and digital transformation was crucial in evaluating whether the organisation's current systems effectively support its overall business objectives. During the assessment, participants expressed unanimous agreement that leadership should play a more active role in supporting the digital transformation strategy. They expressed the importance of improved engagement and communication from leaders to foster a conducive environment for successful digital transformation initiatives. Luftman (2000) emphasises the significance of Senior-management support and strong leadership in achieving alignment during transformation efforts.

One recurring finding among participants is the persistent absence of a clearly defined and widely comprehended digital strategy. Participants expressed the need for awareness campaigns and informative sessions to ensure that all stakeholders have a clear understanding of the goals and objectives associated with the organisation's digital transformation efforts. Furthermore, the findings revealed instances of failed initiatives within the organisation, leading to the wastage of valuable resources such as time, money, and effort.

The study revealed that Organisation X has a low level of digital maturity, primarily due to its slow response to technological developments and limited successful technological implementations. The organisation has struggled to keep up with the evolving technological landscape, and its initial digital strategy may have become

obsolete, considering these changes. This highlights the need for the organisation to enhance its agility in adapting to new technologies and embracing digital transformation.

Findings indicated that the organisation's MIS is found to be inadequate, and integrating multiple systems remains a significant challenge. Furthermore, the malfunctioning of some of the organisation's systems exacerbates operational disruptions, which necessitates improvement of its systems. Expanding on this, another concern raised by participants is the insufficient skills and training provided to effectively manage systems. Participants expressed that the organisation explores new systems without adequate preparation and training, which poses a risk to the successful implementation and long-term sustainability of these systems. Moreover, incorporating digital technology into its operations necessitates that the organisation prioritises security and risk management in its digital initiatives.

Participants also revealed that the organisation's KMS is below the expected standard, and many of them were unaware of its configuration. They emphasised the significance of having a robust KMS that can efficiently control and manage information flow to meet the core requirements of each business unit within the organisation, considering its diverse operations. Participants also stated that the reliance on the ERP system and intranet for information is insufficient. The ERP system primarily focuses on finance management, while the intranet lacks updated and relevant information for effective use.

The assessment of Organisation X's value chain activities, in relation to digital transformation, reveals several areas of improvement. The lack of structured processes and strategies to manage change associated with digital transformation initiatives, needs to be prioritised for improvement. While the COVID-19 pandemic highlighted the importance of digitalisation across various business areas and prompted the organisation to adopt virtual meetings, it has been relatively sluggish in implementing other planned digital solutions. To further advance its digital transformation journey, Organisation X should focus on addressing the aforementioned areas and aligning its value chain activities with its digital transformation objectives.

CHAPTER 6. CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

This Chapter provides that concluding remarks pertaining to the research findings and provides recommendations for the organisation. In recent years, digital technology in the water sector of South Africa has steadily gained traction. Understanding digital transformation and the changes stemming from this is not always understood by impacted employees, suppliers, customers, investors, and communities. The prioritisation of what needs to be transformed and how to strategically ensure such transformation often presents a myriad of challenges, as organisational leaders often do not know where to start. As discussed in the preceding chapters, the implementation of digital technology is underpinned by the digital strategy which comprises of several elements that drive its success, such as: stakeholder management, assets management, business capabilities, robust leadership, and culture.

The data analysed and interpreted for the case study are the perceptions of participants who are employed in the organisation and thus do not represent conclusive factual evidence of the barriers that hinder digital transformation at Organisation X. Understanding the digital transformation journey of Organisation X and the value chain provided an understanding of the interrelated elements that prevent the organisation from forging forward with its digital endeavours. The theoretical framework served as a guide in developing the conceptual framework to aid in analysing, interpreting, and presenting the concluding remarks that follow hereunder. The concluding remarks address the research design, whilst considering the limitations, and are intended to benefit the stakeholders of Organisation X, as well as other global and local industry players.

The propositions for the research were established during the literature review and stated as follows:

- a) The Digital transformation journey must align with the business's operating model and is a prerequisite delivering key business outcomes at Organisation X.

- b) The capability of the CIO is critical to the digital transformation journey and is regarded as the lead implementor that must maintain a service provider role in the digital transformation journey with EXCO members and their respective teams.
- c) The KMS of Organisation X is critical to controlling and managing the flow of information to meet business core requirements.

6.2 Research Question 1 concluding remarks

The organisation’s strategy incorporates essential plans, such as the National Development Plan (NDP), recognising the significance of providing safe drinking water in fostering socio-economic development. As stated in Organisation X’s IAR for 2022, the organisation adopts the International Integrated Reporting Framework (IIRF) to establish its strategy, performance and governance frameworks (Organisation X, 2022b). Given that digital transformation is supported by a digital strategy, it should be harmonised with the corporate strategy frameworks and structure, as illustrated in Figure 19 below.

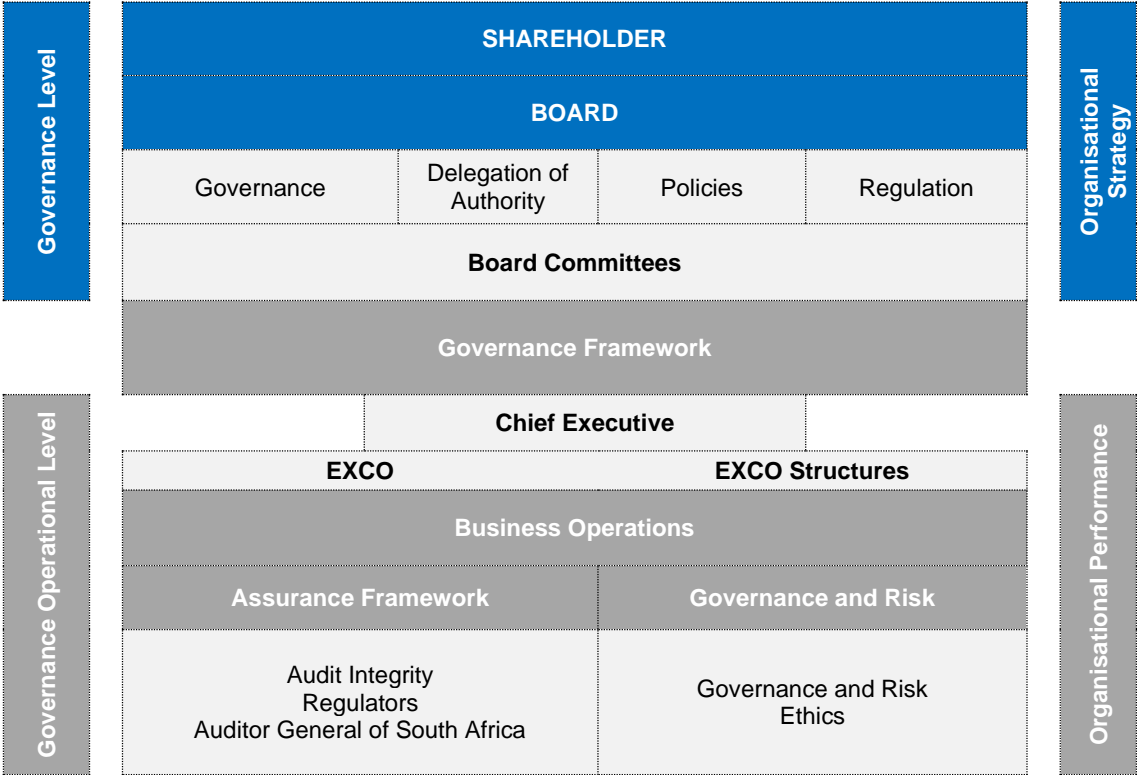


Figure 19: Organisation X’s Governance Structure

As a SOE, Organisation X is driven by its core mandate to implement sustainable and innovative solutions that foster ongoing optimisation through cost-effective business processes. The strategic utilisation of digital technologies, in conjunction with innovation, aligns with the organisation's Risk-based Innovation strategy, and aids in the achievement of its strategic objectives. To effectively spearhead the digital transformation journey, Organisation X must establish a clear and concise digital transformation vision, accompanied by a well-defined plan and the formulation of SMART³ objectives. The complete commitment and active participation of stakeholders in this process are essential. Given the diverse range of stakeholders associated with the organisation, effective stakeholder management is a critical component of its business operations. Consequently, it is evident that stakeholder management is equally crucial for digital transformation, as it is instrumental in sustaining and advancing operational activities. The executives within the organisation play a pivotal role in ensuring the efficient management of functional areas, thereby ensuring the successful realisation of the strategic goals outlined in the digital transformation strategy. However, based on the findings, the scope of Organisation X's digital transformation is not clearly defined, and the objectives are inadequately communicated. It is apparent that the organisation is in the early stages of its digital maturity journey, as indicated by the current state of affairs.

Many participants regard digital transformation as the optimisation of business processes, wherein an electronic system enhances efficiencies through automation and improves the management of operational activities. Business processes are integral to effectively managing organisations, irrespective of their size. The literature review highlights the significance of business processes in the context of digital transformation. As business processes constitute a fundamental component of the business operating model, it is imperative to establish digital transformation in alignment with these processes to ensure the attainment of key objectives. The research findings underscore the undeniable impact of digital transformation on business processes. Streamlining the current processes would enable Organisation X to position itself more favourably for the digital transformation of its processes and

³ SMART stands for Specific, Measurable, Attainable, Relevant, and Timebound, which are key criteria for goal setting.

business model. Consequently, it can be concluded that research proposition one is valid and indeed essential.

Based on the responses, it was difficult to ascertain the comprehensive framework employed for Organisation X's digital transformation journey. While the organisation's management is aware of the Innovation Hub driving innovation and the functional role of IT, they lacked knowledge regarding the frameworks guiding the organisation's digital transformation journey. To facilitate a successful digital transformation, it is crucial to underpin the journey with an appropriate framework that provides guiding principles. According to the organisations IAR for 2022, its ICT and Information Management are established in accordance with corporate governance standards. The organisation's digital technology framework aligns with the principles outlined in King IV and includes policies focusing on information management, cybersecurity, system infrastructure, and architecture (Organisation X, 2022b). Additionally, the organisation must adhere to the DPSA's Corporate Governance of ICT Policy Framework, which aims to ensure that Executive-management utilises ICT to create value. The current findings reveal that the adoption of digital technologies primarily occurs within functional areas, with the aim of process optimisation and improvement. However, there is a failure to fully acknowledge that digital transformation is an organisation-wide endeavour, and its impact should be evaluated within the broader context of the business operating model. In leading the digital transformation journey, the CIO plays a pivotal role, ensuring that the organisation attains the desired level of digital maturity, in alignment with the strategic objectives. Given that Organisation X has a Charter in place to govern digital technology, the CIO should ensure the successful execution of the digital transformation journey in alignment with Board-approved plans and compliance with adopted governance standards. The CIO must receive support from other members of the EXCO and their respective teams. This collaborative effort should involve regular engagements and effective change management initiatives to foster organisation-wide commitment. As a result, it can be concluded that research proposition two is both valid and essential.

Regrettably, participant highlighted that the IT infrastructure of the organisation exhibits a substandard state, thereby rendering it inadequately equipped to effectively onboard and manage digital solutions. Furthermore, the empirical findings explicitly indicate that the organisation must diligently focus on nurturing and retaining critical skills to sustain

its operational endeavours. It is also imperative that the organisation improves its due diligence assessments for transformative initiatives and conducts robust pilot studies on digital technology, with due consideration given to the organisation's capabilities.

Participants expressed an urgent need for the organisation to prioritise addressing and resolving the challenges faced by the SCM department, as these challenges significantly impact on operational activities. Moreover, there is a pressing need to facilitate improved communication throughout the entire organisation.

In summary, Organisation X has encountered significant challenges in the successful implementation and sustainability of its digital initiatives. The following key barriers have emerged for Research Question 1:

- **Lack of leadership:** There is insufficient leadership support in driving the digital transformation strategy, which adversely affects the progress and alignment with strategic goals.
- **Organisational culture:** The existing culture acts as a hindrance to change and digital transformation efforts. There is a prevailing resistance to change among employees, making it difficult to move forward with transformational initiatives.
- **Unclear strategy:** The organisation lacks a clear and well-defined digital transformation strategy, resulting in confusion and uncertainty of the desired objectives.
- **SCM:** Challenges within the organisation's SCM processes adversely impact the implementation of digital initiatives.
- **Insufficient and inefficient training:** There is a sense of inadequate training programs and resources to enable employees' ability to effectively adopt and utilise digital technologies.
- **Unintegrated systems:** The lack of integration of various systems impedes the availability and accessibility of accurate and timely data. It thus creates inefficiencies and challenges in data sharing and collaboration.

Addressing these barriers and developing strategies to overcome them is crucial for Organisation X to successfully navigate its digital transformation journey and achieve its desired outcomes.

6.3 Research Question 2 concluding remarks

The findings from the assessment of Organisation X indicated the presence of several barriers impeding the successful implementation of digital transformation. These barriers include a lack of clarity in the organisation's strategy and goals, ineffective leadership, lack of agility in business processes, inadequate change management, weak MIS, and the need for cultural reform.

A well-defined and widely-understood digital strategy is essential for evaluating the contribution of different value chain components to overall performance and competitive advantage. Findings indicate that Organisation X needs to develop a more robust strategy, enhance project governance, and foster agile business processes to effectively drive and manage digital transformation initiatives. Furthermore, articulating a clear problem statement and effectively communicating the tangible benefits of digital transformation are crucial.

According to participants, Organisation X allocates a significant amount of funds for capital expenditure, particularly for maintenance, infrastructure renewals, and augmentation, which are vital for the organisation's sustainability. Considering the size and complexity of the organisation, robust systems that allow for the seamless flow of information is essential to ensure the smooth operation and sustainability of its core business. The lack of integration and centralisation of the MIS within Organisation X is hindering the availability and accessibility of accurate and timely data. The organisation needs to prioritise the integration of its systems to eliminate silos and enable real-time data sharing across departments. This will facilitate an improved approach to decision-making. Following this, the implementation of a robust KMS is necessary for effective decision-making and to ensure operational sustainability. By implementing a comprehensive KMS, Organisation X can enhance its digital maturity and address the challenges related to system integration and infrastructure. A well-designed KMS will enable the organisation to effectively control and manage the flow of information whilst ensuring that it aligns with the organisation's core requirements. Thus, to advance digital maturity, Organisation X must prioritise the implementation of a comprehensive KMS. This includes document management systems and databases to support the efficient storage and retrieval of knowledge. Consequently, it can be concluded that research proposition three is valid and indeed essential.

Building upon the identified barriers from the analysis of Research Question 1, the following key barriers have emerged for Research Question 2:

- **Leadership support:** The organisation's leaders seemingly do not champion digital transformation by providing clear direction and effectively engaging with stakeholders.
- **Lack of agility in business processes:** Organisation X has not streamlined its existing processes before embarking on its optimisation efforts. Consequently, the organisation's current processes do not align with agile methodologies and thus hinder the organisation's ability to adapt quickly to changing market dynamics and effectively leverage emerging technologies. Furthermore, the organisation has a shortage of technical skills required for the new systems it adopts, which results in unnecessary operational delays.
- **Inadequate change management:** The reliance on outsourced change management has led to delays and challenges due to consultants lacking the necessary organisation knowledge. The organisation does not have a structured and internally facilitated approach to manage resistance and promote a smooth adoption of new technologies and processes.
- **Training and skills development:** Enhancing platforms for knowledge sharing and recognising innovative behaviours is an area that requires improvement within the organisation. Insufficient user training indicates that the organisation needs to invest in training programs to improve employees' proficiency in using digital systems.
- **Infrastructure capabilities:** Given Organisation X's limited in-house capabilities, and the success of only a few initiatives, the organisation is not equipped to embrace advanced technologies. Enhancing the MIS and establishing an efficient KMS should be given significant attention as part of the organisation's efforts to enable improved decision-making.

6.4 Possible limitations and challenges of the study

The research of the case study pertains to an SOE within South Africa. The following limitations were identified:

- The organisation has a complex system of operations and a broad hierarchical structure. Although interviews were conducted across 3 management tiers, it is possible that the research subject matter may not have been fully understood by some participants. Consequently, the responses obtained may be generic and lack applicability. To address this, further engagement and clarification were requested from the respondents.
- The quality of results generated was dependent on the participants' willingness to provide honest answers. It is presumed that some participants may have been reluctant to share sensitive or confidential information.
- The scope of the study is limited to one specific SOE. Insights derived from this case study may not be applicable to other organisations, which could have different operational dynamics and digital transformation challenges.
- The dynamic nature of digital transformation means that the findings represent a snapshot in time. The pace at which digital technologies and organisational strategies evolve could make some insights obsolete.
- Constraints on resources and time may have curtailed the depth of the study. A wider range of interviewees could have resulted in a more thorough analysis.
- The potential for bias cannot be overlooked, as the study relies heavily on qualitative data. The subjective interpretations of the researcher and the participants' personal viewpoints can influence the study's objectivity.

6.5 Recommendations

The findings of this study provide valuable insights that can serve as guidelines for Organisation X and other similar entities that are grappling with similar challenges. Organisational leaders should take note of these findings when formulating their own digital strategies, as they can benefit from the key takeaways.

Exploring technologies for Organisation X's digital transformation journey is vital for enhancing its long-term viability. The advent of the 4IR has brought forth a range of

advanced technologies that offer various opportunities for Organisation X. However, these opportunities can be fully harnessed if the organisation enhances its digital readiness. Simultaneously, it is crucial to conduct a comprehensive assessment of their potential impact on the organisation's business operating model, as well as its implications for society and the environment.

Several recommendations are presented for Organisation X to consider to effectively overcome the barriers outlined in sections 6.2 and 6.3 and embark on its digital transformation journey. These include:

a) Leadership support and change management: The organisation requires stronger leadership support to drive and support the digital transformation journey. The organisation needs to drive culture reforms and be more receptive to change proposals from its employees. Moreover, change management should be prioritised through more comprehensive training and awareness initiatives to ensure successful adoption of new technologies and processes.

b) Stakeholder engagement: Through effective stakeholder engagement, a platform for knowledge-sharing should occur more frequently to maximise the benefits of shared learning throughout the value chain. The impact of digital transformation is of substantial value, and based on the research findings, the following stakeholders stand to benefit significantly from it:

- **Government:** According to Manda and Backhouse (2017), the South African government has placed a high priority on addressing three key challenges, namely poverty, unemployment, and inequality. Water is a vital natural resource which is essential for ensuring socio-economic sustainability, making its effective management imperative. As Organisation X is entrusted with a public mandate of ensuring a continuous supply of safe drinking water to authorised areas in South Africa, embracing digital transformation can greatly enhance its operational efficiency and ability to fulfil this mandate (Organisation for Economic Co-Operation and Development [OECD], 2020; Omotayo & Telukdarie, 2020). It is recommended that Organisation X collaborates with other government entities to share insights and expedite the implementation of digital initiatives. This, in turn, would lead to a quicker turnaround in successful

digital transformation, streamlining Organization X's processes, improving reporting, and ultimately contributing to more informed government decision-making.

- **Leaders:** As the business landscape continuous to change, leaders within Organisation X play a crucial role in achieving the strategic objectives. To achieve strategic KPIs', it is essential to embrace agile business processes empowered by effective utilisation of digital technology. Given the broad and complex operations of Organisation X, streamlined processes are necessary for efficient and effective management. By integrating digital technologies, the organisation can effectively manage large volumes of data, extracting valuable insights to support more informed decision-making by its leaders. It is important for Organisation X's leaders to champion a culture of innovation to foster an environment that encourages the adoption of new technologies that can enhance the management of operational processes. Currently, Organisation X's leaders can benefit from advanced connectivity technology and a KMS to facilitate collaboration and unlock the potential for shared value creation.
 - **Employees:** Automation of organisational processes reduces or eliminates repetitive labour-intensive tasks, which in turn improves efficiency. Organisation X has already initiated the implementation of digital technologies such as robotics, drones, and sensor technology in its core business operations, which is a commendable step forward. However, there is a need to accelerate these efforts, as indicated by the research findings, which suggest a delay in progress. Expediting the current digital initiatives would improve employee safety, reduce employee workload, and have a positive impact on their productivity and overall well-being. Concurrently, it is imperative to prioritise interventions aimed at enhancing the organisational culture, fostering collaboration, and promoting knowledge sharing among employees.
- c) **Adequate system infrastructure and software:** Organisation X should invest in reliable and scalable infrastructure to support its MIS. This includes hardware, networks, and storage systems that can handle the volume and complexity of data generated by the organisation. Furthermore, regular updates to the MIS are required to uphold effective performance and usable functionality. This should also include a systematic approach to implementing software updates.

Given the organisation's current capabilities, the exploration of advanced technologies should be pursued as the organisation progresses in its digital maturity. This may involve the incorporation of AI to efficiently gather both new and existing information, thereby facilitating informed decision-making. Moreover, expediting the implementation of predictive analytics is of paramount importance, considering that Organisation X is entrusted with the maintenance of critical state-owned infrastructure. Neglecting such infrastructure can have severe adverse impacts on the economy.

- d) System integration:** Organisation X needs to prioritise the integration of its systems to eliminate data silos and enable real-time data sharing across departments.

- e) Data analytics:** The findings indicate that the organisation is making progress in this area by actively exploring technologies that can effectively manage significant cost drivers and enhance cost efficiency. Incorporating data analytics technology, such as ML, aligns with the participants' emphasis on the need for real-time information. Moreover, given the scale and complexity of Organisation X, the utilisation of data analytics solutions becomes imperative for extracting comprehensive insights from the vast amount of data generated. By leveraging advanced data analytics, the organisation can unearth value from its data resources.

- f) System integrity and security:** To enhance system integrity and security, Organisation X needs to enhance its quality control processes and data governance practices to ensure the sustainability of its MIS. Additionally, Organisation X should prioritise the protection of its MIS by implementing robust security controls which should include enhanced access controls and data encryption. By incorporating these measures, the organisation can effectively safeguard sensitive information and mitigate potential risks.

- g) Defined digital strategy:** Organisation X should clearly define its digital transformation strategy, and effectively communicate the anticipated benefits of

automation initiatives, especially to internal teams. This will help in aligning the understanding of the objectives of digital transformation.

- h) Governance alignment:** Organisation X acknowledges that digital transformation should not be treated as isolated initiatives, as clearly stated in its governance framework outlined in section 6.1. However, the organisation should establish clear policies that explicitly assign digitalisation as a function under the office of the CIO. While digital transformation efforts appear to occur organisation-wide, anything related to systems should be managed through IT. This approach ensures standardisation and compliance with governance frameworks.
- i) Due diligence:** Prior to implementing digital systems, Organisation X should enhance its due diligence assessments to optimise the value derived from digital transformation initiatives and prevent unnecessary resource depletion. It is essential for the organisation to evaluate whether adequate time and resources are available for the implementation process. Furthermore, the organisation should adopt a gradual approach by integrating technologies that align with its current capabilities.
- j) Financial implication:** Organisation X should evaluate the alignment of its digital transformation initiatives with its financial framework. This should involve assessing the financial impact of implementing new technologies. Furthermore, the organisation needs to ensure diligent management of its finances by evaluating the financial implications of potential fruitless and wasteful expenditure.
- k) Streamlined SCM processes:** The current state of the organisation's SCM calls for reform and intervention due to delays in procuring goods and services, which in turn hinders operational activities. To achieve the objectives outlined in the digital strategy, it is imperative to streamline the organisation's existing SCM processes. Based on the research findings, it is evident that the successful implementation of digital transformation initiatives is dependent upon effectively addressing supply chain bottlenecks. Given the current digital maturity of Organisation X, one of the technologies that stands out as particularly beneficial is Machine Learning (ML), which is a branch of AI. The deployment of ML could

enable the organisation to better predict supply needs and evaluate the backlog of suppliers, thereby minimising operational hold-ups due to supply issues. Integrating ML capabilities with the organisation's existing ERP system, specifically SAP, could promote coherence throughout the business operations. Furthermore, introducing Robotic Process Automation (RPA) could drastically improve SCM, as it allows for the automation of monotonous tasks. This reduction in manual effort not only curtails the likelihood of human errors but also enhances efficiency regarding turnaround times, freeing up current employees' time for more complex tasks.

By addressing these key points, Organisation X can not only advance considerably in its digital transformation journey but also enhance operational efficiency to accomplish its strategic objectives.

6.6 Suggestions for further research

The research findings provide Organisation X with an opportunity to address and overcome the identified barriers to the implementation of digital transformation. It is important to note that these barriers may not be exhaustive, as they are based on the feedback and data collected from a selected sample. They serve as a guideline, raising awareness of potential weaknesses that need to be addressed.

Further studies of this nature are valuable for organisations, particularly SOEs, as they help identify barriers to transformational initiatives, whether they are digital or otherwise. Case studies play a crucial role in conducting due diligence assessments when considering the adoption of new technologies to optimise business processes. Benchmarking can also be incorporated to evaluate the performance of other industry players and identify areas for improvement.

Organisations should constantly keep in mind that a business is composed of individuals, processes, and systems. It is of utmost importance to not overlook the human element. Executives should display more hands-on leadership and actively engage with employees throughout the digital transformation process. Being people-centric is key to the success of the transformation journey. It is important to address

fears and concerns and create a supportive environment that reduces pressures associated with change. Furthermore, providing hands-on support and training contributes to a smoother and more successful transformation.

With that being said, the following suggestions are presented for potential research:

- Organisation X should investigate strategies for leveraging its talent pool to drive digital transformation, acknowledging the intricate and essential nature of its operations in contributing to South Africa's socio-economic development.
- Evaluating the adoption of a suitable change management framework to reduce dependence on external consultants and foster the development of internal staff capabilities.
- Exploring strategies for culture reforms and effective communication within SOEs in the context of digital transformation is crucial, as these entities often face specific challenges during the process.

The research conducted on the barriers encountered by Organisation X in its digital transformation efforts can indeed contribute to the existing body of knowledge. By identifying and analysing the implementation barriers faced by Organisation X, the study provides valuable insights that can be applied to other SOEs and similar entities undergoing digital transformation.

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⁴ The term "Organisation X" is used to denote the specific organisation that was the subject of the case study. However, due to restrictions on disclosure, permission was not obtained to reveal the actual name of the organisation.

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APPENDIX A: PARTICIPANT AGREEMENT AND CONSENT FORM

My name is Veshal Paima, and I am a Masters student in Digital Business at the University of the Witwatersrand, Johannesburg. As part of my studies, I have to undertake a research project, and have chosen to explore the barriers a South African water utility encounters in the implementation of Digital Transformation. The research will be under the supervision of Mr Ashraf Patel.

The aim of this research project is to assess the organisation's digital transformation journey and the value creation of digital technologies on the organisations operating model.

With this said, I would like to invite you to take part in the research by means of an interview. With your permission, I would also like to audio record the interview. The research will be written as a report that will be available online through WITS library if approved for publication. All data collected for the research will be stored on my personal cloud account for a period of 3 years after which it will be deleted. Your permission permits extracts of the interview to be quoted in the research report and the use of data collected in this study to be used by other researchers provide anonymity is maintained.

There will be no personal cost, penalties, disadvantages, repercussions, or benefits that accrue to you if you participate or withdraw from participation. The interview will be confidential and any other personal information will not be disclosed. As your participation will only be known by me, the researcher, I pledge to maintain your anonymity throughout the study. Your comfort during the procession of the interview is sought and you are free to stop and resume at a later point in time. The ethics committee of the University regards ethics a vital aspect of research and as such any breach of ethical standards results in punitive measures.

My personal details are listed below should you need to contact me.

The University's Human Research Ethics Committee can be contacted if you have any concerns or complaints regarding the ethical procedures of this study.

Email: hrecnon-medical@wits.ac.za

Contact number: +27 11 717 1408

I, _____ agree to participate in the research conducted by Veshal Paima

Signed : _____

Date : _____

APPENDIX B: INTERVIEW GUIDE

Thank you for participating in this interview.

Your particulars will remain anonymous, though the following information is required:

PARTICIPANT INFORMATION

Age	
Gender	
Highest qualification	
Profession	
Management Level	
Year of professional experience	

Note: Organisation X refers to the company being researched

Objective 1: Assess the digital transformation journey of Organisation X and the process of selecting an appropriate digital transformation journey.

Question 1

What does Digital Transformation mean to you?

Question 2

Considering Organisation X's Digital Transformation Journey, what are the key elements required to digitally transform the organisation?

Question 3

What capabilities do you consider to be critical to have before embarking on implementation of digital transformation?

Question 4

Where is change currently taking place within the organisation, in terms of digital transformation?

Question 5

In your opinion, how can the promise of technology be fulfilled within Organisation X?

Objective 2: Unpack the value chain of the operating model with regards to the MIS and digital maturity model.

Question 6

How are affected stakeholders managed in relation to transformational initiatives?

Question 7

What means of communication is used for keeping stakeholders informed?

Question 8

How do you ensure adoption of digital technology initiatives within your functional area?

Question 9

What is your view of the organisation's current Management Information System (MIS) and what changes would you propose?

Question 10

What has been the most notable change in terms of automation?

Question 11

What is the role of innovation within Organisation X?

Question 12

Considering the ever-changing business landscape, do you think that Digital Transformation is a necessary to achieve Organisation X's strategic objectives?

Question 13

In your opinion, who is charged with facilitating Digital Transformation in Organisation X?

Question 14

Is Organisation X's Knowledge Management System (KMS) critical in sustaining operational activity?

Definition of terms

Digital Transformation	The change in an organisation's operational processes and culture stemming from the integration of digital technologies with the aim of creating value.
Knowledge Management System	An IT system that retrieves and stores knowledge with the aim of improving understanding and collaboration. Additionally, it involves process alignment pertaining to the creation, acquisition, capturing, distribution, and use of knowledge.
Management Information System (MIS)	A set of integrated computerised systems that are responsible for collation of data from various data sources and transposes the data, through analytics, into readable reports that is used in decision making.
Digital Transformation Journey	A structured plan that indicates the various activities that will be optimised through the application of technological solutions. The start of the journey indicates the current business activities and the maps out the transformational shift towards attaining a desired end point.

APPENDIX C: EXTRACT OF PARTICIPANT INTERVIEW

Participant name : Participant 9

Question 1

What does Digital Transformation mean to you?

Response	Coding
<p>In the context of us as a water utility it is certainly about migrating to a more electronic system. Especially noting that I'm from operations. From a very basic perspective, which us at head office, its still very paper based. For example, in my 12 years of managing #, we haven't had as many emergencies as we have had in the last two years. The plant is aging, and this is going to be a lot more frequent. I then wanted us to put together a Standard Operating Procedure specifically under emergency operations as I began to realise how much of what the sites do is still manual, and paper based. So even though during the advent of COVID there was this drive to move towards electronic logbooks. I'm not certain how far the other sides have progressed with that. Naturally when the urgency diminishes, the endeavour to get it done also follows suit.</p> <p>You'll find that we are very manual because our workforce is primarily labourers on the site. It's very difficult for them to move mindset-wise to an electronic system even though they use an electronic system, if they have to with the electronic logbooks that was introduced, they still revert to the manual system. The manual system is still what they have the most comfort in, especially when they are changing over to shifts.</p> <p>So, from a very basic perspective, from an operational point of view, digital transformation would really be for us to move into that to move an electronic state of operation. The second part, which relates to as being a little bit more advanced perhaps in terms of head office staff and the more support functions, is finding intelligence from the information that we have.</p> <p>The chemical budget for example was done on an Excel based system for the longest time. And even though we've been moving in the last two years to a system that is meant to be a bit more full-proof, I think both our experiences that we still reverting to the Excel system because we know it works, it's far more rudimentary, malleable, a lot quicker and can work. The system a lot better.</p> <p>So, there's also that sort of intermediate movement where there are certain very principal functions that we would do as an organisation that is still not on a secure system.</p> <p>Where we still working with an office suite, for example, with contract management, we manage our contracts based on Excel spreadsheets as opposed to looking to have a time based type contract management system for example, where any one of us, including the Auditor General (AG), if they need to know what's happening on some of the chemical contracts, can go into a system and you're able to see on an entire time base - this is when the contract was awarded, what happened, when you had liaison meetings, when you concluded addendums, etcetera.</p>	<p>Electronic system</p> <p>Change in Operation Processes</p> <p>Emergencies – plant</p> <p>Covid-19 – Propel</p> <p>Workforce – manual labour</p> <p>Mindsets</p> <p>Comfort and experience</p> <p>Support Functions</p> <p>Intelligence from Information</p> <p>Chemical budget – complexity</p> <p>Reverting back</p> <p>Rudimentary</p> <p>Malleable</p> <p>Quicker</p>

Response	Coding
<p>For the moment, all that intelligence basically sits on an Excel spreadsheet where you log it almost like a diary, as in when it kind of happens. So, we certainly we certainly need to move to a more sort of integrated system.</p> <p>On the one side you have the laborers on the ground, there are still manual based and we're trying to move them to maybe like an office suite type of operation.</p> <p>You have our head office operations which are support structures, which are very affair with office type modules which can't switch over to more integrated type systems.</p> <p>Then you get to the more advanced aspects where you are looking at neural networks and you're looking at artificial intelligence and where you can take these masses of data and glean intelligence from it.</p> <p>You know, as a utility, our norm is not to use neural networks and artificial intelligence or anything of the sort. We just want to crunch the data and operate the plant.</p> <p>Those 3 phases; where it is very manual based on the sites, intermediate phase where people like ourselves work in offices, and the more advanced phase where on a real-time basis you would have some kind of artificial neural network that's crunching your data and giving you intelligence from that information.</p> <p>We need to be at a point where all this data that comes through monthly and should not be manually analysed and interpreted like we currently doing now. So, it's about that migration of the various technologies into something that works that we can glean intelligence from.</p>	<p>Contract management</p> <p>Neural networks</p> <p>Artificial intelligence</p> <p>Data volume</p> <p>System integration</p> <p>Culture – appetite</p>

Question 2

Considering Organisation X's Digital Transformation Journey, what are the key elements required to digitally transform the organisation?

Response	Coding
<p>Change management!</p> <p>I don't think the finance program worked from the onset because there wasn't proper change management. It was almost like Finance telling us how the system is going to work now.</p> <p>How does Finance know that this is better than what we were doing?</p> <p>Change management is a very important aspect in terms of digital transformation because there will be an area that decides that this will be an optimal solution.</p> <p>How do you know it's an optimal solution? It's from your perspective and your view.</p> <p>If there isn't proper consultation with the various business units and the various areas that have to actually implement and work these systems together with the required change management, I don't think these things would work as quickly as they should because you are going through the change management process and selling the idea to me at the same time that you want this project to be implemented.</p>	<p>Change management</p> <p>Optimal solution</p> <p>Benchmarking</p> <p>Educating / Demonstrating</p> <p>Nature and functional roles</p> <p>DT stakeholders – limited</p> <p>Expectations – unreasonable</p> <p>Tickbox exercise</p>

Response	Coding
<p>The other aspect would be to be educating the various business units in terms of what's the latest and greatest out there. If one wants to embark on digitalisation and certain programs, it would always be very important to, at various platforms, educating the various business units in terms of your particular area, what systems that are working, what are other organisations doing!</p> <p>When you work in an area where your performance is dependent on pumping out a certain volume of water, that's what your performance is based on. I'm not sitting in my free time Googling other organisations and seeing what's the latest and greatest financial modules that they are using.</p> <p>If there's education on a regular basis in terms of saying taking an organisation and say this organisation for example is using this, how it worked for them, how it happened and how many years it took them to implement it.</p> <p>It gives us a bit of perspective of what's happening, especially the key players that need to implement a new system, because not everybody is involved in a digital transformation journey. There are only certain people that are involved in it. Everyone else are just bystanders and they go along with it.</p> <p>There are always these unreasonable expectations to have a program implemented because we need to tick a box and we need to pay. The goal is not to pay the service provider and do a sign off on something to happen. No, I need to see what the benefit is for me!</p> <p>If there isn't that proper change management and education in terms of benchmarking, I can't see how it's going to work. The chemical budget, for example, was double work for us this year. We had to do it on Excel and BPC.</p> <p>So, I think everybody needs to be taken along and the timelines need to be reasonable as well.</p>	<p>Regress - Additional work</p> <p>Timelines</p>