

# **Adoption of digital transformation in logistics sector: A case of a state- owned enterprise in South Africa**

**Thandokuhle Mpumelelo Ngcobo**

2386710

[2386710@students.wits.ac.za](mailto:2386710@students.wits.ac.za)

**A research proposal submitted to the Faculty of Commerce, Law and  
Management, University of the Witwatersrand, in partial fulfilment of the  
requirements for the degree of Master of Management in the field of  
Digital Business**

**Johannesburg, 2023**

## **ABSTRACT**

Digital technologies have brought about disruption in all industries and state-owned enterprises are not immune to the pervasive force of digital transformation. Digital adoption has emerged as a crucial aspect of organisational growth and competitiveness. As digital adoption grows in state-owned enterprises it is essential to know the starting point in their digital transformation journey by measuring digital maturity, identifying drivers and barriers, and devising strategies to manage them.

The aim of this research was to evaluate the maturity level following the introduction of the Transnet 4.0 Strategy at the state-owned enterprise, exploring the drivers and barriers.

This study used a convergent mixed methods design. The participants were management employees from Transnet Freight Rail, a state-owned enterprise. Qualitative data was collected through surveys completed by the TFR managers (n = 45) assessed the current digital maturity and used descriptive statistics in analysing survey data. Qualitative data was collected through semi-structured interviews. The interviews were verbatim transcribed and Braun and Clarke's thematic analysis was used to analyse interviews with executive and senior managers (n=9). Findings from both quantitative and qualitative data were triangulated to provide a richer understanding of digital transformation adoption in Transnet Freight Rail.

Overall, TFR is still in the early stages of their digital transformation journey according to qualitative findings, quantitative findings suggest that TFR has moved beyond the early stage and is in the early developing stage. Concerningly, many participants highlighted digital strategy communication, change management and digital skills as lacking in TFR. This study identified a range of factors and barriers that influence and affect digital transformation adoption including leadership support, conducive employee environment, organisational

readiness, poor IT infrastructure, high leadership turnover and employees resisting technology.

As demand for the state-owned enterprise to be operationally efficient and financial constraints increase, so does the need to leverage digital technologies to change business models, improve operational processes and increased customer experience to improve organisational performance. As industries get disrupted by digital technology it is essential for organisations effectively manage barriers and leverage key drivers for a successful digital transformation implementation.

**KEYWORDS:** Digital transformation; Digital maturity; Digital technology; Logistics sector; South Africa; State-owned enterprise

## **ACKNOWLEDGEMENT**

I would like to express my deepest gratitude to my family and friends for their unwavering love, encouragement, and sacrifices throughout my academic pursuit. I am immensely thankful to God for His blessings, guidance, and strength, which have been instrumental in every step of this journey.

To the participants of this study, I extend my sincere appreciation for their valuable contributions, insights, and cooperation, without which this research would not have been possible.

Furthermore, I am indebted to my supervisor Dr Michael Sony for unselfishly sharing knowledge and expertise, guidance, and unwavering support, which have been indispensable in shaping the direction and quality of this work.

## DECLARATION

I, \_\_\_\_\_, 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: \_\_\_\_\_ Signature: \_\_\_\_\_

Signed at \_\_\_\_\_

On the \_\_\_\_\_ day of \_\_\_\_\_ 2024

# TABLE OF CONTENTS

<b>ABSTRACT .....</b>	<b>ii</b>
<b>ACKNOWLEDGEMENT .....</b>	<b>iv</b>
<b>DECLARATION.....</b>	<b>v</b>
<b>LIST OF TABLES.....</b>	<b>ix</b>
<b>LIST OF FIGURES .....</b>	<b>x</b>
<b>LIST OF ACRONYMS .....</b>	<b>xii</b>
<b>CHAPTER 1. INTRODUCTION.....</b>	<b>1</b>
1.1 STATEMENT OF PURPOSE .....	1
1.2 BACKGROUND OF THE STUDY .....	1
1.3 RESEARCH PROBLEM .....	3
1.4 RESEARCH OBJECTIVES.....	4
1.5 RATIONALE.....	5
1.6 DELIMITATIONS OF THE STUDY.....	6
1.7 DEFINITION OF TERMS .....	7
1.8 ASSUMPTIONS .....	8
<b>CHAPTER 2. LITERATURE REVIEW AND THEORETICAL FRAMEWORK9</b>	
2.1 INTRODUCTION .....	9
2.2 DEFINITION OF TOPIC.....	9
2.2.1 DIGITAL TRANSFORMATION.....	9
2.2.2 DIGITAL MATURITY .....	11
2.2.3 DIGITAL MATURITY MODELS.....	11
2.3 ANALYTICAL FRAMEWORK.....	13
2.3.1 THEORETICAL FRAMEWORK .....	13
2.3.2 CONCEPTUAL FRAMEWORK .....	16
2.4 TO MEASURE THE CURRENT DIGITAL MATURITY LEVEL AT TFR. ....	16
2.4.1 PROPOSITION 1.....	17
2.5 TO UNDERSTAND THE KEY DRIVERS AND DISCOVER BARRIERS TO DIGITAL TRANSFORMATION ADOPTION AT TFR. ....	17

2.5.1	DRIVERS OF DIGITAL TRANSFORMATION.....	18
2.5.2	PROPOSITION 2.....	19
2.5.3	BARRIERS TO DIGITAL TRANSFORMATION.....	19
2.5.4	PROPOSITION 3.....	20
2.6	SUMMATIVE ANALYSIS OF LITERATURE .....	20
2.7	CONCLUSION OF LITERATURE REVIEW.....	21
2.7.1	PROPOSITION 1.....	21
2.7.2	PROPOSITION 2.....	22
2.7.3	PROPOSITION 3.....	22

## **CHAPTER 3. RESEARCH METHODOLOGY.....23**

3.1	RESEARCH APPROACH .....	23
3.2	RESEARCH DESIGN .....	23
3.3	DATA COLLECTION METHODS .....	24
3.3.1	QUANTITATIVE DATA COLLECTION.....	24
3.3.2	QUALITATIVE DATA COLLECTION.....	24
3.4	POPULATION AND SAMPLE.....	25
3.4.1	POPULATION.....	25
3.4.2	SAMPLE AND SAMPLING METHOD.....	25
3.5	THE RESEARCH INSTRUMENT. ....	25
3.6	PROCEDURE FOR DATA COLLECTION.....	26
3.7	DATA ANALYSIS STRATEGIES AND INTERPRETATION.....	26
3.8	POSSIBLE LIMITATIONS AND CHALLENGES OF THE STUDY .....	27
3.9	QUALITY ASSURANCE.....	27
3.9.1	EXTERNAL VALIDITY OR TRANSFERABILITY .....	27
3.9.2	INTERNAL VALIDITY OR CREDIBILITY .....	27
3.9.3	RELIABILITY OR DEPENDABILITY.....	28
3.10	ETHICAL CONSIDERATIONS.....	28

## **CHAPTER 4. PRESENTATION OF FINDINGS .....29**

4.1	QUANTITATIVE DATA FINDINGS .....	29
4.1.1	DEMOGRAPHICS OF PARTICIPANTS .....	29
4.1.2	VALIDITY AND RELIABILITY .....	30
4.1.3	FINDINGS PERTAINING TO OBJECTIVE 1 .....	32
4.2	QUALITATIVE DATA FINDINGS.....	35
4.2.1	DEMOGRAPHICS OF PARTICIPANTS .....	35
4.2.2	FINDINGS PERTAINING TO OBJECTIVE 1.....	38
4.2.3	FINDINGS PERTAINING TO OBJECTIVE 2.....	46
4.2.4	FINDINGS PERTAINING TO OBJECTIVE 3.....	60
4.3	COMBINED ANALYSIS OF QUANTITATIVE AND QUALITATIVE FINDINGS ...	68

<b>CHAPTER 5. DISCUSSION OF THE FINDINGS.....</b>	<b>70</b>
5.1 OBJECTIVE 1 – TO MEASURE THE CURRENT DIGITAL MATURITY LEVEL AT TFR. ....	70
5.2 OBJECTIVE 2 – TO UNDERSTAND THE KEY DRIVERS TO DIGITAL TRANSFORMATION ADOPTION AT TFR. ....	71
5.3 OBJECTIVE 3 – TO DISCOVER THE BARRIERS TO DIGITAL TRANSFORMATION ADOPTION AT TFR. ....	72
5.4 IMPLICATIONS FOR PRACTICE .....	74
5.5 IMPLICATIONS FOR RESEARCH.....	75
5.6 REFLECTIONS ON THE LIMITATIONS .....	76
<b>CHAPTER 6. CONCLUSION.....</b>	<b>77</b>
6.1 SUGGESTIONS FOR FUTURE RESEARCH.....	78
<b>REFERENCES .....</b>	<b>79</b>
<b>APPENDIX A - Participant information letter .....</b>	<b>84</b>
<b>APPENDIX B - Participant agreement form.....</b>	<b>85</b>
<b>APPENDIX C – Research instrument.....</b>	<b>86</b>
<b>APPENDIX D – Analysis data .....</b>	<b>94</b>
<b>APPENDIX E - Ethics Clearance Certificate .....</b>	<b>103</b>
<b>APPENDIX F - Permission letter from the organisation .....</b>	<b>104</b>
<b>APPENDIX G – Digital Technologies currently in use.....</b>	<b>106</b>

## LIST OF TABLES

Table 1: Definitions of keywords .....	7
Table 2: Classification of Cronbach's Alpha Coefficient .....	31
Table 3: Cronbach's alpha coefficient per dimension .....	31
Table 4: Descriptive statistics of survey data .....	33
Table 5: Participant demographics (interviews).....	36
Table 6: TOE factors that hinder digital transformation adoption. ....	73

## LIST OF FIGURES

Figure 1: Exposure of sectors of the South African economy to technological disruption. (Armstrong & Lee, 2021, p. 528) .....	2
Figure 2: Digital Maturity Model (Berghaus, S;, 2018).....	13
Figure 3: Technology-Organisation-Environment Framework (Oliveira & Martins, 2011).....	14
Figure 4: Digital Transformation Framework (Matt, Hess, & Benlian, 2015) ....	15
Figure 5: Conceptual framework .....	16
Figure 6: Model of barriers and success factors to digital transformation at LSPs (Cichosz, Wallenburg, & Knemeyer, 2020) .....	18
Figure 7: Convergent Design (One-Phase Design) (Cresswell & Creswell, 2018) .....	26
Figure 8: Participant's experience in years (online survey) .....	30
Figure 9: Participant's employment level.....	30
Figure 10: Correlation Matrix.....	32
Figure 11: Digital maturity level per Dimension.....	34
Figure 12: Digital Maturity groupings (Deloitte Africa, 2020) .....	35
Figure 13: Participant's experience in Transnet (years) .....	37
Figure 14: Participant's employment level.....	37
Figure 15: Correlation Matrix.....	97
Figure 16: Word cloud from all the data .....	98

Figure 17: Nodes and codes .....	99
Figure 18: Cluster analysis from Theme 1 .....	100
Figure 19: Hierarchy chart from Theme 2 .....	101
Figure 20: Tree map from Theme 3 .....	101
Figure 21: Word cloud from Theme 4.....	102

## **LIST OF ACRONYMS**

DT – Digital Transformation

IoT – Internet of Things

IT – Information Technology

SOE – State-owned Enterprise

TFR – Transnet Freight Rail

4IR – Fourth Industrial Revolution

TAM – Technology Acceptance Model

UTAUT – Unified Theory of Acceptance and Use of Technology

TOE – Technology-Organisation-Environment Framework

AI – Artificial Intelligence

# **CHAPTER 1. INTRODUCTION**

## **1.1 Statement of purpose**

The purpose of this study is to examine the adoption of digital transformation within a state-owned enterprise in South Africa, employing a convergent mixed methods design. The quantitative data assesses the extent of digital technology integration, while the qualitative data explores the experiences and perceptions of senior management. The combination of both datasets provides a comprehensive understanding of digital transformation initiatives, validates findings, and offers insights to inform decision-making and strategies for the organization's digital transformation journey.

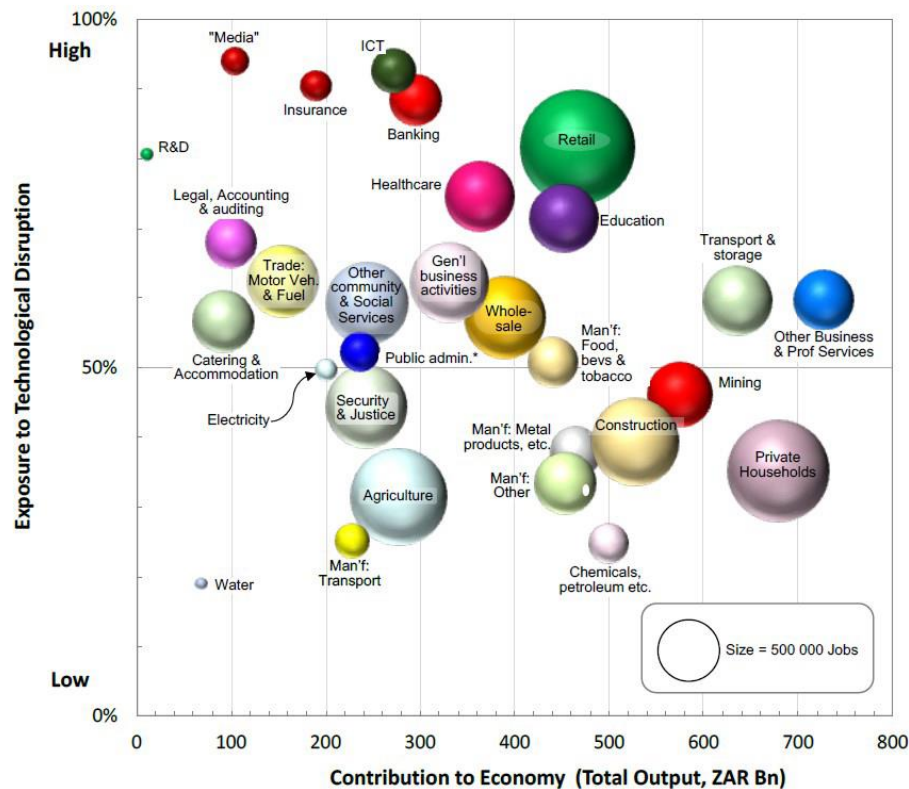
## **1.2 Background of the study**

The concept of digital transformation (DT) encompasses various definitions, with Vial (2019) describing it as a strategic approach aimed at enhancing the performance and competitiveness of an entity, such as a business, organisation, or government agency. Digital transformation involves the integration of digital technologies into all areas of a business, fundamentally changing how the organization operates and delivers value to its stakeholders. In addition, digital transformation offers organisations the opportunity to use digital technologies to survive, maintain their competitive edge, and bring about changes to their business model, market approach strategy, organisational structure, and operational processes (Hess et al., 2016)

Digital technologies such as information systems, computing, communication, and connectivity to drive innovation and create new value for stakeholders. However, simply using these technologies is not enough and more changes are required for successful transformation. Digital transformation through digital technologies have the potential to transform an organisation and disrupt entire

industries, operational efficiency and organisational performance as primary advantages, which includes process optimization (Gust et al., 2017), cost savings (Pagani, 2013), automation innovativeness (Svahn et al., 2017), financial performance (Karimi & Walter, 2015), and reputation.

Digital technologies bring about disruption in all industries where businesses operate including the logistics sector. Figure 1 illustrates the South African sectors exposure to technological disruption. Transport & storage represents the logistics sector in the graph. The logistics sector has is the 3<sup>rd</sup> biggest impact on the South African economy, and a significant exposure to technological disruption (Armstrong & Lee, 2021).



**Figure 1: Exposure of sectors of the South African economy to technological disruption. (Armstrong & Lee, 2021, p. 528)**

Transnet is a South African State-owned Enterprise (SOE) which own railway, ports, and pipelines infrastructure, with an objective to ensure a globally

competitive freight system that enables sustained growth and diversification of the country's economy. Transnet is an essential component of the freight logistics process in South Africa, responsible for transporting goods to every corner of the country and is also the largest part of this supply chain. Transnet Freight Rail (TFR) provides rail network infrastructure and operates rail services over major rail corridors to transport commodities for export, regional and domestic markets.

SOEs, as quasi-government organisations, are not immune to the pervasive force of digital transformation. The digital economy is disrupting businesses, sectors, and entire value chains. TFR in the integrated report highlights the importance of digital transformation in areas such as innovation, digital systems, technology, logistics capability, investment funding, and new business models to improve the rail system's effectiveness and the sustainability and future growth of South Africa's rail industry (Transnet, 2022).

### **1.3 Research problem**

In 2018, Transnet introduced the Transnet 4.0 Strategy to transform into a digitally driven organisation and enhance its competitiveness within the rapidly evolving technological landscape of the Fourth Industrial Revolution (4IR) (Transnet, 2018). The strategy aimed to enhance operational reliability by digitalising processes through technologies such as Artificial Intelligence, Machine Learning, and the Internet of Things. Additionally, it sought to modernise legacy customer-facing processes to improve service excellence (Transnet, 2018).

However, Transnet has faced challenges such as volatile commodity prices, leading to decreased freight volumes and profit margins. Consequently, the organization transitioned from the Transnet 4.0 Strategy to the Growth and Renewal Strategy, which emphasizes improving cash generation, enhancing operational performance, reforming procurement, and leveraging strategic partnerships (Transnet, 2022). The government's introduction of private

participation in the freight rail sector is anticipated to be a significant driver of digital transformation, providing Transnet with a competitive edge, increased efficiency, reliability, and reduced business costs (South African Government, 2023).

Despite these initiatives, there is a notable lack of understanding regarding the critical areas management should address during digital transformation initiatives (Burmam & Peter, 2019). Additionally, there is an absence of an integrated approach to developing a comprehensive digital transformation strategy encompassing the entire organization (Hess et al., 2016).

Many South African organisations are in the early phase of digital transformation adoption and struggle to adapt to the new digital reality. Specifically, within the South African logistics context, there is a deficiency of theoretical and practical frameworks accurately describing the digital transformation process. This study evaluates the digital maturity of TFR following the implementation of the Transnet 4.0 Strategy, identifying key drivers and barriers to digital transformation. Using a Digital Maturity Model, the study assesses the current state of digital transformation at TFR and provides recommendations to facilitate successful implementation.

## **1.4 Research objectives**

The study sought to answer the main research question, “What is the current state of digital transformation at Transnet Freight Rail (TFR), and what are the key drivers and barriers to its adoption?”. The main research question summarises the objectives of this study as follows:

- i. To measure the current digital maturity level at TFR.
- ii. To understand the key drivers to digital transformation adoption at TFR
- iii. To discover the barriers to digital transformation adoption at TFR

## 1.5 Rationale

The rationale for conducting this study includes:

- i. Importance of logistics sector: Transnet plays a crucial role in the economy of South Africa and its growth. The adoption of digital technologies is key to Transnet delivering its core mandate to “effectively manage the cost of doing business in South Africa, enable economic growth and enable security of supply through providing appropriate ports, rail and pipeline infrastructure as well as operations in a cost-effective and efficient manner, within global benchmarks” (Transnet, 2022).
- ii. Digital technologies: The logistics sector is witnessing significant changes with the adoption of digital technologies such as the Internet of Things (IoT), big data analytics, and blockchain. This study provided insights how these digital technologies can be leveraged to improve operations.
- iii. Challenges faced by state-owned enterprises: SOEs often face several challenges in adopting new technologies due to bureaucratic processes, lack of funding, and resistance to change. Understanding these challenges and how they can be overcome is essential to promote digital transformation in TFR.

According to Bumann and Peter (2019) there seems to be a shortage of comprehension regarding the areas that management ought to explore and encompass while carrying out initiatives for digital transformation. This study aims to assist TFR stakeholders, mainly to empower the leadership to understand where TFR is in their digital transformation journey and how the barriers/challenges can be managed to maintain a competitive advantage. When it comes to wider significance, this study will contribute to the debate on this subject and provide insight on how the rest of the Transnet operating divisions can implement digital transformation strategies.

## **1.6 Delimitations of the study**

The delimitations of the study are listed below:

- i. The study focused specifically on a single state-owned enterprise (Transnet Freight Rail) in South Africa and may not be generalizable to other companies or industries.
- ii. The focus of the study was on the adoption of digital technologies in the logistics sector.
- iii. The study relied primarily on data collected from the SOE and will not consider external factors that could influence the adoption of digital technologies in the logistics sector.
- iv. The study focused on the perspective of the SOE and its employees and the perspective of other stakeholders such as customers, suppliers, or regulators were not considered.
- v. The study only examined the adoption of digital technologies up to the point at which data was collected and may not account for future developments or changes in the industry.
- vi. All interviews were conducted online, the quality of the interview may have been affected by technical issues such as poor internet connection, dropped calls, or audio or video lag.

## 1.7 Definition of terms

The table below lists keywords and definitions used in this study.

**Table 1: Definitions of keywords**

<b>Term</b>	<b>Definition</b>
Digital Maturity	Digital maturity involves preparing an organisation to effectively compete in a rapidly evolving digital landscape. This includes adapting to new digital technologies and processes to maintain competitiveness and achieve success in a digital environment (Kane et al., 2017).
Digital Transformation	Digital Transformation is a strategic approach that aims to improve the performance and competitiveness of an entity (such as a business, organisation, or government agency) by leveraging digital technologies to create significant changes to its properties and operations (Vial, 2019)
Digital technologies	Digital technologies refer to technology such as the Artificial Intelligence (AI), Cloud Computing, Robotics Process Automation (RPA), Internet of Things (IoT), big data analytics, and blockchain.
State-owned Enterprise	Government owned organisations

## **1.8 Assumptions**

The study makes the following assumptions:

- i. Participants were honest and truthful in their responses.
- ii. Participants have an understanding of digital transformation.
- iii. The participants were not pressured to take part in the study.
- iv. The state-owned enterprise has already begun to adopt digital technologies in its logistics operations.

# CHAPTER 2. LITERATURE REVIEW AND THEORETICAL FRAMEWORK

## 2.1 Introduction

Across many industries, including the logistics sector, digital transformation has emerged as a crucial aspect of organisational growth and competitiveness. The purpose of this study was to investigate the adoption of digital transformation in the logistics industry in South Africa, with a particular focus on the state-owned company. This review sought to identify the important drivers, barriers, and strategies involved in the successful adoption of digital technologies in this setting by reviewing relevant studies and publications.

## 2.2 Definition of topic

### 2.2.1 *Digital Transformation*

Digital Transformation (DT) has emerged as a critical concept in modern organisations, driven by the revolutionary impact of state-of-the-art technologies such as social software and data analytics. According to Wessel et al. (2021), the distinction between DT and the more established IT-enabled organisational transformation is in the nature of the transformation. DT “involves the emergence of a new organizational identity through leveraging digital technologies, whereas IT-enabled organisational transformation involves the enhancement of an existing organisational identity” (Wessel et al., 2021). The transformative potential of these technologies has permeated every aspect of organisational operations, necessitating a clear and precise understanding of the concept.

Despite its importance, the academic literature on digital transformation lacks a clear categorisation and frequently gives ambiguous definitions. In this study, a definition by Reis et al. (2018) was adopted. This definition combines and

evaluates multiple definitions from academic sources in an effort to produce a comprehensive description of digital transformation. According to Reis et al. (2018), digital transformation is the adoption of new digital technologies to enable major business improvements and influences all aspects of customers' life.

The various definitions from academic sources were categorised into three distinct elements: Technological, Organizational, and Social (Reis et al., 2018).

#### Technological Element

One key aspect of Digital Transformation is its reliance on new digital technologies, including social media, mobile devices, analytics, and embedded systems (Fitzgerald et al., 2013). These technologies integrate into various aspects of a business or industry, leading to fundamental changes in operations, processes, and customer experiences.

#### Organizational Element

Digital transformation requires a fundamental change in organizational processes or the creation of new business models (Solis et al., 2014). It involves the realignment of technology and business models to engage digital customers more effectively throughout their entire experience lifecycle. It encompasses the integration of digital technologies into existing organizational structures and operations (Collin et al., 2015; Kane et al., 2015).

#### Social Element

Digital transformation is a phenomenon that influences all aspects of human life, particularly by enhancing customer experiences (Solis et al., 2014). It encompasses the changes and influences brought about by digital technologies in various domains, including politics, business, and social issues (Collin et al., 2015). The impact of digital transformation extends to all aspects of human life and society, transforming the way people interact, work, and live.

### **2.2.2 Digital Maturity**

Digital maturity plays a crucial role in guiding organisations through their digital transformation journeys. The rapid advancements in technology and the increasing digitalisation of businesses have led to the emergence of the concept of digital maturity. Due to the novelty of the term, there is no single, generally accepted definition characterizing the phenomenon of digital maturity. Digital maturity can be seen more as a systematic way for an organisation to transform digitally (Kane et al., 2017), referring to the integration of organisational operations and human capital into digital processes and vice versa.

In recent years, scholars have focused on understanding and assessing digital maturity in organisations. The reviewed literature identified various dimensions that contribute to an organisation's digital maturity. Technology, culture, strategy, organization, customer, and people/employees are prominent dimensions (Berghaus & Back, 2016). These dimensions include digital capabilities, leadership and governance, customer-centricity, innovation, and workforce readiness. With different frameworks using slightly different terminology or categorisation, requiring a comparative analysis to be conducted regularly.

The success of digital transformation initiatives revolves around an organisation's understanding of its digital maturity. A high level of digital maturity assists organisations to take advantage of the opportunities presented by digital technologies, whereas a low level of maturity could impede development and lead to competitive disadvantage. Gimpel et al., (2018) emphasise the importance of addressing multiple dimensions simultaneously to achieve a comprehensive digital transformation.

### **2.2.3 Digital Maturity Models**

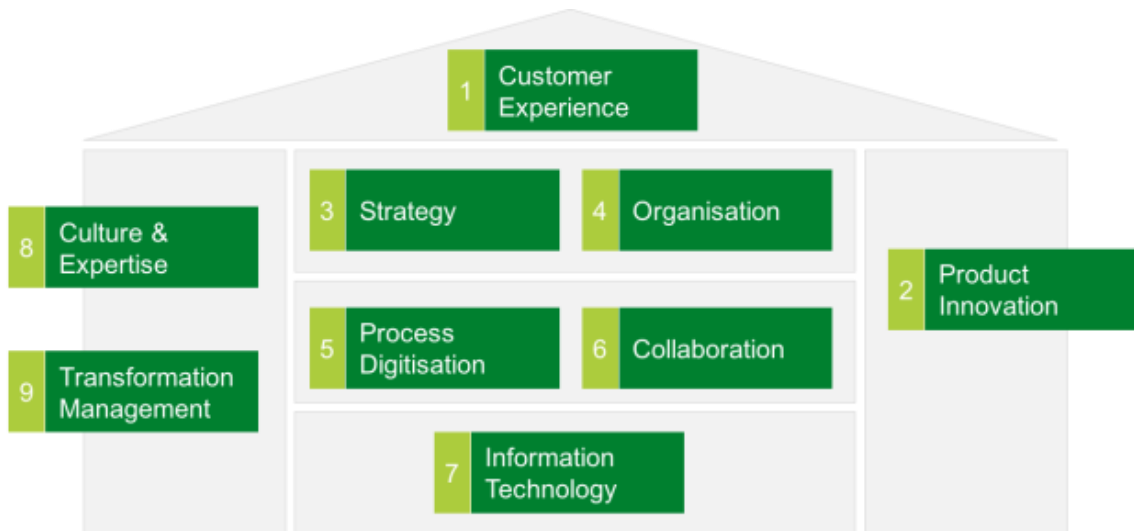
According to Berghaus and Back (2016) a digital maturity model provides some guidance on how organizations approach their transformation and maps out typical paths of how organizations go about their transformation. Effective digital

maturity frameworks provide organisations with actionable insights, enabling them to prioritize investments, define transformation strategies, and cultivate a culture of digital innovation (Kane et al., 2017).

Several studies have developed maturity models, which offer a structured approach to assess an organisation's digital maturity level. Digital maturity models are characterised by purpose, sector scope and approach type. These models often involve self-assessment or third-party assessments, focusing on different dimensions and sub-dimensions (Andersson et al., 2018). However, it is worth noting that majority of the models serve a descriptive purpose, which restricts their ability to give organisations information about the level of the adoption of Industry 4.0 technologies (Kane et al., 2018).

Berghaus and Back (2016) argued in their work “Stages in Digital Business Transformation: Results of an Empirical Maturity Study” that an organisation's digital transformation can be assessed using a Digital Maturity Model. Figure 2 illustrates the nine dimensions of the Digital Maturity Model, which encompasses all important aspects of the organisation that are impacted by digital transformation. The results of the assessment will be presented using Deloitte’s digital maturity levels (Kane et al., 2017). These levels include the following:

- i. Level 1: Early stage.
- ii. Level 2: Developing.
- iii. Level 3: Maturing.



**Figure 2: Digital Maturity Model (Berghaus, 2018)**

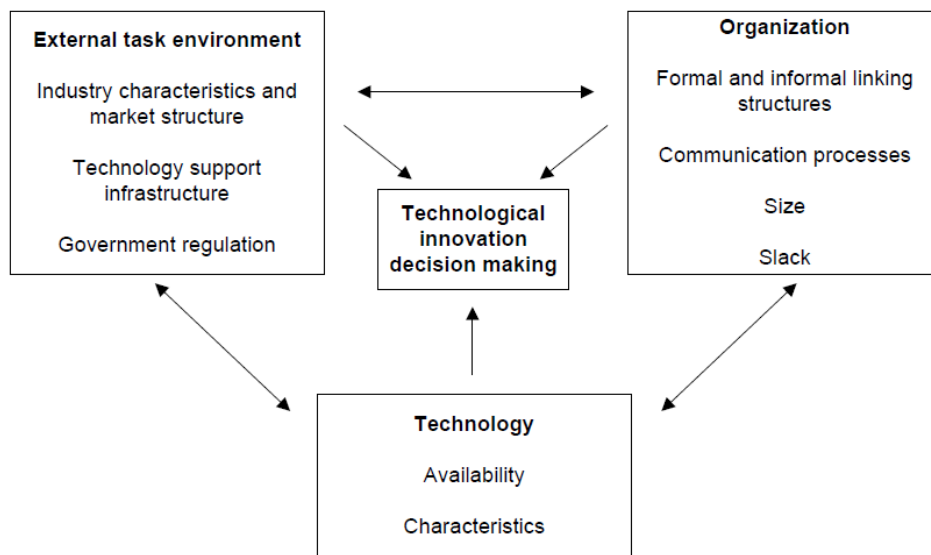
## **2.3 Analytical Framework**

This section discusses the theoretical and conceptual framework underpinning the study. In providing guidance to the study the focus was on theories about the technology adoption.

### **2.3.1 Theoretical Framework**

To identify the appropriate theoretical framework to address the research problem, various models were explored to assess the relevance to the study including Technology Acceptance Model (TAM) (Davis, 1989); Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003), and Technology-Organisation-Environment Framework (TOE) developed by Tornatzky and Fleisher in 1990. This study was based on the TOE framework as it studies the technology adoption at the organisation level, while the other two theories are at the individual level, and the Digital Transformation Framework (DTF) (Matt et al., 2015) used as a supplementary theory.

## Technology-Organisation-Environment Framework



**Figure 3: Technology-Organisation-Environment Framework (Oliveira & Martins, 2011)**

Figure 3 illustrates the three aspects that influence the process for adoption and implementation of technological innovation in organisations: technological context, organisational context, and environmental context. The TOE framework factors are described by Oliveira and Martins (2011) as follows:

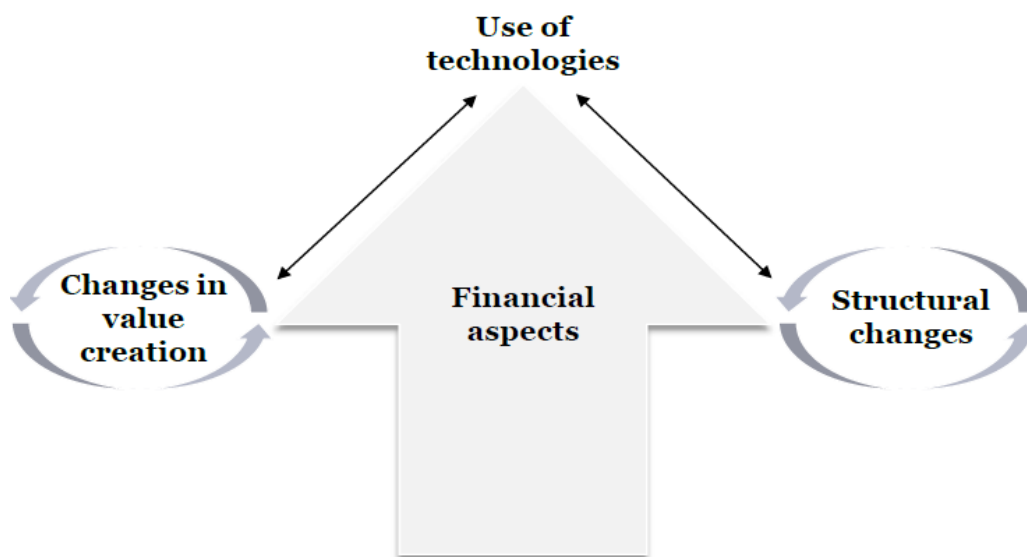
- i. Technological context describes both the internal and external technologies relevant to the organisation.
- ii. Organisational context refers to descriptive measures about the organisation such as scope, size, and managerial structure.
- iii. Environmental context is the arena in which an organisation conducts its business: its industry, competitors, and dealings with the government.

Studies have been conducted in the past using the TOE framework to understand the different IT adoptions, such as e-business adoption; e-commerce; enterprise resource planning; open systems (Oliveira & Martins, 2011). The TOE framework is consistent with other theories which emphasises the individual characteristics

and organisational characteristics (internal and external), as drivers for organisational innovativeness (Oliveira & Martins, 2011).

### **Digital Transformation Framework**

Matt et al. (2015) developed the Digital Transformation Framework which aimed to understand digital transformation processes in an organization. The framework is based on the notion that organisation's digital transformation is underpinned by the concepts of organizational planning, priority, and digitalisation implementation. Matt et al. (2015) suggests that regardless of the sector or organisation, digital transformation strategies are attributed to the four dimensions: use of technologies, changes in value creation, structural changes, and financial aspects. Figure 4 depicts the dependencies between the above-mentioned dimensions in formulation of the strategy and assessment of the organisation's current abilities.



**Figure 4: Digital Transformation Framework (Matt et al., 2015)**

### 2.3.2 Conceptual Framework

The conceptual framework as presented in Figure 5 is underpinned by the TOE framework incorporating the drivers and barriers to technology and digital adoption in organisations. The critical success factor in digital technology adoption and digital transformation begins with visioning dimension supported by the strategy. Drivers and barriers of TOE framework dimensions influence the strategy development and execution. The execution of the Logistics 4.0 vision and strategy improves the value proposition of the organisation and digital readiness.

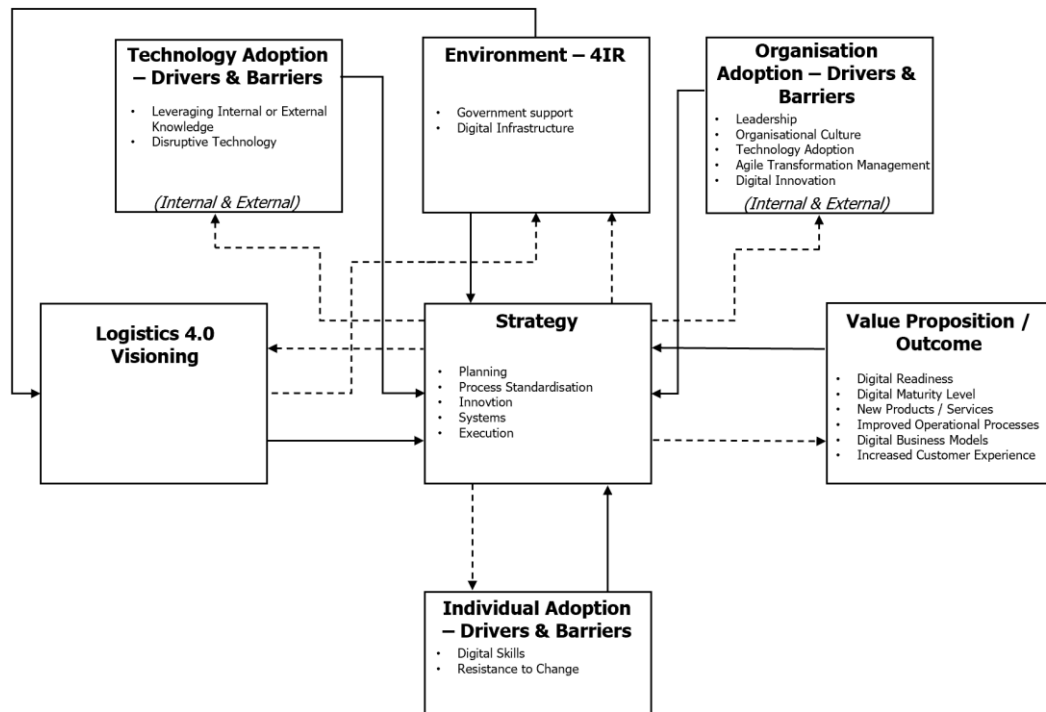


Figure 5: Conceptual framework

## 2.4 To measure the current digital maturity level at TFR.

This section outlines the methodology to assess the digital maturity level at TFR, using the Digital Maturity Model. Digital transformation is not only driving

innovation in the business sector, but also seems to be influencing developments in the public sector. The digital maturity of the implementing organisation, which is defined by Kane et al. (2017) as “the degree to which organisations have adapted themselves to a digital business environment”, will differ depending on the digital transformation evolution over time. Kane et al. (2018) emphasises the importance of knowing the stage at which one’s digital transformation departs from, therefore assessing the organisation’s digital maturity using a digital framework.

#### **2.4.1 Proposition 1**

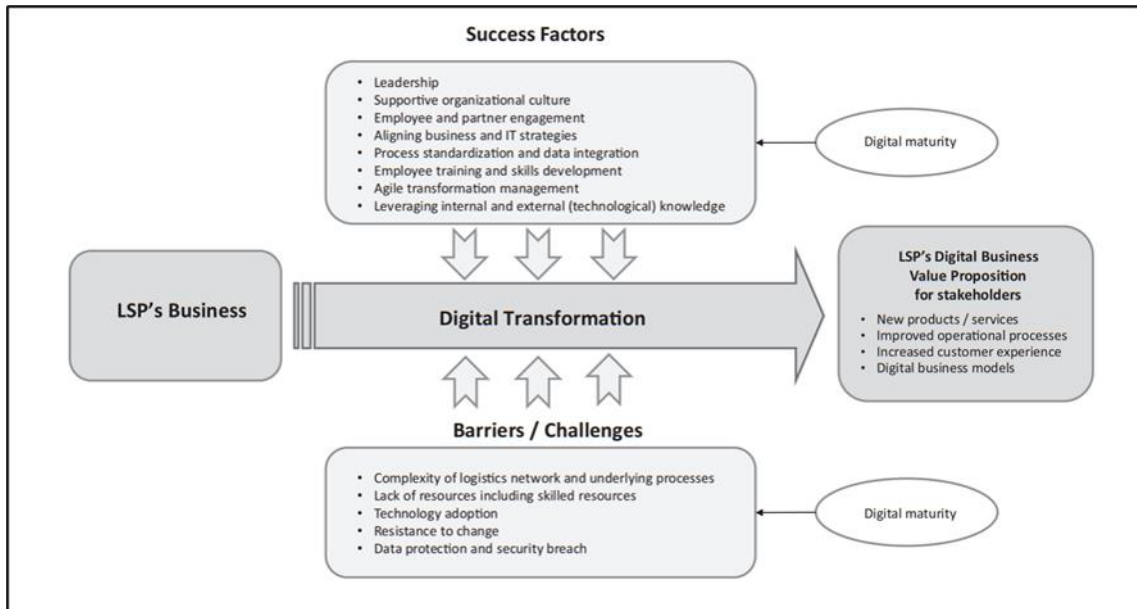
According to the TOE framework, the proposition suggests that the digital maturity level of Transnet Freight Rail, as assessed using the Digital Maturity Model, will be significantly impacted by the integration of the Technological, Organizational, and Environmental factors.

P1: The digital maturity level of TFR is positively correlated with its organisational digital readiness.

## **2.5 To understand the key drivers and discover barriers to digital transformation adoption at TFR.**

The successful implementation of digital transformation is influenced by various drivers and hindered by numerous barriers. Understanding these drivers and barriers is crucial for organizations seeking to manage the complexity of DT and take advantage of its benefits. This literature review seeks to give an overview of existing research on the drivers and barriers of DT, shedding insight on the factors that contribute to or hinder its implementation.

The model adopted from Cichosz et al., (2020), depicts the impact of organisation key drivers (success factors) and barriers to the successful implementation of digital transformation and stakeholder value propositions.



**Figure 6: Model of barriers and success factors to digital transformation at LSPs (Cichosz et al., 2020)**

### **2.5.1 Drivers of Digital Transformation**

In the literature several drivers have been identified as catalysts for successful digital transformation implementation. One prominent driver is technological advancement. Vogelsang et al. (2019) emphasize the simultaneous use of multiple technologies that significantly impact the creation of digital products/services, digital processes, and digital business models. The availability and affordability of advanced technologies such as artificial intelligence, big data analytics, and cloud computing provide organizations with opportunities to enhance efficiency, innovation, and customer experiences.

Another driver of DT is organizational strategy. Kane et al. (2015) highlight the importance of a clear vision and strategic alignment in enhancing the probability of DT success. DT vision and goals as a part of digital business strategy. Organisations that establish a strategic roadmap for DT, aligning it with their business objectives, are more likely to navigate the transformation process effectively. Furthermore, digital leadership plays a crucial role as a driver of DT success. Digital leaders with a compelling vision, supported by empowered, knowledgeable, and collaborative employees, create an environment conducive to successful DT implementation (Vogelsang et al., 2019).

### **2.5.2 Proposition 2**

The study will investigate how the success factors identified by Cichosz et al. (2020) were incorporated into the organisation's digital transformation strategy and how they contributed to successful implementation. In addition, the investigation will provide a deeper understanding of the key drivers of digital transformation adoption at TFR and provide valuable insights to both the organisation and the logistics sector.

P2: Successful digital transformation implementation can be improved by TFR leveraging their key drivers.

### **2.5.3 Barriers to Digital Transformation**

Despite the potential benefits, organizations face various barriers that impede the successful implementation of DT. People-related challenges emerge as a significant barrier. Kane et al. (2018) highlight the concept of "competency traps," where employees become prisoners of their past successes and resist change. Changing people's mindsets, beliefs, and behaviours proves to be a daunting task (Töytäri et al., 2017). Additionally, Vogelsang et al. (2019) underscore the importance of people's IT capabilities, as a lack of digital skills and expertise can hinder DT progress.

Organizational culture and resistance to change are also identified as barriers to DT. The literature suggests that organizations with a rigid and hierarchical culture may struggle to embrace the agile and adaptable nature of digital transformation. Resistance to change often arises due to fear of job displacement, loss of control, or uncertainty regarding the benefits of DT (Oakland & Tanner, 2007). Overcoming these cultural and change-related barriers requires effective change management strategies and clear communication throughout the organization (Oakland & Tanner, 2007).

#### **2.5.4 Proposition 3**

Based on the Model of barriers and success factors to LSPs (Cichosz et al., 2020), the study aims to identify and understand the barriers that were encountered in TFR's digital transformation journey.

P3: The effective management of barriers and challenges is crucial for the successful implementation of digital transformation.

## **2.6 Summative Analysis of Literature**

The comprehensive review of existing literature on digital transformation, particularly within state-owned enterprises, revealed a wealth of knowledge, challenges, and opportunities. This summative analysis served as the foundation for recognising the importance of carrying out the study and making a clear link to the research objectives.

The literature review exposed gaps in current research, especially concerning state-owned entities in South Africa. While digital transformation has been extensively studied in various industries globally, there is a noticeable scarcity of targeted research within the unique context of state-owned enterprises. The shortage of literature specific to this domain underscored the need for a targeted

study, offering insights tailored to the challenges and dynamics faced by such entities.

The analysis highlights the strategic importance of digital transformation in organisational growth and competitiveness, which goes beyond simple technology upgrades. Emphasising the integration of digital technologies across operational processes, customer experiences, and organizational structures. The study focused on exploring digital transformation at TFR, highlighting the significance of understanding digital maturity, as it impacts digital adoption. Theoretical frameworks like TOE and Digital Transformation Framework guide the research, offering structured insights into drivers, barriers, and dynamics of digital transformation. The research objectives are aligned with identified gaps and insights: assessing digital maturity and understanding drivers and barriers at TFR. Overall, the study aimed to contribute to the literature, contextualising digital transformation within a state-owned logistics company and providing practical insights for the industry in South Africa.

## **2.7 Conclusion of Literature Review**

This study focussed on the concept of Digital Transformation, Digital Maturity and reviewed cross-sectional model suitable for assessing the digital maturity levels of an organisation. To address the objectives “to identify the key drivers to digital transformation adoption at TFR” and “to identify the barriers to digital transformation adoption at TFR” various papers were reviewed focusing on the drivers and barriers associated with implementing digital transformation initiatives.

### **2.7.1 Proposition 1**

The digital maturity level of TFR is positively correlated with its organisational digital readiness.

### **2.7.2 Proposition 2**

Successful digital transformation implementation can be improved by TFR leveraging their key drivers.

### **2.7.3 Proposition 3**

The effective management of barriers and challenges is crucial for the successful implementation of digital transformation.

## **CHAPTER 3. RESEARCH METHODOLOGY**

This chapter outlines the methodology followed to examine the adoption of digital transformation in the logistics industry, with a specific focus on Transnet Freight Rail (TFR) in South Africa. The chapter presents the research approach, research design, data collection methods, population and sample size, and the research instrument used to gather relevant data for analysis. Quality assurance and ethical issues were also be covered in this chapter.

### **3.1 Research approach**

This study adopts a mixed methods research approach. According to Johnson, Onwuegbuzie, and Turner (2007), mixed methods research is "the type of research in which a researcher or team of researchers combines elements of qualitative and quantitative research approaches (e.g., use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the broad purposes of breadth and depth of understanding and corroboration."

The first objective of this study, which aims to assess the current digital maturity level at Transnet Freight Rail (TFR), utilises the quantitative component which involves the collection and analysis of numerical data. The other objectives to identify the key drivers and barriers to digital transformation adoption in TFR, were addressed by the qualitative component, which entails the collection and analysis of non-numerical data such as interviews.

### **3.2 Research design**

For this study, a single-case study with Transnet Freight Rail as the case was chosen as the research design. Creswell (2007) states that a holistic single case design is best when a need exists to study a critical case, or a revelatory case. A single-case study design provides for a comprehensive analysis of a single entity,

allowing for an in-depth investigation of the adoption of digital transformation within TFR.

A one-phase mixed methods design was used, with both quantitative and qualitative data collected, analysed separately and then the results are compared to see if the findings confirm or disconfirm each other. This method is called convergent design, which the researcher converges or merges quantitative and qualitative data in order to provide a comprehensive analysis of the research problem (Cresswell & Creswell, 2018). The key assumption of this approach is that, when combined, qualitative and quantitative data should produce results that are comparable because they provide different types of information, often in-depth qualitative opinions of participants and quantitative scores on instruments (Cresswell & Creswell, 2018).

### **3.3 Data collection methods**

#### **3.3.1 *Quantitative Data Collection***

Quantitative data was collected through structured surveys/questionnaires administered to a sample of participants. The survey was designed based on the study's first objective to assess the organisation's current maturity level and included closed-ended questions with response options that can be quantitatively analysed. The survey was distributed electronically using an online survey platform (Qualtrics) to maximize data collection efficiency and reach a larger sample size.

#### **3.3.2 *Qualitative Data Collection***

Qualitative data was collected through semi-structured interviews with selected participants. The primary source of data was interviews conducted online using MS Teams, allowing for in-depth exploration of participants' perspectives and experiences. The participants were interviewed on their understanding and

involvement in the adoption of digital transformation at the state-owned enterprise. The interviews were audio-recorded with participants' consent and transcribed verbatim for analysis.

### **3.4 Population and sample**

#### **3.4.1 Population**

The population for this study was Transnet employees, and a purposive sampling technique was employed to select participants who possess relevant knowledge and experience related to the research topic.

#### **3.4.2 Sample and sampling method**

In this study the sample was TFR management employees (from Middle managers to Executives), for the quantitative component the expected size was 100 participants. Bekele and Ago (2022) suggests that there is no universal rule that determines the maximum and minimum number of interviews for a qualitative study. In a phenomenological study, a sample size from 3 - 25 participants may be reasonable (Cresswell & Creswell, 2018). For the qualitative component, a target of 8 to 10 Executives or Senior managers were to be interviewed or until data saturation was reached, which meant no new insights or information will be obtained from further data collection. The sampling methods used are purposive sampling and quota sampling (the participants will be select based on management level).

### **3.5 The research instrument.**

For the quantitative data collection, an online-questionnaire based on 5-step Likert-scale structured survey questionnaire was developed. The questionnaire consisted of validated scales and items adapted from previous studies, ensuring its reliability and validity. The qualitative data collection involved a semi-

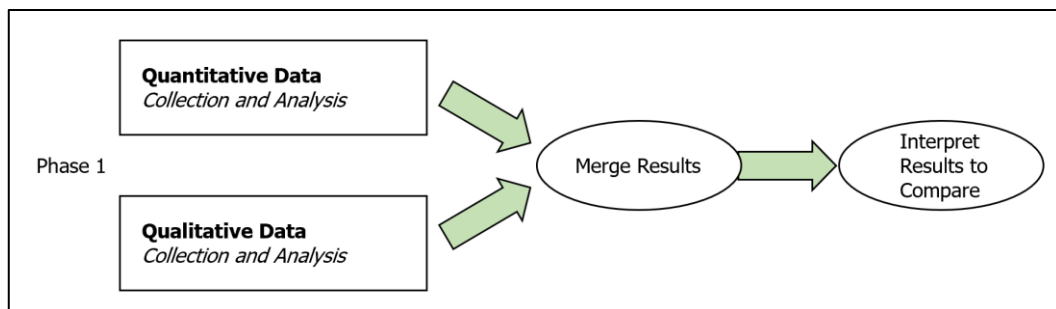
structured interview guide. The interview guide was developed based on the research objectives.

### 3.6 Procedure for data collection

An email with the Qualtrics survey link was sent to “All Transnet Freight Rail Top 1000” mailing group, which included Middle Managers, Senior Managers and Executives. Participants for online interviews were contacted directly, and meetings were scheduled at a convenient time.

### 3.7 Data analysis strategies and interpretation

The convergent mixed methods design was used to interpret and compare results by merging results from collecting and analysing both quantitative and qualitative data (Cresswell & Creswell, 2018). Figure 7 illustrates a basic procedure that this study used in implementing the strategy.



**Figure 7: Convergent Design (One-Phase Design) (Cresswell & Creswell, 2018)**

#### **Descriptive Statistic on Survey Results**

The level of digital maturity was determined using the average sum of responses to each question. SPSS Statistical Software was used for descriptive statistics, to analyse, organise, and visualisation of data.

#### **Thematic Analysis on Interviews**

The interviews were transcribed, and themes and keywords were identified and coded using NVivo 20, in which the themes and keywords were be extracted directly from the raw data.

The study validated and complemented findings from both quantitative and qualitative datasets by looking at the data convergence, and ultimately provided insightful information to guide decision-making and strategies relating to digital transformation in the state-owned enterprise in South Africa.

### **3.8 Possible limitations and challenges of the study**

- i. Failure or unwillingness to respond to the online survey.
- ii. Unavailability of Executives and Snr Managers for a MS Teams meeting.
- iii. Research results represent Transnet Freight Rail, not Transnet as a whole or its other operating divisions.

### **3.9 Quality Assurance**

#### ***3.9.1 External validity OR transferability***

Generalisability criteria of this study was not met as it focuses on one organisation, Transnet Freight Rail. Participants were offered an opportunity to review and provide input on the interpretations and conclusions, improving the transferability of the findings.

#### ***3.9.2 Internal validity OR credibility***

Triangulation was used to improve the reliability of the findings by using multiple data sources. Multiple data gathering methods (e.g., surveys and interviews) were used to collect evidence that is consistent and improve the validity of the study's conclusions. The study was peer reviewed by the Supervisor, who assessed the methodology, analysis, and transferability of the findings.

### **3.9.3 Reliability OR dependability**

According to Saunders et al. (2019), the requirement for dependability in qualitative research can be challenging to meet. To address the issue of dependability, a logical, traceable, and well-documented research process was followed in this study, with all recordings and documentation stored on the server for future reference. To test the reliability and consistency of the questionnaire, Cronbach's Alpha was used to ensure the homogeneity of items within the scale.

### **3.10 Ethical considerations**

The following ethical considerations were adhered to:

- i. Obtaining support and approval from TFR Chief Executive to conduct research through a memo.
- ii. Communicating research objectives with all participants
- iii. Participating on the online survey was voluntary and anonymity was maintained, and online consent was given.
- iv. A signed consent form was required for interview participants.
- v. Participants were notified that they can opt out of the interview at any moment.
- vi. A copy of the ethical certificate and signed memo (authorising research request) was shared with the participants.
- vii. Participants were notified of the interviews being recorded.
- viii. Participant personal details are not included in the final report.

## **CHAPTER 4. PRESENTATION OF FINDINGS**

The previous chapter outlined the methodology and plan used in this study. The chapter presents the research findings from both quantitative and qualitative data in relation to the research objectives of this study. The chapter is divided into Quantitative data findings and Qualitative data findings as the collection and analysis was done simultaneously in phase 1, each of which highlights the demographics of the participants, followed by the analysis.

Below is a summary of the study objectives:

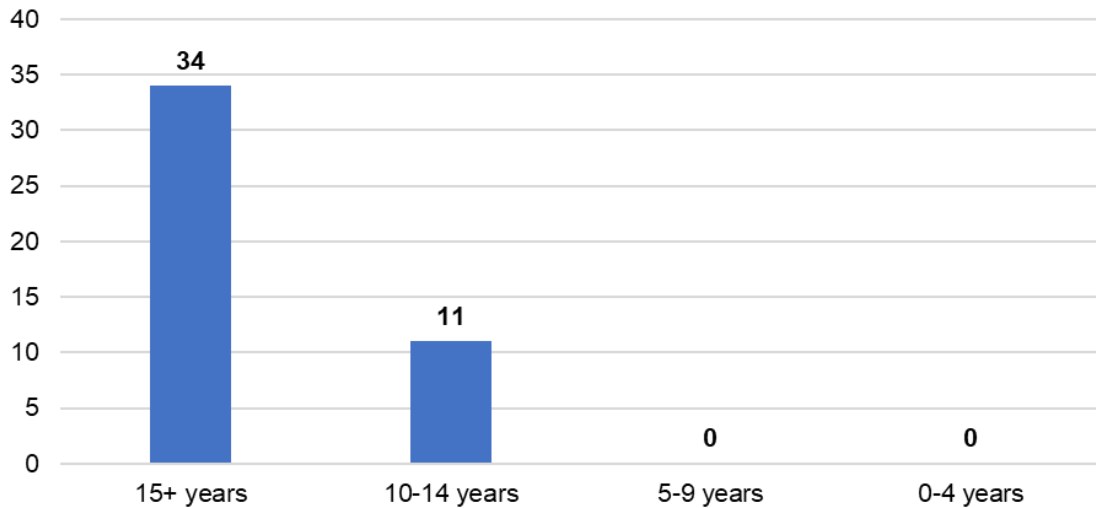
- i. To measure the current digital maturity level at TFR.
- ii. To understand the key drivers to digital transformation adoption at TFR
- iii. To discover the barriers to digital transformation adoption at TFR

Quantitative data addressed objective 1, while qualitative data addressed all three objectives.

### **4.1 Quantitative Data Findings**

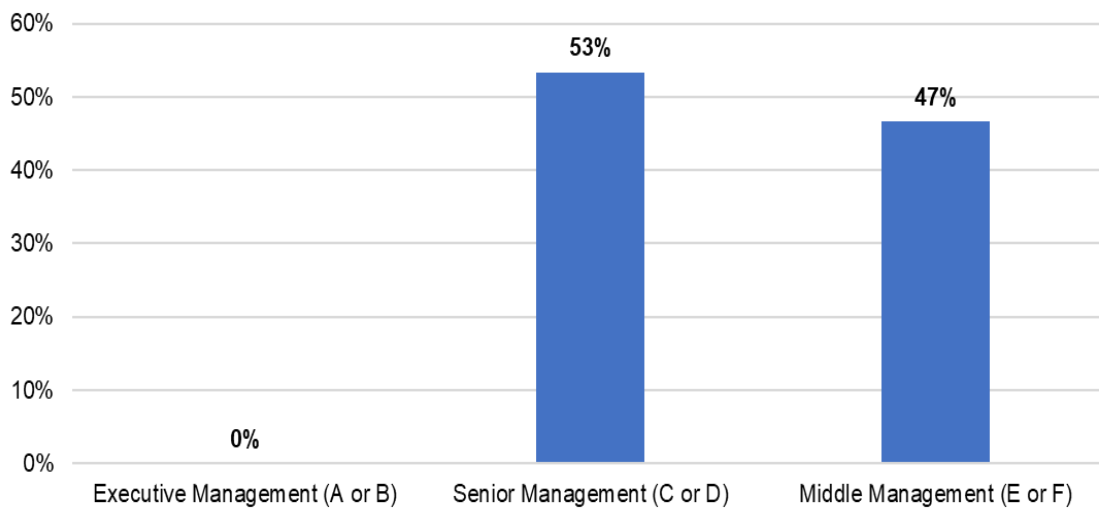
#### ***4.1.1 Demographics of participants***

The survey was disseminated to 1000 TFR management employees at different levels (Executive, Senior Management and Middle Management), with 55 responses of which 10 were incomplete. Figure 8 illustrates the number of participants that completed the survey and the working experience in years.



**Figure 8: Participant's experience in years (online survey)**

According to Figure 9, only senior and middle management employees participated in the survey, with 53% and 47% respectively.



**Figure 9: Participant's employment level**

#### **4.1.2 Validity and Reliability**

The questionnaire used for this study was a digital maturity model developed by Berghaus (2018). To determine face validity two participants were requested to take part in the survey, all 64 questions were deemed as comprehensive and

relevant to the study. To test the internal consistency of the questionnaire, SPSS was used to determine the alpha coefficient. Table 2 below depicts the interpretation of Cronbach's alpha coefficient, with internal consistency acceptable when the scale is  $> 0.7$ .

**Table 2: Classification of Cronbach's Alpha Coefficient**

Cronbach's Alpha Coefficient ( $\alpha$ )	Interpretation of Cronbach's Alpha Coefficient ( $\alpha$ )
$\geq 0,9$	The internal consistency of the scale is high
$0,7 \leq \alpha < 0,9$	The scale has internal consistency
$0,6 \leq \alpha < 0,7$	The internal consistency of the scale is acceptable
$0,5 \leq \alpha < 0,6$	The internal consistency of the scale is weak
$\alpha \leq 0,5$	The scale has no internal consistency.

In this study, the internal consistency scale was measured above 0.8 for all dimensions, meaning that the instrument is reliable. The alpha coefficient of each dimension is shown in Table 3.

**Table 3: Cronbach's alpha coefficient per dimension**

Dimensions	Cronbach's $\alpha$
• Strategy	0.841
• Transformation Management	0.912
• Organisation	0.864
• Product Innovation	0.908
• Customer Experience	0.914
• Process Digitisation	0.932
• Co-operation	0.865
• Information Technology	0.905
• Culture and Expertise	0.886

### 4.1.3 Findings pertaining to Objective 1

A Likert scale was used to assess the digital maturity of TFR across 9 dimensions. Participants were asked to score each question on a scale of 1 to 5 (strongly disagree to strongly agree). SPSS was used to clean and analyse survey data (n=45), and descriptive statistics such as mean, standard deviation and variance were used to describe the questionnaire dimensions.

In figure 10, the correlations between dimensions were assessed to identify possible relationships. Relationships between customer experience and transformation management (0.850); and customer experience and process digitalisation (0.881) showed the highest positive correlations. The correlation of customer experience and transformation management shows that TFR's digital transformation involves reorienting business strategies and technologies around the needs and preferences of customers, ultimately aiming to improve customer experiences and drive business growth. The high correlation between customer experience and process digitalisation indicates that TFR is adopting digital processes to ensure that the organisation remains agile and responsive to evolving customer expectations.

	STRATEGY	TRANSFORMATION MANAGEMENT	ORGANISATION	PRODUCT INNOVATION	CUSTOMER EXPERIENCE	PROCESS DIGITISATION	COOPERATION	INFORMATION TECHNOLOGY	CULTURE AND EXPERTISE
STRATEGY	1.000								
TRANSFORMATION MANAGEMENT	0.777	1.000							
ORGANISATION	0.702	0.822	1.000						
PRODUCT INNOVATION	0.697	0.803	0.766	1.000					
CUSTOMER EXPERIENCE	0.675	0.850	0.785	0.815	1.000				
PROCESS DIGITISATION	0.813	0.849	0.810	0.783	0.881	1.000			
COOPERATION	0.630	0.723	0.730	0.715	0.793	0.809	1.000		
INFORMATION TECHNOLOGY	0.573	0.608	0.573	0.658	0.604	0.690	0.817	1.000	
CULTURE AND EXPERTISE	0.648	0.715	0.664	0.664	0.772	0.749	0.737	0.717	1.000

Figure 10: Correlation Matrix

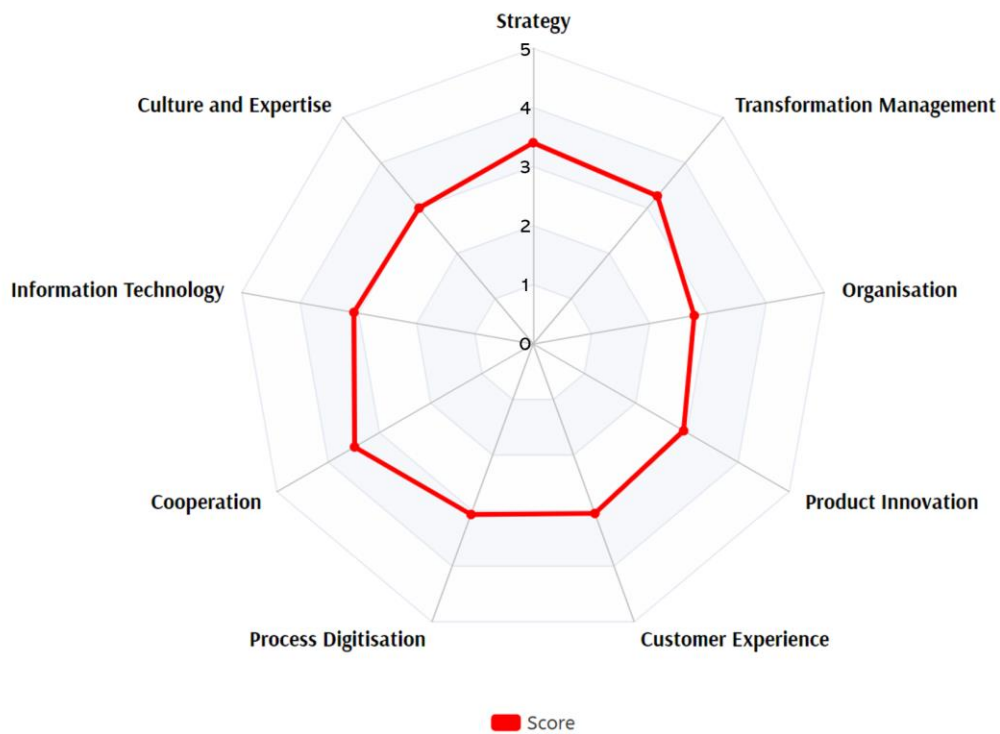
The standard deviation was used to measure how spread out the digital maturity scores are from the mean. A higher standard deviation indicates greater variability among the scores, while a lower standard deviation indicates more consistency. In this study the standard deviation is <0.9, suggesting that the scores in all the dimensions were clustered around the mean (see Table 4 for detailed analysis).

**Table 4: Descriptive statistics of survey data**

<b>Dimensions</b>	<b>N</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Mean</b>	<b>Std. Deviation</b>	<b>Variance</b>	<b>Std. Error on Mean</b>
Strategy	45	1.71	4.71	3.4032	.64559	0.417	0.096
Transformation Management	45	1.14	5.00	3.2667	.83721	0.701	0.125
Organisation	45	1.00	4.14	2.7651	.71892	0.517	0.107
Product Innovation	45	1.00	4.33	2.9370	.84856	0.720	0.126
Customer Experience	45	1.00	4.29	3.0508	.74801	0.560	0.112
Process Digitisation	45	1.00	4.86	3.0698	.89506	0.801	0.133
Cooperation	45	1.71	4.57	3.4857	.75310	0.567	0.112
Information Technology	45	1.67	5.00	3.0765	.75539	0.571	0.113
Culture and Expertise	45	1.00	4.43	3.0000	.80294	0.645	0.120
Valid (listwise)	N45						

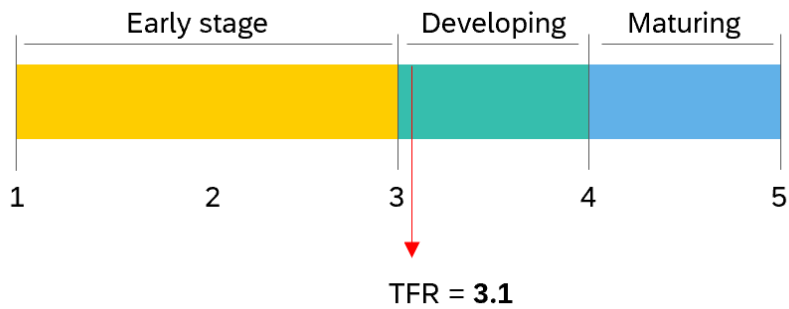
The Standard Error on Mean (SEM) provides insight into the precision of the sample mean estimates for each dimension, with smaller SEM values indicating higher precision and less variability around the mean. The Strategy dimension SEM value suggests that the sample mean estimate is precise with less variability, while other dimensions were less precise compared to Strategy but still relatively precise, indicating moderate variability around the mean.

The mean values represent the digital maturity level of each dimension. Cooperation, Strategy and Transformation Management were the dimensions ranked highest, with Organisation and Product Innovation ranked the lowest. Digital maturity levels for each dimension were plotted in a radar graph, as illustrated in Figure 11.



**Figure 11: Digital maturity level per Dimension**

The overall digital maturity level was calculated as the mean of all dimension scores. Organisations rated 1–2.99 are considered to be at an early stage of digital development, while those rated 3–3.99 are considered to be in the developing stage, and those rated 4–5 are considered to be digitally maturing (Deloitte Africa, 2020). Transnet Freight Rail is considered to be a digitally developing organisation with the current maturity level measured at **3.1**, as illustrated in Figure 12.



**Figure 12: Digital Maturity groupings (Deloitte Africa, 2020)**

## **4.2 Qualitative Data Findings**

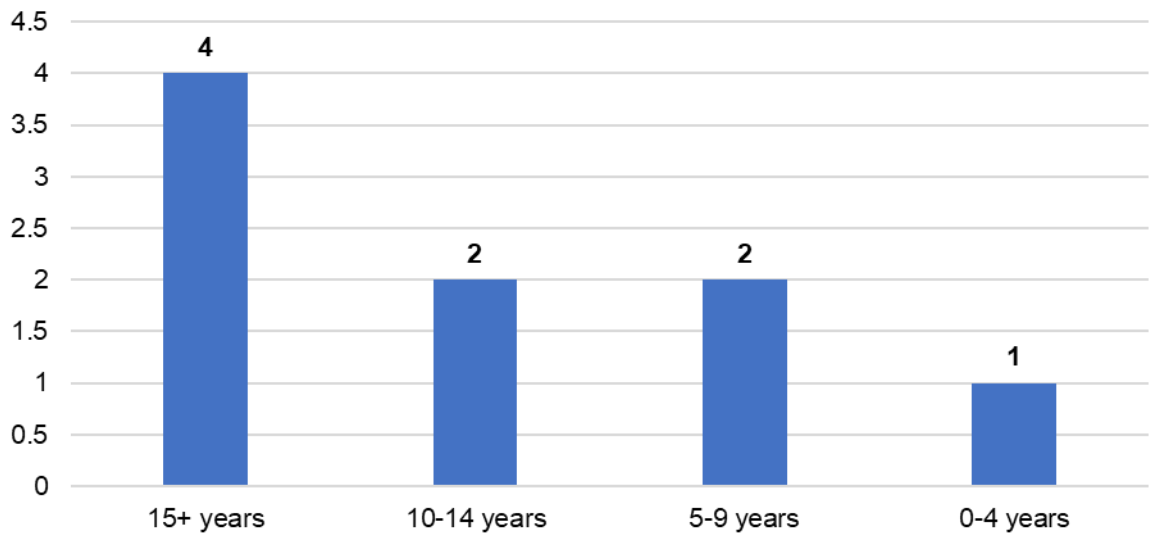
### **4.2.1 Demographics of participants**

The study's participants were Executives and Senior Management with extensive experience in Transnet and the private sector, allowing them to contribute meaningfully to the study. Seniority of the participant's role was linked to access to information typically reserved for senior employees. The selected sample ensured inclusivity, with 33% females and 67% males. To avoid bias, employees from various departments were selected to determine their understanding and experience with digital transformation. The table below shows the participant's gender, race, and the department they work in.

**Table 5: Participant demographics (interviews)**

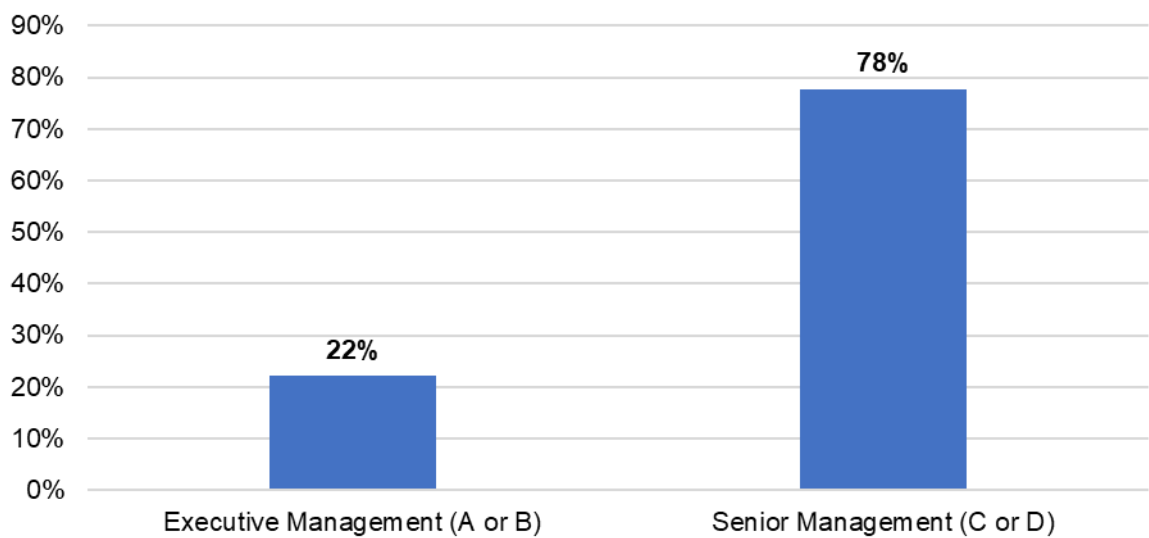
<b>Participants</b>	<b>Gender</b>	<b>Race</b>	<b>Department</b>	<b>Experience in Transnet</b>
Participant 1	Male	Indian	Planning & OCC	24 Years
Participant 2	Female	African	Information & Communication Technology	9 Years
Participant 3	Male	African	Planning & OCC	27 Years
Participant 4	Male	White	People Management	30 Years
Participant 5	Male	African	Office of the ME	11 Years
Participant 6	Female	African	Information & Communication Technology	15 Years
Participant 7	Female	African	Strategy & Office of the CE	8 Years
Participant 8	Male	Indian	Strategy & Office of the CE	14 Years
Participant 9	Male	African	Commercial	1 Year

The graph in Figure 13 represents the experience of participants working in Transnet across operating divisions.



**Figure 13: Participant's experience in Transnet (years)**

According to Figure 14, 22% of those interviewed were in executive roles, while 78% were in senior management.



**Figure 14: Participant's employment level**

#### 4.2.2 Findings pertaining to objective 1.

This section analyses the findings from the interviews conducted. The broad theme was identified from the codes that were initially generated. The participants we asked their understanding of digital transformation, whether there is a digital strategy in place, and where they thought TFR was on the digital transformation journey.

##### 1) Digital transformation and impact on the business

Sub-themes related to digital transformation and impact on the business include (a) understanding of digital transformation; (b) digital business strategy; (c) communication of the strategy; (d) digital maturity level; and (e) impact of digital technologies on the business.

###### a) Understanding of digital transformation

This subtheme derived the understanding of digital transformation from the participant's perspective.

###### i) Moving from manual to digital

Most participants understood digital transformation as changing the organisation to be technology driven rather than manual process driven. They summarised their understanding as automating manual processes as highlighted in the following quotes: *'it's where we convert the manual processes into digital, so we automate the manual processes that are currently in place'* (Participant2), *'How do we then move beyond the current landscape of manual processes?'* (Participant4), and *'my understanding of digital transformation is really just changing the business and make sure that it is technology driven as opposed to manual processes'* (Participant7).

It was also about having centralised operations and minimising human involvement in the workflow, by *'overhauling of much reliance on manual inputting of standard data and the flow of processes in such a manner that is centralized, there is less human involvement in terms of the working of the processes'* (Participant9) and *'moving the organization to a more kind*

*of automated state that is managed and governed by systems with as little human intervention as possible, that's dependent on triggers and events outside the system' (Participant8)*

Transforming traditional practices was also mentioned in the following quote: *'my understanding of digital transformation is to do with moving away from how you do things today. It could be manual; it could be semi-automated and getting it to a platform where it is digitized just by you speaking to the lights and then the lights come on' (Participant3).*

#### ii) Improving performance and efficiency

When it came to understanding digital transformation, improving performance and efficiency was ranked high. The believed that operational efficiencies can be obtained by addressing: *'inefficient processes and resource constraints and optimizing to the benefit of the organization's current systems to become more efficient, processes to come becomes the fully automated' (Participant4)* and *'to ultimately give effect to seamless and quick time turnarounds'(Participant9)*. *'Digital transformation is about making life easier through implementing technologies that people can use in order for them to be more effective or efficient in how they go about in doing everyday business. To sum it up its more on enhancing operational efficiencies and the organizational culture through leveraging of technology' (Participant6).*

Other participants believed that digital transformation referred to the application of technology to support performance across the board, stating that *'it's where we implement technologies to improve performance in the business' (Participant2)* and *'for me digital transformation it's more on enhancing business operations and customer experience by leveraging digital technology' (Participant6).*

#### iii) Driven by systems.

The following statements inform the understanding that digital transformation is system driven:

*'Digital transformation basically it's about looking at the current health of our systems, the technology in TFR, how is it being utilized, the availability of those systems, how can we modernize those systems, replace them, upgrade (Participant4)*

*'It's just shifting away from a partial semi-system environment that is not integrated, that requires people to do a lot of things to moving to a place where we have systems that kind of cover track and record everything (Participant8)*

Shifting from legacy systems, for example: *'in our organization, we largely make use of a large number of systems that are quite archaic, umm and old, and that operates in a siloed fashion. Umm for the longest of times we've been wanting to shift and migrate away from those legacy applications that are very manually intensive and dependent on human intervention to move to a point where individuals need to do as little or provide as little input as possible and updates and information are sourced from IoT devices' (Participant8).*

#### iv) Workforce

Digital transformation was not only about technology and systems but also about transforming the workforce. Behavioural change was reported as needed by the organisation with quotes including: *'they need to be cultural change because obviously if you move from manual to automation, there needs to be some behavioural changes there. So digital transformation for me, it does not only look at technologies or processes, but it also looks at people' (Participant2), and digital mindset 'workforce is then digitized and where they enabled the organization to become agile (Participant4).*

One participant emphasised the important role of people referring to the systems-people-processes triangle, which *'speaks to systems people and processes. So not only should your systems be upgraded and updated, but you need to do the correct change management for people to change their mindsets and attitudes, and also ensure that your processes are*

*aligned to the systems that you have and the manner in which people operate and the way they are structured in the organization' (Participant8)*

b) Digital business strategy

This subtheme examined the current business and digital strategy, communication of strategy and the current digital maturity level.

i) Current business and digital strategy

A participant working in the Strategy and Office of the CE, described the organisation's recently developed turnaround plan: *'recently we've developed the turnaround plan for the organization for all Operating Divisions (ODs) and submitted it to the chairman and the board... there are multiple pillars in that strategy, People, Processes, Rolling Stock, etc., ensuring that our company is a commercially viable entity, the stopping of non-profitable flows. So, our turnaround plan or strategy includes multiple pillars and one of those pillars are digital' (Participant8)*

The organisation does have a digital transformation roadmap which was shared by the executive management, this was expressed in statements including:

*'We have a strategy, and it was approved December 2021 and in that strategy there are road maps that extends to 2026 in terms of tactical, operational and strategic' (Participant2)*

*'we do have a business transformation and digital transformation road map which we have shared across the business with our CEO leading from the front and our various line EXCO members sharing that across the business' (Participant4)*

*'We also have our own digital transformation strategy which is a 5 years digital transformation journey which started in year 2021/22 and suppose to end 2025/26 and part of our strategy and some programmes that I have mentioned they are part of the programme that will take us to a fully digitalized organization by 2025/26 but then since 2021/22 until now some of the programmes they delayed in terms of startup' (Participant6)*

*'We have a strategy to transform and then digitalize TFR. So, our strategy has got 6 pillars, the digital transformation is the third pillar' (Participant7)*

## ii) Communication of the strategy

This subtheme examined how digital transformation strategy is communicated. Management has adopted various methods in communicating the digital transformation strategy to the entire organisation. The task team was mandated to communicate the strategy led by top management, statements including *'The task team got terms of reference; it's got a mandate. So what we do, every single activity that falls under digital transformation, it gets to be socialized there and from there we take it to the different business units' (Participant2)* and *'top management going around preaching digital transformation, it made our life easy as the task team when we go for roadshows, because at least they could see top down a communication and when we came it was easy for people to at least give us an ear regarding digital transformation (Participant2)*

Roadshows are done when it comes to presenting digital transformation projects at various depot sites, *'So any project that has digital transformation in it, it gets to be presented there and then we have roadshows where we go to different depot sites, TFR sites and we communicate the digital transformation strategy and the programs that are coming that will be implementing' (Participant2)*

Formal sessions were also used to communicate the strategy to employee, as highlighted: *'it was communicated with everybody and part of that strategy what was communicated was the things we need to drive as an organization in order for to reach that high level of digitalization. She also shared the pillars that are the base of our strategy' (Participant6)*

## iii) Digital maturity level

Most participants reported that digital transformation was still in the infancy stage. This was due to the organisation facing challenges such as

outdated and fragmented technology systems confirming a lack of integration, as stated in the quotes below:

*'We are at the very infancy stage of digital transformation' (Participant2)*

*'I think we still in our infancy stage and one of the major lessons is that we still isolated, we still work in pockets' (Participant4)*

*'I think we are definitely still in early days in our digital transformation journey I shared with you all of the challenges that we're sitting with, poor data quality, poor state of IoT devices out there. There are 50 plus legacy systems that are disparate and not connected to each other that don't speak to each other. So, we are a long way off where we need to be' (Participant8)*

*'I mean, we're still at the bottom, like I said, and I'm references to in relation to what I do in the day-to-day there isn't it been any implementation of the material change, so we still at the bottom' (Participant9)*

A few participants however felt it was at an intermediate stage but is not at an advanced stage. Statements expressing this view include: *'I think we've passed the early stages but we not at our, you know, at the finish line or at our best as yet, at our peak we've got a long way to go' (Participant1)*, *'I don't think we advanced stage yet, I'll say we maybe in the intermediate stage so far, given the fact that some of the tools that we have don't complement each other as yet and certain systems or processes are not as automated as we love them to be' (Participant5)* and *'I don't think we are advanced and I don't think we are at infancy, I think we just in the middle' (Participant6)*.

c) Impact of digital technologies on the business

Annexure G outline the existing technologies in the organisation, this subtheme examined the impact of digital technologies on the business.

i) Operational performance

Operational impact has improved due to improved efficiency in delivering trains and effective management places that were geared towards operational throughput.

*'It has had a huge impact, to be honest. Because of I've started with the Blato Rail from the beginning, I saw it grow up until it's final stage with being applied and used as a tool, so that has immensely improved operational performance in terms of delivering of trains and efficiently managing your plan and ultimately impacting your operational throughput' (Participant5).*

*'I think some of the technologies I may have mentioned or some of the experiences that I've had. I think we've been able to reduce some waste in that the paperwork and to a large extent have been has been reduced or eliminated' (Participant1).*

*'So, efficiencies are then at rest in that regard and many other things that goes with you know, unlocking capacity from you know from an overstated service design and vice versa because on the opposite side, you understate and then you end up with less number of resources required. And performance wise you always miss your targets because you are basing your execution on a service design that understates reality, and in a way directly so, by the way, when you don't meet your targets, you end up with an unhappy customer' (Participant3)*

## ii) Data and decision making

The key aspect of data accuracy and effective data driven decision-making was enhanced.

*'The CS90 and the tags, that also helps because if you can get accurate data, uh, correct information, it's not distorted information because you know it's based on what's was tracked through the system' (Participant5).*

*'It also helps in managing and improving your business because you're working on something that's true, not something that was maybe typed in by somebody, but it comes from the system, so it gives you some form of benefit in terms of you know managing something based on facts. There's no ambiguity about it or subjectivity, you know that this number is basically what the true system really is performing on' (Participant5).*

*'We've been trying to get to a point where we have real time reporting every single KPI we have, it's available every single hour on the hour as we execute our operations that the data that we report KPI information is as accurate as possible for as long as those things are accurate and correct it will tell you exactly where your challenges are' (Participant8)*

*'In terms of the COMTRAC information and the COMTRAC tool or system that these guys are using it also enables us to make a better informed decisions and quickly, because the information is there, it's available when the stoppage is, so when there's delays, the guys can respond to them quickly and proactively without having to wait for a report to be somebody on the ground. So if the information is available in the tip of your hands, it's just, uh, it's like just makes it easier for one to make for proactive and informed decisions. (Participant5)*

### iii) Efficiency

Efficiency was enhanced through impact of digitalisation, and this was seen as positive.

*'In a manually produced service design, you may end up with the turnaround time being overstated to such an extent that the turnaround time is 7 days in a week, which means if you want to do 5 trains it therefore means that you must have five sets of umm rail wagons available. With a digitized intervention, the overstating of the turnaround time will be done away with such that you end up, let's say, with a 5-day turnaround time. So, with a 5 day turnaround time, the amount of wagons that you require*

*becomes lesser. Now in that way you would have addressed the issue of efficiency' (Participant3)*

*'You then be able to do kind of the five why's and root cause analysis as to what your major bottlenecks are, address those and then immediately see the value that it delivers' (Participant8).*

*'Customer impact becomes even much more significant because then it's becomes a predictable service and you deliver exactly as in accordance with the targets that you have' (Participant3).*

#### **4.2.3 Findings pertaining to objective 2.**

This section analyses the findings from the interviews conducted. The two broad themes were identified from the codes that were initially generated. The themes are closely associated with the second study objective. These themes are: 1) Leadership and employee dynamics in digital transformation; and 2) Factors influencing adoption of digital transformation.

##### **1) Leadership and employee dynamics in digital transformation**

Sub-themes related to leadership and employee dynamics in digital transformation include (a) role of leadership; (b) digital transformation as a KPI; (c) employee skills and attributes; and (d) employee willingness to embrace new technologies.

###### **(a) Role of leadership**

Leadership dynamics was important to identify, as digital transformation should be motivated and driven at the top. This primary subtheme enquired the role of leadership in digital transformation.

###### **i) Communication**

All participants agreed that leaders must articulate the strategy and inspire the organization to embrace digital transformation. They stated that strategies should be clear and understandable to employees at all levels, *'So, the role of leadership is to be clear about the why and then the how,*

*how do we plan to do it? Getting the management team to break it down into easily understandable steps, for everybody in the organization to understand, we have to, we have to realize that not everybody is a friend of technology' (Participant1) and 'We communicate in a manner that is palatable, and that would be understandable by any laymen on the ground that that does not have an IT background, let alone a grade 12 certificate. So, ensure that the language is simple' (Participant8).*

Regular communication and simplification of technical concepts to ensure that everyone understands and participates in the changes, was also highlighted: *'People that have been working for the organization for 30 years and close to 40 years, this is a huge step up for them. Therefore, they may not be friends of technology and because me at leadership, I understand technology or the concepts and the terminology does not mean that you know, everybody does the same way. So, I've got to take the time to break it down into its simplest form so that you know the people within my team, for example, understand what we are talking about.'*(Participant1) and one experienced leader described point in detail *'firstly, so when you talk about digital, ICT and systems that can be very complicated and complex. So, the first requirement is to ensure that we translate that to a very layman basic language with no technical jargon or the like, so we don't talk about integrated train plan and interim planning solutions and rescheduling and real-time scheduling on the fly and IoT etcetera' secondly communicate that message as often and frequently as possible and ensure that that everyone has a good understanding of what the strategy is and what it looks to achieve. So yes, in summary, the leadership objective is to simplify the language communicated to all levels of the organization, because everyone would be affected and touched by it and then ensure that communication happens as often and frequently as possible (Participant8).*

Communication of progress on strategic objectives was identified as an issue that needs to be addressed. This includes openly sharing whether the organisation is on track or behind schedule, *'but not only should the*

*strategy be communicated, but progress on that strategy, we plan to achieve this by this date, do we are falling behind we've only achieved this, or we plan to deliver so many initiatives and we have exceeded that and delivered this many, very often the strategy communicated, but seldom is progress communicated on that strategy'*(Participant8).

ii) Drivers of transformation

Leadership must be the champions in promoting digital transformation and providing necessary support to enable the organization to succeed. To describe leaders being champions of digital transformation, participants used statements including: *'we need to champion the adoption of digital transformation'* (Participant6) and *'well, so digital transformation in TFR was not even led by IT. The main sponsor was the CEO and this is why it's part of the transformation strategy, that's why it's a pillar on its own. It is not IT driven, it's more business driven'* (Participant7).

Digital savvy leaders that have a deep understanding of operations to create the vision are crucial. Such leaders have a growth mindset and enable organisations to leverage digital opportunities, *'the envisioning of where the organization needs to go to, certainly must be set by the leadership, but the leadership would not be able to can come up with visions of where the organization should go to without hardly understanding what is going on in the organization and for that understanding to come through, it is the very employees that deal with operations on a daily basis, in fact, daily basis is even an understatement'* (Participant3). Understanding of agile principles, *'everyone always talks about agile and that we want to deliver initiatives, projects and value in an agile manner, but I really think that maybe a very small amount of people truly understands what agile is. And not only does it speaks to IT and systems, but it's a mindset shift and change, umm, you kind of need to add to have after have an appreciation of the delivery methodology to truly understand it and understand how it delivers value'* (Participant8).

### iii) Environment and culture

Creating an enabling and supportive environment that allow all employees to also propose valuable ideas that are aligned with the overall vision of the organisation. Participants mentioned that *'the environment must be fine for people to come out and give this input to the leadership whose role it is to take the lead in terms of where we going to. But it's also not always the case that the leadership must be the ones that always take the lead. Umm, you know? So, if they create the right environment, here can come a junior manager with a brilliant idea, and that idea becomes supported because it meets with the targets, or rather the visions that the leadership would have, you know, dreamed up. And they then give space to the junior manager to be the one that champions this thing with support obviously from the leadership, you know, and which is something that is done so brilliantly by Discovery Group, under Mr. Gore, I forget his first name and in his EXCO they always allow presentations of any idea from staff members and the best winning idea gets given the full support behind it, up until it is seen to fruition, so Discovery is where it is and you know they are the first ever to come out with this fully digital banking solution'* (Participant3) and further quoted what was said by the Group CIO in a meeting, *'one of the things that he mentioned was that people need to be empowered. As part of digital transformation, leadership should be able to create an environment whereby people are able to come up with innovative ideas that can be implemented in the organisation, creating that culture of innovation within the environment'* (Participant6).

Effective change management and support was a further element of the role of leaders in digital transformation that was identified. Leaders must be ambassadors for change to fully get support from the entire organisation. One participant stated: *'you've got to lead from the front, leadership at all levels have to embrace it. And they also have to do the proper change management, so that people understand what it's about and allay all fears and get people's support'* (Participant4).

(b) Digital transformation as a KPI

This subtheme established if digital transformation was part of management KPI. Results imply that it is part of their KPI but however a more standardised approach was needed.

i) Executive Committee (EXCO)

Several participants reported that digital transformation was on the balanced scorecards of EXCO members as a KPI, especially the CEO and CITO. When asked whether digital transformation was part of management KPIs, they were quoted as saying:

*'So, everyone has it, and even when the CEO was going around preaching the digital transformation' (Participant2)*

*'So yes, most definitely it was expected of her to champion this thing and make sure that it goes through. And at least I know also that the CEO the outgoing chief executive office, Miss Mzimela, it was on her KPI because she was reporting on it, even to the shareholder on what it is that is being done to counter the effects of non-performance as things stand. So yes, most definitely it was, it formed part of KPIs on the leadership' (Participant3)*

*'The Chief of Information Technology definitely it is on their KPI. Umm, because they were reporting on progress on it at the Exco' (Participant3)*

*'Yes, CITO (Chief Information and Technology Officer). She has line item in her scorecard for digital transformation and the other General Managers for business areas they have digital transformation' (Participant2)*

*'They do... now when you look at how CEO and the EXCO scorecard around digital transformation, mainly what you see is progress on key digital initiatives' (Participant8)*

*'All six pillars, including digital transformation will be part of the executive's scorecard because we need to drive the transformation, it's not just a*

*digital transformation it's a TFR transformation strategy of which one pillar is digital transformation' (Participant7)*

ii) Departmental KPI

Digital transformation is sometimes customized per department based on respective scorecards. DT KPIs were aligned with departmental responsibilities, to describe this participants used statements including: *'you won't find digital transformation as one KPI on its own but we have it in some areas differently phrased in IT space, yes clearly, in some areas, like on recruitment, you then say what are the performance measures, in other words, how do you make it more efficient, uh, reducing your time to recruit will force me to automate certain processes' (Participant4)* and *'I think on a broader level, my duties with respect to digitalisation is to ensure that our data management is in line with those principles that will give effective data management is essential and I guess the question then would be what sort of tools or processes would I be required to put in play' (Participant9).*

iii) Programmes and projects

According to some participants digital transformation was not a direct KPI but was integrated in strategic programmes and projects. Emphasising the importance of including digital transformation in performance scorecards when implementing strategic programmes, they stated that *'In our department digital transformation is part of our KPIs in a sense that all the programmes that we are working on which our strategic programmes are part of the digital transformation strategy they are part of our performance scorecards. So, we need to make sure that those programmes get executed in order for us to realise full digitalization as an organization, so it is included' (Participant6).* One suggested that digital transformation may not be explicitly mentioned in any aspect of the business, but many projects are in line with the digitalisation goals and stated they *'haven't seen any but there are some parts of the business, like continuous*

*improvement for example, when we are involved in a project of maybe documenting processes, like for example we busy with a rail operations management tool. We have to first document the processes so because its our responsibility to document these processes, we are aware of these technologies that are coming in and we are engaged on a regular basis. That will come into my performance scorecard that I'm part of this project and these are the set deliverables set for me during within this quarter or financial year and I'll be measured on that' (Participant1).*

(c) Employee skills and attributes

This primary subtheme examined employee skills and attributes in line with digital transformation.

i) Adequacy of employee digital skills

All participants indicated that current employee digital skills were inadequate, with a large number of employees lacking the necessary modern digital knowledge. This was informed by the following statements:

*'We do need more people with sufficient digital skills. The issue of adequate skills, I don't think we have sufficient and that's on all areas whether it's on the SAP side' and 'I do think we have a serious gap and we don't retain those skills for long enough because obviously the competition in the market is high' (Participant4)*

*'When I look at the entire structure, particularly in my corridor, I'll say there's a 50% of the guys don't have that kind of, you know, knowledge' (Participant5)*

*'So, most of the time you find that we don't have enough resources to be able to deliver the solutions to business' (Participant6)*

*'we don't have enough skills, firstly, that's one of the reasons why we also want to have a partner that will walk with us. We don't have enough skills and or people' (Participant7)*

*'We do not have the necessary skills. Like I said, we've had a massive brain drain and please don't, this is not the general statement' (Participant8)*

ii) Initiatives to upskill employees.

Training and skills transfer were initiatives suggested as being used to upskill employees to ensure the sustainability of implemented solutions. The following statements highlight how employees are upskilled with digital skills:

*'In terms of upgrading of skill, we have also asked the Transnet Academy to look not only at the rail specific competence, but also do the soft skills for the upgrade on the digitalization competence within the business' (Participant4)*

*'One of our programs are those on the silver foxes where we brought in people who left with the SAP expertise or coding to come in and transfer skills, even if they're working for other companies' (Participant4)*

*'Yes, certainly as you know we do our training through the School of Rail. So, we try to capacitate our team through the skills and the modules that are actually driven through the School of Rail' (Participant5)*

*'We will have a requirement for the partner to upskill part of the internal people so that they are able to maintain whatever is being implemented' (Participant7)*

(d) Employee willingness to embrace new technologies.

It was important to determine the employee willingness to embrace new technologies. The subtheme was split into two categories: i) generational digital divide and ii) digital divide by job level.

i) Generational digital divide

There was also the generational component to consider. There was a difference between the older and younger generations in accepting and

using technology. Job security was one of the factors listed that hindered the acceptance of technology by the older generation, one experienced participant described this situation as *'the older members of the community, then you struggle to make inroads because their attitude is "maybe I'm going to lose my job", or "somebody will come and take my job" or you know there are many various factors that can come out of that' (Participant1)*. Other factors included literacy levels were expressed with statements like *'let's qualify it, you've got old people who are the level of education or literacy is not high up there and then you also have old people from old school who still want to have a notebook and pages, you know, and write with a pen so resistance is not only from old people who are relatively educated' (Participant2)* and *'then you find that old Oom Peet, that old Mr. Magagula that came into the organization with only a matric and they are still in the system, and they only get to pick up here and there snippets of technology. So, with all due respect to the Oom Peet and to the Mr. Magagula. Umm, that third category of employees would not be well versed with the technology aspects of, you know, the question that you're asking. But then the likes of Thando Ngcobo and another example that I can make mention of Mr X without mentioning any name, you know, for that matter, they come into the folder already with that with that knowledge' (Participant3)*.

The younger generation are more agile to embrace technology and are easily onboarded. Such employees also take initiative in researching and staying abreast of technological advancements. Statements including, *'I don't know what generation they call them. Those are very quick to adopt and to get a on boarded because they really want to use technology' (Participant2)* and *'there are those ones that take it upon themselves to do research... but then there are others that tend to know about technological advancements because they would have seen a movie about robots' (Participant3)* show more adaptability from the younger generation.

## ii) Digital divide by job level

Apart from generation there was also discrepancies at different levels. Higher levels of management, such as middle management and above, found it easier to adopt technology because they could see its benefits for their teams. *'For the guys at the top, it's easier for them, I'm talking maybe from middle management and above, you know, because maybe we've read about the benefits, and you've already gotten the buy in through our interactions from the business at the top. So by and large, I'll say more than 80% of those have interacted with in management positions they've gotten on the wagon, so they buy into the idea. Uh, you know, because they've seen the benefits, they've observed the benefits and they understood the benefits through the entire team with management'* (Participant5).

However, at lower levels, there was more resistance as staff were fearful that digitalisation might compromise their jobs or impact their hours of work thereby cutting down their overtime compensation. *'The slight challenge is our lower-level employees, the resistance comes to thinking maybe digitalization will take their jobs out or they might not be able to accommodate the hours that they accumulate for some time because you know, hours translate to overtime and so on and so forth'* (Participant5).

## 2) Factors influencing adoption of digital transformation.

Sub-themes related to factors influencing adoption of digital transformation include (a) Effective communication; (b) Conducive employee environment; (c) Change management; (d) Buy-in and support; (e) Organisational readiness (f) Skills and development and (g) Funding.

### (a) Effective communication

Participants emphasised the importance of having effective communication at all levels regarding digital transformation initiatives. The following statements support the point:

*'...communication is very important. We need to spell out what we are doing, how we are doing it and why at all levels using different forms of communication' (Participant1)*

*'Communication, communication, Communication. Let's not leave anyone behind' (Participant2)*

*'Honest, transparent communication and then just kind of get our hands dirty' and 'effective communication, buy-in from staff at all levels' (Participant8)*

*'Communication and openness around these changes, people would be familiar with what they need to do, and people should also you know understand that the impact of not aligning with these changes would have a great influence on the success of the business' (Participant9)*

(b) Conducive employee environment

The participants stressed the importance of creating an environment to promote innovation which can make it easier for people to adopt new technologies and adopt innovative ways of working. The quoted statements support this sub-theme:

*'...making sure that all the employees feel valued when we implement even the ones that have phobia of technology or whatever, if we can create an environment where they feel valued and their inputs are valued, that is a key for our success' (Participant2)*

*'...creating that environment of innovation, once you create that environment of innovation it will be easier for people to adopt, to technologies and new ways of doing things. I think we need to create that environment of innovation' (Participant6)*

(c) Change management.

Change management was seen as an added key factor. Change management must be built on the following:

i) Education and awareness

People should be made aware of the potential of technology and that education is important to develop an understanding thereof. The goal is for the individual to gain the necessary understanding of the process to better adopt the technology when implementing it.

*'Number one thing, for the people, its more on education. Educating people about our processes so that they understand, because sometimes things don't get stuck because we are just delaying as IT, we have got the SCS process which in itself it got a whole lot of elements so I think people need to be educated on these things to understand that sometimes things take time but it does not mean they will never happen, so that even by the time it happens they can still able to embrace the technology because they have an understanding'* (Participant6)

ii) Promote more adaptability from manual to automated.

Manual work should be gradually reduced to encourage people to adapt to change. This involves creating an environment where there is trust in the systems to encourage employees to accept the changes introduced.

*'As soon as we introduce these changes, we must make sure that there is less and less possibilities of working out of these systems... but also ensure that we limit more and more manual working so that people would ultimately have no choice but to adapt to these changes. Yeah, and then obviously giving them the full support that they require to adapt to the changes, be it training and whatever support that may be required'* (Participant9)

iii) Training

Support and training should be ongoing thereof to promote change and acceptance. Training can be done in-house and /or through digital partners.

*'Sometimes it's about change management, how do you turn people's heads, uh, so we are still working through that, but at least the resistance is no longer the same. We've also over the last five years*

*improved the education level of people within the organization. In that we've trained more people, our training is no longer just inward focus, but also bringing key partners from outside to help us with that type of transformation' (Participant2)*

(d) Buy-in and support.

i) Leadership support

Participants emphasised the importance of leadership buy-in for digital transformation strategy. Hence, executive sponsorship is seen as the critical starting point for successful implementation.

*'Leadership buy-in and visibility and the ownership of the digital transformation strategy' (Participant2)*

*'Leadership must have their heads on the right way around in terms of dreaming up the vision of where we want to go to. They should be tuned into the environment, the business world and the business environment, not just locally but geopolitically as well' (Participant3)*

*'Buy in is going to be important from the top' (Participant4)*

*'Well, for me it is the executive sponsorship, the leadership. So if it's sponsored at that level that will be a the first price and luckily with us, that's exactly where it started' (Participant7)*

*'Executive and sponsor buy-in' (Participant9)*

ii) Stakeholders buy-in

It is very important to gain the support from labour unions as these are the key representative entities of staff concerns. It can also help to alleviate staff concerns.

*'...get buy-in from our users and involve labour from the onset so that they understand the vision, because what I have realised is that the users especially bargaining unit employees because most of the users in TFR are Operators and they will listen more to labour than they will listen to anybody else like their managers. Get the labours to be the one that drives the change so that we get the 100% buy-in that we need from our users' (Participant6)*

(e) Organisational readiness

i) Infrastructure

There must be reliable IT infrastructure to ensure technology effectiveness and an alignment between technology capability and necessary infrastructure.

*'Another important factor will be our infrastructure as IT, we need to make sure our infrastructure is on point so that all these technologies can be use because it of no use to get the people to be ready but the technology itself is not' (Participant6)*

ii) Policies

It is critical for the organisation to comply with policies that meet regulatory requirements. This was expressed in the statement below:

*'I think from a risk management perspective, this introduction of digital integration, whatever policies that would outline this must be very clear and have clear guidelines for managing the risks associated with digitalization and obviously, as a state owned company as well, it is crucial for us to comply with all the laws, regulations and the standard, so whatever policies that would under underpinned that should include guidelines for ensuring that moving to digitalisation and would not contradict prevailing policies stemming from regulatory compliance' (Participant9)*

(f) Skills and development

Without relevant skills, there can be no transformation, and therefore skills development is crucial. Below statements support the importance of developing employees with digital skills:

*'I found also training is very important' (Participant1)*

*'We are trying to skill our people to be able to participate in the digital environment' (Participant2)*

*'Bring in more people with digital transformation skills' (Participant4)*

*'Umm, the correct skill sets, doing a good architecture blueprint' (Participant8)*

(g) Funding

Leaders must ensure that adequate funding is provided as funding challenges can hamper digital transformation. One participant stated that digital transformation initiatives *'stop halfway because of the funding. But I think once we have clearly articulated the business need and the benefit of the business. Then it enables approval or the release of the funding because then if we can demonstrate that by embarking on this journey'* (Participant7)

#### **4.2.4 Findings pertaining to objective 3.**

This section analyses the findings from the interviews conducted. The two broad themes were identified from the codes that were initially generated. The theme is synonymous with the third study objective.

##### **1) Challenges and barriers to digital transformation.**

Sub-themes related to challenges and barriers to digital transformation include (a) Environment and culture; (b) Organisational challenges; (c) Employees; (d) Challenges in communication; (e) Systems and infrastructure; (f) Safety and risk management.

###### **(a) Environment and culture**

###### **i) Embedding digital culture**

The organisation lacks experience in creating a digital transformation culture. This is due to the transformation not being confined to just one department but extending through the entire organisation.

*'So, the challenge number one is digital transformation is deemed to be something very new because it does not only talk to processes, it's the whole transformation even the culture. So, the challenge currently is we do not have experience in and embedding the digital transformation culture in TFR'* (Participant2).

ii) Outdated and manual systems

The current manual culture seems engrained in the organisation's behaviour is a significant constraint. The TFR environment is outdated, with majority of the applications introduced decades ago that function independently of one another.

*'I think the OEM's are now running on different versions today, we still have, like Multi Rail, we've got the earlier versions, the very first version of Multi Rail... So, technology is there, but that Multi Rail thing, the one that we have requires that you tinker are with it manually. So, it's fragmented standalone and it requires you to interact with it manually' (Participant3)*

*'You know, the biggest constraint is our processes and systems. I would say to a certain extent, we've gotten used to doing things manually. It is embedded in our behaviour, so sometimes we focus mainly on the tool.'* (Participant5)

*'So firstly, our environment is very, very archaic. I think in TFR we have in excess of about 50 applications that that operate in siloed manner with minimal integration, a lot of it is in the mainframe and comes out of the 80s and 70s that we've not been able to successfully migrate from'* (Participant8)

iii) Technology acceptance and utilisation

The human element in digital transformation must be taken into account. As a result, this gives support to the 'formula' that the quality of a technology solution is determined by user acceptance in achieving expected results. User acceptance accounts for nearly 80% of the formula, and therefore focus cannot only be on the solution but also on the human dimension.

*'So, more than 90% of the time we think we've got the digital tool, well everybody will buy into it and move on with it, forgetting that there's people elements in this whole thing, the mere fact that you've developed the tool*

*don't assume that everybody would buy into it... if you want to work on your solution, don't only just work on the solution and the tool that you are planning to deploy or implement, also work on the people aspects because it forms huge part of the equation.'*(Participant5)

*'I think for me the barriers would be the issue of adopting because you will find instances by they are some technologies that are implemented but they just become a white elephant because you implement a solution and users don't want to use it for example, the Crew Management System, we have a system called CMS, I was part of the implementation few years before I left (IT department) to my surprise when I come back only to find out that system is not being utilised and it sad, people are the number one thing' (Participant6)*

(b) Organisational

i) Financial

One of the biggest challenges faced includes financial investment and budget constraints. Financial difficulties are currently faced by the organisation, which makes it difficult to allocate funds for the digital transformation projects.

*'Some of the things that we want to implement they require money and there is some investment that needs to be done and with the current situation of the organization and costs becoming issue' (Participant2)*

*'Another barrier is the issue of the budget because in other instances you find that you get people excited, people get involved, they are ready for this technology or for the solution and while in execution and then you are being told that there is no budget and we no longer moving forward, people just get disappointed and there is lack of interest now if you want to revive that initiative' (Participant6)*

*'The other big challenges funding because if you are transforming the entire organization, particularly where Transnet is right now there is the challenge of funding' (Participant7)*

ii) Stakeholders buy-in and support.

To realise the success of digital transformation, it will be necessary to achieve alignment between stakeholders such as labour unions, senior management and IT. Digital transformation may face considerable resistance without union support, thereby requiring collaboration to achieve its objectives.

*'...like I told you about the task team, so we need each other, the labour unions, senior management and IT we need to be taking from the same hymn sheet for us to make an impact or for us to make traction in the vision of digital transformation. If there is no buy in from labour unions, then we can forget about digital transformation, so we need to walk together and take the people along with us' (Participant2)*

*'The other barrier because we're highly unionized there was resistance from unions because they were concerned that not all members will be treated fairly and have equal access. They were concerned that we would no longer have the same benefits, travel and having one on one interaction, we don't all have the same tools' (Participant4)*

*'The biggest problem would be sort of getting the overall support teams to understand to see that firstly there would have been a change and to ensure that they quickly adapted to those changes that may have been brought by implementation of the envisaged changes' (Participant9)*

iii) Leadership turnover

Frequent changes in leadership lead to continuity issues with digital transformation. One senior participant stated *'constant change in leadership, not only in ICT for CIOs but also our organization. We've had*

*several changes in CEOs, several GMs (General Managers), EXCO restructures which kind of creates uncertainty' (Participant8).*

(c) Employees

i) Resisting technology

Fear and resistance to digitisation, driven by concerns of job loss, were at the heart of this adverse factor. The fear of unfamiliarity of automation and its impact on reducing traditional job roles have been expressed by employees in particular those without prior technological knowledge/experience.

*'Initially when we started introducing some of these things, there was a lot of resistance to the point where we'd see people unwilling to use it or complaining that it doesn't work the way it should or the way the old methods do' (Participant1)*

*'On the other side, the negative part of it, as you might be aware anything digital, it is met with resistance and there's also fear that jobs will be lost because when we implement some of these technologies like I told you, we have employees who are called general workers and some of them they don't even have tools of trade'(Participant2)*

*'They don't use laptops or desktops, they're moving the trains so when you come with technology, there's always that fear of the unknown where people will now need to be trained on using gadgets and whatever and some are saying, you are taking away our jobs or something that people will do in five days, now you're able to do in maybe 10 minutes, so what's going to happen for the other remaining four days. So you always have those responses and people are uncertain, that's what causes the resistance and the tension and the fear of digital transformation'(Participant2)*

ii) Lack of training

The lack of training has led to misunderstanding and reluctance to new systems. Users tend to find simpler methods through spreadsheets and manual processes, thereby reluctant to use technology-based processes. *'It was a lack of training which resulted in lack of understanding of what needs to be done and a lack of willingness to change and embrace the new way of doing things' and 'the difficult part within the TFR environment is shift work and getting people into a classroom to do training is difficult because you cannot pull off people all at one go, keeping the operation running while getting some people into the classroom in little groups, train these people, get them back into the operation' (Participant1)*

iii) Skills retention

Skills retention remains a problem with many skills and senior employees leaving for other opportunities.

*'Like I shared this been a big exodus of skill where all of the senior, more flexible individuals have left, and the juniors have remained umm and like obviously there's impact your culture in the organization and ICT' (Participant8)*

(d) Challenges in communication

i) Not simplified at lower levels

The communication of the strategy was identified as a problem at lower levels of the organization, as it was complex and inaccessible.

*'We've seen communication coming through from Transnet Group, from the corporate office and I must admit that you know it's not broadly taken down. A strategy needs to be taken down to its simplest form, to the person on the ground' and 'So, in other words, we'll communicate strategy which will tell you this is what we intend on doing, we might use high level description or terminology... but what does it mean for the average person on the ground, the guys that really get the work done? Do we take it to them in the simplest form and explain this spreadsheet or this system that you work with every day?' (Participant1)*

*'In terms of communicating that to the organization I believe that we definitely can do a better job of it. I think strategic individuals and the executive in TFR have a firmer understanding and knowledge of that strategy, but I think we need to do a lot more to communicate it to middle and lower level of employees in the organization. So, if I were to score ourselves out of 10 in terms of communicating that strategy and give us three out of 10.'* (Participant8)

ii) Large population

The current population was estimated at 24 000 employees, making it difficult to communicate strategy to all at a simplified level and gain buy-in.

*'I just think that the challenge with our organization is that it is so large you need to communicate this to 24,000 people in TFR alone and get all of their buy in and understanding, so because we are so massive, it becomes very difficult'* (Participant8)

(e) Systems and infrastructure

i) IT infrastructure

Existing IT infrastructure were laden with challenges. There were challenges due to poor network infrastructure resulting in frequent system failures and malfunctions.

*'IT infrastructure can also be a barrier... Our network was so bad and so poor because the system was always down, half the time it was not working, that goes back our infrastructure'* (Participant6)

ii) Maintenance and upkeep

Despite the many technologies available to provide information on operation, the organisation still struggles to maintain and update these systems.

*'Remember I told you about the handheld devices that we used to use early 2012, 2013, to date we sort of reverted back to using manual again*

*in many parts of the of the of the organization simply because we thought of a good intervention, but behind that intervention, it seems as though we didn't have proper plans to sustain that intervention and to build on it and make sure that we continue with it' (Participant3)*

*'There's a host of technologies out in our network that we could theoretically use to report on the movement and progress of our rolling stock and assets. But unfortunately, we do not maintain and upkeep them very well, so the information that comes from them is often questionable, the data quality index (DQI) is quite low under 50% so often we need to put manual systems or people in place to validate and to use that that information' (Participant8)*

iii) Systems not integrated.

There are challenges in achieving alignment of key systems to ensure seamless integration allowing the extraction of information related various facets of the business.

*'We would need a number of systems I won't go to each and every one of them, costing and pricing tools, business intelligence tools, but ultimately, we need to find ourselves having all these systems eventually aligning to one another in such a manner that umm I should be able to pull out information relating to pricing, but still link it to our contact management system. So that's where I think we have an issue and that's where I think we need to do a whole lot of work on.'* (Participant9)

iv) No CRM system

There is a lack of customer relationship management (CRM) system to track daily customer interaction inclusive of sales, enquiries, and complaints. This can provide valuable insights.

*'I think one of the things that also I'm measured on, around customer relationship management, there's also no system there so we would really need to have something that I can track day to day important interactions*

*with customers and including sales, enquiries and complaints umm because that then can provide some invaluable data for contract management and revenue protection, helping us to identify potential issues before they can actually materialize, umm into serious problems.'* (Participant9)

v) Cybersecurity and risk management

There are also network risks where these can be hacked and corrupted by employees and external parties both intentionally and unintentionally.

*'So, everyone has access to our network, the issue of safety and security risks to our network. How do we ensure that our network is not corrupted or doesn't become corrupted?'* (Participant4)

### **4.3 Combined Analysis of Quantitative and Qualitative Findings**

Quantitative findings provided numerical evidence, while qualitative insights offered a richer understanding of the complexities and nuances involved. The quantitative analysis assessed TFR's digital maturity on nine different dimensions, providing insightful numerical data. Identifying relationships between dimensions and determining dimensions that are performing well and those that the organisation needs to focus on. The qualitative analysis was based on interviews, investigating participants' perceptions of digital transformation, the current digital business strategy, and TFR's digital maturity level.

The integration of quantitative and qualitative findings provided a holistic understanding of TFR's digital transformation journey. The quantitative analysis quantified the organization's digital maturity levels across different dimensions, while the qualitative analysis contextualized these findings by exploring participants' perceptions and experiences. The qualitative data validated the

quantitative results by offering explanations for the observed digital maturity scores and highlighting key factors influencing TFR's digital transformation efforts, such as technology adoption, communication of the digital strategy, and organisational culture. Additionally, the qualitative insights added depth to the analysis by revealing nuances and complexities that quantitative measures alone could not capture, such as the importance of organisational change management in driving digital transformation initiatives.

Triangulating data from multiple sources allowed the study to produce detailed findings and practical insights to guide digital transformation initiatives and strategic decision-making.

## **CHAPTER 5. DISCUSSION OF THE FINDINGS**

This penultimate chapter discusses the findings presented in the previous chapter in relation to the study's research objectives.

### **5.1 Objective 1 – To measure the current digital maturity level at TFR.**

This study utilised a mixed-methods approach to assess the digital maturity level at TFR. While quantitative analysis revealed TFR as a digitally developing organisation, qualitative interviews yielded contradictory findings, with majority of the participants evaluating TFR as an organisation at the early stages of digital development. The conflicting results may be attributed to differences in the methodologies and perspectives captured by quantitative surveys and qualitative interviews. Quantitative measures may overlook nuances in individual experiences and involvement in digital transformation, resulting in an overemphasis on positive results. In contrast, qualitative data provide a more in-depth understanding of digital transformation adoption through the lens of executives and senior management.

Qualitative insights support the proposition that the level of digital maturity correlates with organisational digital readiness and adaption to the external digital ecosystem. Results from this study are consistent with previous research by Kane et al. (2017) referring to the integration of organisational operations and human capital into digital processes as digital maturity and a systematic way for an organisation to transform digitally. Additionally, Kafel et al. (2021) identified low levels of digital maturity in e-innovation, process digitization, and responsiveness to stakeholder needs in public sector organisations. Attaining digital maturity, which is regarded as a state of complete digital development, is a challenge that coexists with the idea of digitalization (Kafel et al., 2021).

In conclusion, this study highlights the complexities of assessing digital maturity in organisations. While quantitative data may point to overarching generic dimensions in assessing digital maturity, qualitative insights remind us of the diversity of experiences and the need for a more nuanced understanding. By embracing this complexity, TFR can facilitate discussions on how the organisation should perform in the digital age, which is dependent on many factors.

## **5.2 Objective 2 – To understand the key drivers to digital transformation adoption at TFR.**

Results from this study identify many factors impacting the adoption of digital transformation at TFR. Cichosz et al. (2020) suggests that organisations need to incorporate these factors for a successful implementation of digital transformation strategies: digital leadership; supportive organisational culture; employee and partner engagement; and aligning business and IT strategies. In addition, process optimisation and data integration, employee training and skills development, agile transformation management, and leveraging technological knowledge are also factors required (Cichosz et al., 2020).

Participants in the current study believed that the factors identified by Cichosz et al. (2020) are the key drivers of digital transformation adoption in TFR. However, the study further states additional factors including effective communication of digital transformation strategy and the progress; conducting change management; stakeholder buy-in, adequate IT infrastructure; and funding of digital transformation initiatives. These findings correlate with previous studies and support the proposition that successful digital transformation implementation can be improved by TFR leveraging their key drivers. In addition, Vogelsang et al. (2019) stresses the importance of using digital technologies such as artificial intelligence, big data analytics, and cloud computing provide organisations with

opportunities to enhance efficiency, innovation, and customer experiences, while impacting the creation of digital products/services, digital processes, and digital business models.

In conclusion, this study explores the relationship between leveraging key drivers and a successful implementation of digital transformation in organisations, particularly in TFR. While there might be other factors not mentioned in this study, the factors highlighted from literature and findings are seen as key drivers of digital transformation at TFR. By understanding these dynamics, we can develop more targeted interventions to promote the well-being of young people in the digital age. These findings provide valuable insights for management working to drive and support Transnet Freight Rail in its digital transformation journey.

### **5.3 Objective 3 – To discover the barriers to digital transformation adoption at TFR.**

This study explored the challenges and barriers to digital transformation through qualitative interviews with stakeholders from Transnet Freight Rail. Participants shared candid perspectives and detailed examples, offering a nuanced understanding of the challenges experienced in TFR. The TOE framework was used in the study to express the findings. Table 6 shows common categories found in qualitative data analysis that affect digital transformation adoption at TFR.

**Table 6: TOE factors that hinder digital transformation adoption.**

<b>Technology Factors</b>	<b>Organisational Factors</b>	<b>Environmental Factors</b>
Outdated and fragmented technology systems	Lack of digital skills	Influence of labour unions
Processes not digitally optimized	Unclear digital strategic objectives	Strict rail regulatory laws and standards
Poor IT infrastructure	Leadership turnover	
Systems not integrated	Working in silos	
No CRM system	Large population estimated at 24 000 employees	
Cybersecurity and risk management	Employees resisting technology	
Maintenance and upkeep of systems	Embedding digital culture	
	Communication – not simplified for lower levels	
	Lack of training	
	Skills retention	
	Lack of funding for DT initiatives	

The results reveal that organisational factors emerged as a significant barrier to the adoption of digital transformation at TFR, with participants citing difficulties in embedding digital culture, reluctance to adopt new technologies, lack of digital skills and unclear digital strategic objectives. According to Hess et al. (2016), Bumann and Peter (2019) organisations lack an integrated approach when

developing a digital transformation strategy and management's inadequate understanding of areas to explore while implementing digital initiatives, these statements are supported by findings in this study.

Technology factors followed closely, citing poor IT infrastructure, systems not being maintained, outdated and fragmented.

The study findings are consistent with previous studies by Töytäri et al. (2017), Vogelsang et al. (2019) and Cichosz et al. (2020), who have also found lack of skilled resources, technology adoption, resistance to change and data protection and security breaches as relevant challenges to digital transformation. The results further support the proposition that effective management of barriers and challenges is crucial for the successful implementation of digital transformation.

In conclusion, the study sheds light on the multifaceted nature of challenges and barriers to digital transformation. While difficulties in embedding digital culture, poor IT infrastructure, and lack of skilled resources pose significant barriers, understanding and addressing these challenges is essential for organizations to thrive in an increasingly digital world. By embracing the complexities of digital transformation, stakeholders can develop adaptive strategies that drive sustainable change and innovation.

#### **5.4 Implications for practice**

It is essential for management to understand what digital transformation offers organisations: the opportunity to use digital technologies to survive, maintain a competitive edge, and make changes to their business model, market approach strategy, organisational structure, and operational processes, as mentioned by (Hess et al., 2016). Management should be aware of the constraints associated with a singular approach towards digital transformation, as well as the limitations of a strategic top-down approach. Management should endorse a hybrid approach that incorporates a bottom-up approach, thereby fostering innovation and cultivating a culture of collaboration and promoting continuous improvement.

Appointing digital transformation champions in various corridors will facilitate a bottom-up approach by empowering employees to actively contribute to the organisational change. These champions, with digital skills and an understanding of corridor-specific needs, will be responsible for scaling successful initiatives across the organization, to drive meaningful transformation, leveraging the collective expertise of the workforce to achieve digital maturity.

Apart from the organisation sourcing a digital partner and lacking digital skills and resources, TFR must prioritise the development of internal digital talent while effectively attracting essential digital skills to support and deliver on the digital strategy. Given that digital transformation has no set end state, constantly measuring the performance improvements on key performance indicators (KPIs) and the digital maturity of the organisation is a must to realise its full potential.

## **5.5 Implications for research**

The study significantly advances the TOE framework by providing empirical confirmation of its applicability to the context of digital transformation adoption within Transnet Freight Rail. The study identified and analysed key drivers, challenges, and outcomes across the technology, organization, and environment dimensions, contributing to theoretical progress in understanding the intricate dynamics of digital transformation. Exploring the interactions between technology adoption, organisational characteristics, and external environmental factors, deepening the understanding of the multifaceted nature of digital transformation processes, offering both empirical evidence and theoretical insights that have significant implications for both theory and practice in the field.

Research into the adoption of digital transformation at a state-owned enterprise using a larger sample and extending it all levels of the organisation is needed to identify consistency of the results. A similar study is needed to evaluate alignments between various operating divisions in Transnet. In addition, the

inclusion of middle management as participants in the survey to assess the current digital maturity was necessary to get a different perspective.

## **5.6 Reflections on the limitations**

While efforts were made to ensure a representative sample, the sample size may not fully capture the diversity of experiences and perspectives within TFR. Furthermore, the study relied heavily on self-reported data from surveys and interviews, which may introduce response biases and affect the accuracy of the findings. Utilising a cross-sectional design, capturing data at a single point in time, this approach limits the ability to observe changes over time.

Finally, the study was confined to Transnet Freight Rail (TFR), a state-owned enterprise in South Africa. Therefore, the findings may not be generalisable to other organisations, or industries.

However, the study provides a current comprehensive understanding of TFR's digital maturity level as well as the key drivers and barriers to digital transformation adoption.

## **CHAPTER 6. CONCLUSION**

This comprehensive research study underscores the complexities associated with digital adoption within organisations. The study highlights the need of both quantitative data, which assess the digital maturity, and qualitative insights, which highlight the diversity of experiences and the need for a nuanced understanding. By embracing this complexity, Transnet Freight Rail (TFR), can perform at optimal levels and become competitive in the digital era.

Furthermore, the study investigates the vital relationship between exploiting key drivers and the successful implementation of digital transformation in TFR. While acknowledging the potential existence of other factors, the study focuses on key drivers identified in literature and findings. These factors are deemed essential for driving digital transformation at TFR, providing valuable insights for management to navigate and support the organisation on its digital transformation journey.

The study also discussed key challenges and barriers related to digital transformation. From difficulties in embedding digital culture to issues with IT infrastructure and the scarcity of skilled resources, the study emphasizes the necessity of understanding and addressing these challenges for TFR to thrive in an increasingly digital world. By acknowledging and embracing the complexities, stakeholders can develop adaptive strategies that foster sustainable change and innovation.

In conclusion, it is crucial for management to take advantage the opportunities digital transformation presents, emphasising its potential to enhance survival, maintain a competitive edge, and bring about fundamental changes in business models, market approaches, organisational structures, and operational processes. The study recommends a hybrid approach to digital transformation, combining both top-down and bottom-up strategies to encourage innovation, collaboration, and continuous improvement. Highlighting the importance of developing internal digital talent, effective recruitment of key digital skills, and

constant measurement of performance improvements through key performance indicators (KPIs). Recognising that digital transformation is an ongoing process with no set end state, the study urges TFR to continually assess and strive for improved performance to realize the full potential of digital transformation.

## **6.1 Suggestions for future research**

This study presents the key drivers and barriers to digital adoption at TFR and make suggestions for practice. Future research may take into account the following future directions to expand on the current study:

- Compare digital transformation practices and challenges across different Transnet operating divisions. This cross analysis can highlight factors that influence digital transformation outcomes in the ports, engineering, and pipeline divisions.
- Develop a comprehensive measurement framework for assessing digital maturity and performance in state-owned enterprises. This could involve refining existing models or creating new framework tailored to Transnet.
- Investigate the employee perspective on digital culture in state-owned enterprises. Developing an understanding of how employees view and adjust to digital changes can provide valuable insights for creating a digitally friendly environment.
- Comparative study with other rail logistics organisations in other countries.

## REFERENCES

- Andersson, P., Movin, S., Mähring, M., Teigland, R., & Wennberg, K. (2018). *Managing Digital Transformation*. Stockholm School of Economics Institute for Research (SIR).
- Armstrong, B., & Lee, G. J. (2021). *Digital Business* (2nd ed.). Johannesburg: Silk Route Press.
- Bekele, W. B., & Ago, F. Y. (2022). Sample Size for Interview in Qualitative Research in Social Sciences: A Guide to Novice Researchers. *Research in Educational Policy and Management*, 42-50.
- Berghaus, S., & Back, A. (2016). Stages in Digital Business Transformation: Results of an Empirical Maturity Study. *Mediterranean Conference on Information Systems*.
- Berghaus, S;. (2018, May 16). *Digital Maturity & Transformation Study*. Retrieved from Sabine Berghaus: <https://sabineberghaus.com/home/projekte/digital-maturity-transformation-study/>
- Bumann, J., & Peter, M. (2019). Action Fields of Digital Transformation - A Review and Comparative Analysis of Digital Transformation maturity Models and Frameworks. *Edition Gesowip*.
- Cichosz, M., Wallenburg, C. M., & Knemeyer, A. M. (2020). Digital transformation at logistics service providers: barriers, success factors and leading practices. *The International Journal of Logistics Management*, 209 - 238.
- Collin, J., Hiekkanen, K., Korhonen, J. J., Halén, M., Itälä, T., & Helenius, M. (2015). *It Leadership in Transition-the Impact of Digitalization on Finnish Organizations*. Aalto University publication series .

- Cresswell, J. W., & Creswell, D. J. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). Los Angeles: SAGE Publications.
- Creswell, J. W. (2007). *Qualitative inquiry and research design: Choosing among five approaches* (2nd ed.). California: Sage Publications.
- Davis, F. D. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly*, 319-340.
- Deloitte Africa. (2020). *Digital Disruption Index – South Africa*. Johannesburg: Deloitte Africa.
- Fitzgerald, M., Kruschwitz, N., Bonnet, D., & Welch, M. (2013). *Embracing Digital Technology: A New Strategic Imperative*. MIT Sloan Management Review.
- Gimpel, H., Hosseini, S., Huber, R. X., Probst, L., Röglinger, M., & Faisst, U. (2018). Structuring Digital Transformation: A Framework of Action Fields and its Application at ZEISS. *Journal of Information Technology Theory and Application*, 31 - 54.
- Gust, G., Neumann, D., Brandt, T., Ströhle, P., & Flath, C. (2017). How a Traditional Company Seeded New Analytics Capabilities. *MIS Quarterly Executive*, 216-230.
- Hess, T., Matt, C., Benlian, A., & Wiesböck, F. (2016). Options for Formulating a Digital Transformation Strategy. *MIS Quarterly Executive*, 103-119.
- Johnson, B. R., Onwuegbuzie, A. J., & Turner, L. A. (2007). Toward a Definition of Mixed Methods Research. *Journal of Mixed Methods Research*, 112-133. doi:10.1177/1558689806298224
- Kafel, T., A., W.-H., & Kusa, R. (2021). Multidimensional public sector organizations' digital maturity model. *Administratie si Management Public*, 27-40.

- Kane, G. C., Palmer, D., Phillips, A. N., Kiron, D., & Buckley, N. (2017). *Achieving Digital Maturity*. MIT Sloan Management Review and Deloitte University Press.
- Kane, G., Palmer, D., Phillips, A., Kiron, D., & Buckley, N. (2015). *Strategy, not Technology, Drives Digital Transformation*. MIT Sloan Management Review and Deloitte University.
- Kane, G., Palmer, D., Phillips, A., Kiron, D., & Buckley, N. (2018). *Coming of Age Digitally*. MIT Sloan Management Review and Deloitte Insights.
- Karimi, J., & Walter, Z. (2015). The Role of Dynamic Capabilities in Responding to Digital Disruption: A Factor-Based Study of the Newspaper Industry. *Journal of Management Information Systems*, 39-81.
- Matt, C., Hess, T., & Benlian, A. (2015). Digital Transformation Strategies. *Business and Information Systems Engineering*, 339-343.
- Oakland, J. S., & Tanner, S. (2007). Successful Change Management. *Total Quality Management*.
- Oliveira, T., & Martins, M. F. (2011). Literature Review of Information Technology Adoption Model at Firm Level. *The Electronic Journal Information Systems Evaluation*, 110-121.
- Pagani, M. (2013, June). Digital business strategy and value creation: Framing the dynamic cycle of control points. *MIS Quarterly*, 37(2), 617-632.
- Reis, J., Amorim, M., Melão, N., & Matos, P. (2018). Digital Transformation: A Literature Review and Guidelines for Future Research. *Springer International Publishing*, 411–421.
- Saunders, M. N., Lewis, P., & Thornhill, A. (2019). *RESEARCH METHODS FOR BUSINESS STUDENTS* (8th ed.). Pearson Education Limited.

- Solis, B., Lieb, R., & Szymanski, J. (2014). *The 2014 State of Digital Transformation*. Altimeter Group.
- South African Government. (2023, 02 09). *Western Cape Finance and Economic Opportunities welcomes Transnet's move towards greater private sector participation*. Retrieved 04 19, 2023, from South African Government: <https://www.gov.za/speeches/transnet%E2%80%99s-move-towards-greater-private-sector-participation-welcomed-9-feb-2023-0000>
- Svahn, F., Mathiassen, L., & Lindgren, R. (2017). Embracing digital innovation in incumbent firms: How Volvo Cars managed competing concerns. *MIS Quarterly*, 239-253.
- Töytäri, P., Turunen, T., & Klein, M. (2017). Overcoming Institutional and Capability Barriers to Smart Services. *Hawaii International Conference on System Sciences*, 1642 - 1651.
- Transnet. (2018). *Integrated Report*. Retrieved from Transnet: <https://www.transnet.net/InvestorRelations/AR2018/Transnet%20IR%202018.pdf>
- Transnet. (2022). *Freight Rail Report*. Retrieved from Transnet: <https://www.transnet.net/InvestorRelations/AR2022/Freight%20Rail%202022.pdf>
- Transnet. (2022). *Transnet Integrated Report*. Retrieved from Transnet: <https://www.transnet.net/InvestorRelations/AR2022/Transnet%20IR%202022.pdf>
- Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User Acceptance of Information Technology: Toward a Unified View. *MIS Quarterly*, 425-478.
- Vial, G. (2019). Understanding digital transformation: A review and a research agenda. *Journal of Strategic Information Systems*.

- Vogelsang, K., Packmohr, S., & Hoppe, U. (2019). Barriers to Digital Transformation in Manufacturing: Development of a Research Agenda. *Hawaii International Conference on System Sciences*, 4937 - 4946.
- Wade, M., Noronha, A., Macaulay, J., & Barbier, J. (2017). *Orcherstrating Digital Business Transformation*. Global Center for Digital Business Transformation.
- Wessel, L., Baiyere, A., Ologeanu-Taddei, R., Cha, J., & Jensen, T. (2021). Unpacking the difference between digital transformation and IT-enabled organizational transformation. *Journal of the Association for Information Systems*, 102 - 129.
- Westerman, G., Bonnet, D., & McAfee, A. (2014). Leading digital: Turning technology into business transformation. *Harvard Business Review Press*.

# APPENDIX A - Participant information letter



## Informed consent for participation in an academic research project

### Adoption of digital transformation in logistics sector: a case of a state-owned enterprise in South Africa

Dear Participant

You are herewith invited to participate in an academic research study conducted by Thandokuhle Ngcobo, a Master of Management (Digital Business) student at Wits Business School (WBS).]

The purpose of this study is to assess the current digital maturity and identify key drivers and barriers to digital transformation adoption at Transnet Freight Rail.

All your answers will be treated as confidential, and you will not be identified in any of the research reports emanating from this research.

Your participation in this study is very important to us. You may however choose not to participate, and you may also withdraw from the study at any time without any negative consequences.

Interviews will be conducted on MS Teams lasting approximately an hour at a time convenient to the participant, responses will be audio or video recorded.

The results of the study will be used for academic purposes only and, as such, will be reported in a form of a dissertation. Summary of the findings will be provided to you only on request.

Please contact my supervisor, Dr. Michael Sony at [michael.sony@wits.ac.za](mailto:michael.sony@wits.ac.za) or 0117173817 if you have any questions or comments regarding the study. Please sign below to indicate your willingness to participate in the study.

Yours sincerely

.....  
Thandokuhle Ngcobo

I ..... herewith give my consent to participate in the study.  
I have read the letter and understand my rights with regard to participating in the research.

\_\_\_\_\_  
Participant's signature

\_\_\_\_\_  
Date

# APPENDIX B - Participant agreement form



## Consent Form

**Research Title:** Digital transformation adoption in South Africa's state-owned enterprise.  
**Name of researcher:** Thandokuhle Ngcobo

I, ....., agree to participate in this research project.

I agree to the following:

**(Please circle the relevant options below)**

The research study was explained to me. I understand what this study is about.	YES	NO
I understand that I can volunteer to take part in the study	YES	NO
I agree that the interview may be audio recorded.	YES	NO
I agree that direct quotations from my interview may be used by the researcher in their research report.	YES	NO
I agree that my participation will remain anonymous (my name or other identifying data will not be used by the researcher in their research report)	YES	NO
I agree that other researchers may use the information I provide in my interview (depending on their own ethics clearance being obtained) but my name and any personal information will not be used or passed on	YES	NO

### Participant

Signature: .....

Name: .....

Date: .....

### Researcher

Signature: .....

Name: .....

Date: .....

## APPENDIX C – Research instrument

Survey to assess digital maturity - adopted from (Berghaus, Digital Maturity & Transformation Study, 2018)

<b>Years Experience</b>	e.g., 5 Years
<b>Position Grade</b>	e.g., E / D / C / B / A

Survey Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
<b>1. Customer Experience</b>					
We ensure a customer experience on all digital and non-digital platforms that delivers content that is consistent and appropriate to the platform.					
Interactions with our customers can take place via both traditional and digital channels (e.g., complaints & feedback, customer service).					
We have Customer Relationship Management (CRM) solution that manages current and potential customers					
We use the Net Promoter Score to measure customer experience and loyalty to the company					
Customer data is analysed and relevant actions are triggered automatically in real time					
We bring together customer and interaction data across multiple channels.					
<b>2. Product Innovation</b>					
We have supplemented our products and services with digital innovations.					
In recent years, we have successfully implemented new digital business ideas or business models.					
We have created underlying conditions suitable for the development of digital innovations (e.g., goals, financial/human resources, flexible schedules).					

Survey Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
We have a clearly defined innovation process for the development, evaluation and implementation of new ideas by employees and customers.					
We actively involve customers in the development of new digital innovations.					
We systematically consult our customers to improve our existing digital offerings.					
<b>3. Strategy</b>					
"Digital Business" is critically important in our overall strategy.					
We know which core competencies form the basis for our success in an increasingly digital future.					
We prioritise the advancement of digital projects.					
We understand digital transformation as the continuous strategic development of our company.					
We are perceived by competitors and experts as a driver of digital innovations.					
We purposefully and systematically advance digital innovations.					
We systematically evaluate new technologies and changes in customer behaviour to identify potential for digital innovation.					
<b>4. Organisation</b>					
Digital projects are planned and implemented across departments and functions.					
Business units dealing with customers directly (e.g., marketing, sales, customer service) have a cross-channel operational leadership.					

Survey Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
We have an "early warning" system to identify new technologies or business models relevant to us.					
We are able to respond quickly to changes in the technological or market environment.					
We have enough resources in our day-to-day operations to simultaneously advance digital innovation.					
In the area of digitisation, we maintain a partner network with external service providers, start-ups or research institutions.					
We rely on standardised, efficient processes in our cooperation with external partners.					
<b>5. Process Digitisation</b>					
We have consistently integrated digital channels (including mobile and social media) into communication and service processes.					
We have defined quality criteria and targets for digital channels that are reviewed on a regular basis.					
We base our expenditure planning for digital communication on how intensively customers use individual media.					
We regularly review our core processes for potential for improvement through digital technologies.					
We take full advantage of the latest digital opportunities to automate our routine processes.					
We base decisions on findings from data analysis (e.g., to improve communication).					
We actively use our expertise in the field of big data, for example when designing new products or business models.					
<b>6. Cooperation</b>					

Survey Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The use of digital collaboration platforms (e.g., SharePoint, MS Teams) improves the exchange of information and collaboration between departments in our company.					
Digital collaboration platforms are used in our organisation to reduce complexity and redundancy in communication.					
Our employees proactively share relevant knowledge on digital collaboration platforms in a structured manner.					
We use the exchange with external experts to develop additional knowledge in the field of digitisation.					
We have defined internal experts for digital matters, who are available as points of contact for employees or external parties.					
Our mobile infrastructure with full data access enables employees to work and collaborate on the go.					
Our company specifically uses new forms of work (e.g. coworking, mobile office) to promote creativity and exchange between employees.					
<b>7. Information Technology</b>					
We are able to tailor our digital offerings at short notice if required by our business.					
We can quickly test and modify new digital products and services based on prototypes.					
Thanks to open interfaces, we can quickly and easily connect our systems to new services, either our own or from a third party.					
We regularly update our IT infrastructure to meet changing requirements.					
Our internal IT department can ensure the deployment of digital technologies relevant to our company.					

Survey Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
In terms of technological innovations, our internal IT department proactively and competently advises the specialist departments.					
Important rules of conduct for IT security are known to employees and their compliance is regularly reviewed (e.g. external audits).					
To ensure IT operations and the availability of data, we have planned and tested measures for various threat scenarios.					
We proactively and comprehensibly explain to customers how their data is used by us.					
<b>8. Culture and Expertise</b>					
Building digital expertise is a central component in employee development.					
Function-related digital skills are an important selection criterion in the recruitment of new employees					
Our employees are familiar with our own digital products and use them themselves.					
Our managers are prepared to take risks for the existing business by implementing innovative digital solutions.					
Despite investment risks, our managers encourage the development of innovative digital solutions.					
Errors and lessons learned from failed digital projects are proactively communicated throughout the company.					
We evaluate mistakes made to improve our digital processes and solutions.					
<b>9. Transformation Management</b>					
Our company's digital transformation follows a defined strategic plan.					

Survey Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Digital transformation is managed on the basis of defined roles, responsibilities and decision-making processes.					
The goals of digital transformation are measurably defined and known within the company.					
Target attainment of all activities related to digital transformation is reviewed periodically.					
The top management level (executive management / board of directors / etc.) recognises the importance of digital business and provides appropriate resources.					
Mid-level management actively promotes change processes within the company that are necessary for digitisation.					
All managers promote their employees' personal responsibility and willingness to change in the context of digital transformation.					

## **Interview guide**

### **Preliminary information**

- **Background of the study**

The research study focuses on assessing the extent of digital technology integration and determine the drivers and barriers to digital transformation at Transnet Freight Rail.

This study aims to assist TFR stakeholders, mainly to empower the leadership to understand where TFR is in their digital transformation journey and how the barriers/challenges can be managed to maintain a competitive advantage.

- **Ethical principles**

Your participation in this study is very important to us. You may however choose not to participate, and you may also withdraw from the study at any time without any negative consequences. I want to assure you that your personal information will be kept strictly confidential. Your participation will be anonymous in the research report, and your identity will not be disclosed. The results of the study will be used for academic purposes only.

### **Questions**

#### **Introduction**

- 1) Could you please briefly introduce yourself, your current position and experience in TFR.
- 2) What is your understanding of Digital Transformation?

#### **Digital Transformation**

- 3) What is your experience with digital transformation (DT) in your department or at TFR?

- 4) Can you mention the digital technologies that are in use at TFR?
- 5) Does TFR have a digital business strategy? Is it communicated at all levels of the organisation?
- 6) What do you think is the role of TFR leadership in Digital Transformation? Is Digital Transformation part of management's KPI?
- 7) What has been the impact of digital transformation in the organisation or digital technologies adopted in improving efficiency, performance and customer experience?
- 8) In your opinion, what has been the organisational attitude towards digital transformation? The willingness of individuals and teams to embrace and implement new technologies?

### **Digital transformation – Key Drivers & Barriers**

- 9) What specific challenges and barriers did TFR face during the DT process?
- 10) How did TFR overcome these barriers?
- 11) In your opinion, does TFR have the employees with adequate digital skills to compete in the digital economy? Which initiatives are in place to upskill the employees?
- 12) Which factors do you think are important for a successful implementation of Digital Transformation in TFR?

### **Conclusion and outlook**

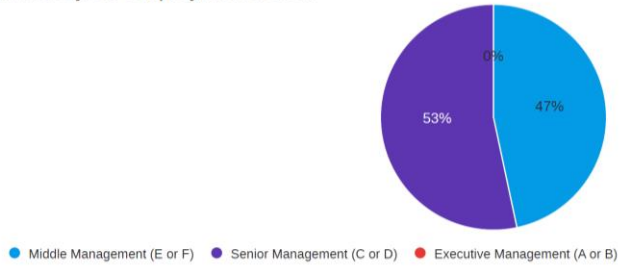
- 13) In conclusion, where do you think TFR is in their digital transformation journey and what are the major lessons learnt from implementing Digital Transformation in TFR?

# APPENDIX D – Analysis data

## Quantitative Analysis

The data below was extracted from Qualtrics XM

What is your employment level?



Number of years experience?



### Strategy.

Field	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
"Digital Business" is critically important in our overall strategy.	0	0	0	8	37
We know which core competencies form the basis for our success in an increasingly digital future.	0	2	12	26	5
We prioritise the advancement of digital projects.	2	11	14	15	3
We understand digital transformation as the continuous strategic development of our company.	1	3	13	22	6
We are perceived by competitors and experts as a driver of digital innovations.	8	16	14	7	0
We purposefully and systematically advance digital innovations.	2	10	13	19	1
We systematically evaluate new technologies and changes in customer behaviour to identify potential for digital innovation.	7	10	13	12	3

### Product Innovation

Field	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
We have supplemented our products and services with digital innovations.	4	9	13	19	0
In recent years, we have successfully implemented new digital business ideas or business models.	3	9	14	18	1
We have created underlying conditions suitable for the development of digital innovations (e.g. goals, financial/human resources, flexible schedules).	3	11	13	16	2
We have a clearly defined innovation process for the development, evaluation and implementation of new ideas by employees and customers.	7	7	16	13	2
We actively involve customers in the development of new digital innovations.	7	8	21	9	0
We actively involve customers in the development of new digital innovations.	7	8	19	10	1

## Transformation Management

Field	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Our company's digital transformation follows a defined strategic plan.	2	7	14	16	6
Digital transformation is managed on the basis of defined roles, responsibilities and decision-making processes.	2	8	13	16	6
The goals of digital transformation are measurably defined and known within the company.	2	12	15	12	4
Target attainment of all activities related to digital transformation is reviewed periodically.	3	10	17	14	1
The top management level (executive management / board of directors / supervisory board / etc.) recognises the importance of digital business and provides appropriate resources.	3	4	16	19	3
Mid-level management actively promotes change processes within the company that are necessary for digitisation.	2	5	13	19	6
All managers promote their employees' personal responsibility and willingness to change in the context of digital transformation.	3	9	14	13	6

## Organisation

Field	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Digital projects are planned and implemented across departments and functions.	2	11	13	18	1
Business units dealing with customers directly (e.g. marketing, sales, customer service) have a cross-channel operational leadership.	1	4	20	18	2
We have an "early warning" system to identify new technologies or business models relevant to us.	8	13	17	7	0
We are able to respond quickly to changes in the technological or market environment.	12	14	14	5	0
We have enough resources in our day-to-day operations to simultaneously advance digital innovation.	9	15	14	6	1
In the area of digitisation, we maintain a partner network with external service providers, start-ups or research institutions.	7	9	19	10	0
We rely on standardised, efficient processes in our cooperation with external partners.	4	11	14	15	1

## Customer Experience

Field	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
We ensure a customer experience on all digital and non-digital channels that delivers content that is consistent and appropriate to the channel.	2	9	20	14	0
Interactions with our customers can take place via both traditional and digital channels (e.g. consulting, final purchase, customer service).	2	3	16	22	2
We personalise our digital customer communications (e.g. in terms of content and frequency) according to user behaviour and available Customer Relationship Management (CRM) data.	4	1	25	14	1
We take account of the user's individual situation (e.g. time of day, current location, device used) when designing digital content.	4	5	23	13	0
We bring together customer and interaction data across multiple channels.	3	9	19	14	0
We derive insights from customer and interaction data that influences our marketing and communications activities.	5	6	20	13	1
Customer data is analysed and relevant actions are triggered automatically in real time.	8	7	16	14	0

## Process Digitisation

Field	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
We have consistently integrated digital channels (including mobile and social media) into communication and service processes.	2	6	12	21	4
We have defined quality criteria and targets for digital channels that are reviewed on a regular basis.	2	7	22	13	1
We base our expenditure planning for digital communication on how intensively customers use individual media.	4	8	23	9	1
We regularly review our core processes for potential for improvement through digital technologies.	4	5	21	14	1
We take full advantage of the latest digital opportunities to automate our routine processes.	8	12	10	11	4
We base decisions on findings from data analysis (e.g. to improve communication).	6	4	11	20	4
We actively use our expertise in the field of big data, for example when designing new products or business models.	8	7	13	13	4

## Co-operation

Field	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
The use of digital collaboration platforms (e.g. SharePoint, MS Teams) improves the exchange of information and collaboration between departments in our company.	0	1	3	18	23
Digital collaboration platforms are used in our organisation to reduce complexity and redundancy in communication.	0	6	9	18	12
Our employees proactively share relevant knowledge on digital collaboration platforms in a structured manner.	1	9	10	21	4
We use the exchange with external experts to develop additional knowledge in the field of digitisation.	6	4	19	12	4
We have defined internal experts for digital matters, who are available as points of contact for employees or external parties.	3	10	11	19	2
Our mobile infrastructure with full data access enables employees to work and collaborate on the go.	2	7	10	21	5
Our company specifically uses new forms of work (e.g. coworking, mobile office) to promote creativity and exchange between employees.	5	8	12	17	3

## Information Technology

Field	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
We are able to tailor our digital offerings at short notice if required by our business.	7	16	10	11	1
We can quickly test and modify new digital products and services based on prototypes.	7	16	12	8	2
Thanks to open interfaces, we can quickly and easily connect our systems to new services, either our own or from a third party.	4	17	12	10	2
We regularly update our IT infrastructure to meet changing requirements.	3	14	11	15	2
Our internal IT department can ensure the deployment of digital technologies relevant to our company.	1	14	7	20	3
In terms of technological innovations, our internal IT department proactively and competently advises the specialist departments.	4	9	11	19	2
Important rules of conduct for IT security are known to employees and their compliance is regularly reviewed (e.g. external audits).	0	7	11	23	4
To ensure IT operations and the availability of data, we have planned and tested measures for various threat scenarios.	0	2	17	22	4
We proactively and comprehensibly explain to customers how their data is used by us.	2	7	18	15	3

## Culture and Expertise

Field	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Building digital expertise is a central component in employee development.	4	9	10	15	7
Function-related digital skills are an important selection criterion in the recruitment of new employees.	3	7	13	18	4
Our employees are familiar with our own digital products and use them themselves.	1	10	15	17	2
Our managers are prepared to take risks for the existing business by implementing innovative digital solutions.	7	9	16	13	0
Despite investment risks, our managers encourage the development of innovative digital solutions.	6	7	14	18	0
Errors and lessons learned from failed digital projects are proactively communicated throughout the company.	8	14	13	10	0
We evaluate mistakes made to improve our digital processes and solutions.	4	9	18	14	0

The figure below shows the relationship between dimensions, calculations were done on SPSS Statistics.

	STRATEGY	TRANSFORMATION MANAGEMENT	ORGANISATION	PRODUCT INNOVATION	CUSTOMER EXPERIENCE	PROCESS DIGITISATION	COOPERATION	INFORMATION TECHNOLOGY	CULTURE AND EXPERTISE
STRATEGY	1.000								
TRANSFORMATION MANAGEMENT	0.777	1.000							
ORGANISATION	0.702	0.822	1.000						
PRODUCT INNOVATION	0.697	0.803	0.766	1.000					
CUSTOMER EXPERIENCE	0.675	0.850	0.785	0.815	1.000				
PROCESS DIGITISATION	0.813	0.849	0.810	0.783	0.881	1.000			
COOPERATION	0.630	0.723	0.730	0.715	0.793	0.809	1.000		
INFORMATION TECHNOLOGY	0.573	0.608	0.573	0.658	0.604	0.690	0.817	1.000	
CULTURE AND EXPERTISE	0.648	0.715	0.664	0.664	0.772	0.749	0.737	0.717	1.000

**Figure 15: Correlation Matrix**

## Qualitative Analysis

Thematic analysis was used to generate themes and code the responses from nine participants. The process was done using NVivo 20, with all the figures below representing the various reports generated.



Figure 16: Word cloud from all the data

	A	B	C
1	Name	Files	References
2	Digital transformation and impact on business	0	0
3	Digital business strategy	0	0
4	Communication of Strategy	0	0
12	Current Business and Digital Strategy	0	0
21	Current status of digital transformation	0	0
24	Impact of Digital technologies on Business	0	0
25	Efficiency	0	0
28	Knowledge and decisions	0	0
33	operational and performance	0	0
39	people management and learning	0	0
42	Roles and Understanding	0	0
80	Use of Digital technologies	0	0
112	Challenges and barriers	0	0
113	challenges in communication	0	0
118	Employees	0	0
123	environment and culture	0	0
124	embedding	1	2
125	politics and unpredictability	1	1
126	traditional and silos	1	1
127	deep rooted manual culture	2	2
128	technology acceptance and utilisation	3	4
129	Organisational	0	0
135	safety and risks	0	0
138	systems and infrastructure	0	0
143	Factors influencing adoption of Digital Transformation	0	0
144	Factors influencing implementation of digital transformation	0	0
145	Organisational Culture	0	0
149	Leadership	0	0
154	alignment and focus	0	0
159	change management	0	0
163	Skills and development	0	0
169	Lessons learnt from implementing Digital Transformation	0	0
183	Leadership and Employees dynamics in Digital Transformation	0	0
184	Employee skills and attributes	0	0
212	Leadership dynamics and Digital technologies	0	0
213	Digital transformation and management KPI	0	0
214	Leadership	0	0
218	Programme and projects	0	0
221	lack of standardised approach	1	1
222	customised per department	2	3
223	general management	2	2
224	Role of leadership in digital transformation	0	0
225	communication	0	0
229	Drivers	0	0
232	environment and culture	0	0
236			

Figure 17: Nodes and codes



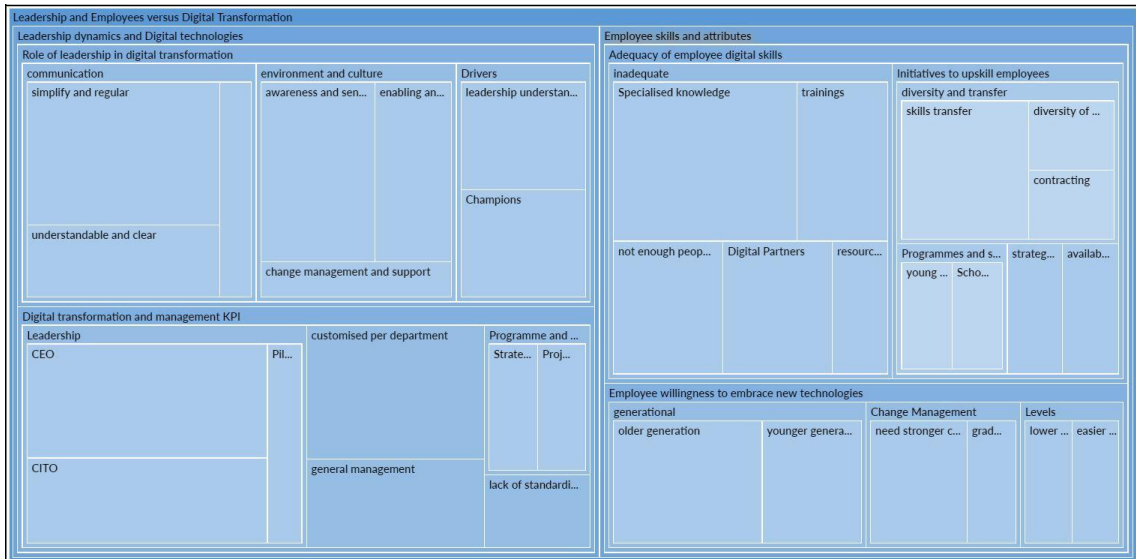


Figure 19: Hierarchy chart from Theme 2

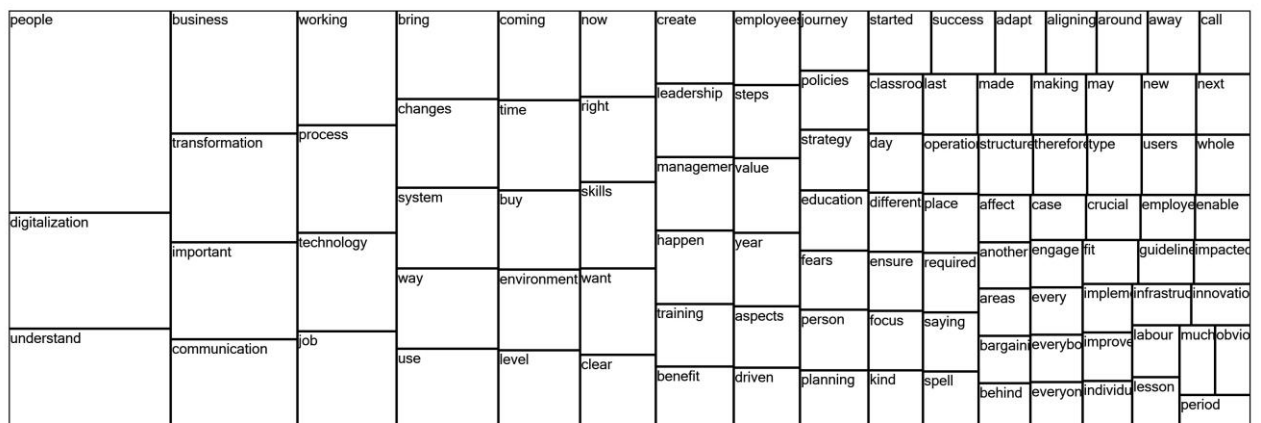


Figure 20: Tree map from Theme 3



# APPENDIX E - Ethics Clearance Certificate


Graduate School of Business Administration  
University of the Witwatersrand, Johannesburg



**Wits Business School Ethics Committee**  
Constituted under the University Human Research Ethics Committee (Non-Medical)

## Ethics Clearance Certificate

**Ethics protocol number:** WBS/DB2386710/443  
*This certificate is only valid with a legitimate ethics protocol number and signed by the Researcher (below).*

<b>Project title</b>	The adoption of digital transformation in logistics in a state-owned enterprise in South
<b>Investigator / Researcher</b>	Mr Thandokuhle Ngcobo
<b>Nature of Project</b>	MM (Digital Business)
<b>Decision of the Committee</b>	Approved, provided stakeholders and participants are guaranteed confidentiality.
<b>Issue Date of Certificate</b>	9/11/2023
<b>Expiry date</b>	Date of submission of the project / research report
<b>Chairperson</b>	Dr Pius Oba  ☎ +27 11 717 3976 ☎ +27 82 733 6587 ✉ pius.oba@wits.ac.za

---

### Declaration by Researcher

*One copy must be signed by the Researcher and returned to the Chairperson of the Wits Business School Ethics Committee.*

I fully understand the conditions under which I am authorized to carry out the abovementioned research a guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I undertake to resubmit the protocol to the Committee.

  
Signature

04/10/2023

Date:

# APPENDIX F - Permission letter from the organisation

Transnet SOC Limited  
Registration Number  
1990/000900/30

160 Lynette Str.  
Kilner Park  
Pretoria  
0186

PO Box 15912  
Lynne East  
Pretoria, 0039  
T +27 12 391 1304  
F +27 12 391 1371



## MEMORANDUM

www.transnet.net

---

**TO :**

**FROM :**

**DATE :** 17 April 2023

**SUBJECT :** REQUEST FOR PERMISSION TO CONDUCT RESEARCH IN TRANSNET FREIGHT RAIL

---

### PURPOSE:

1. The purpose of this memorandum is to request approval from the Chief Executive, Transnet Freight Rail, Sizakele Mzimela for Thandokuhle Ngcobo to conduct research in Transnet Freight Rail, as part of his research towards a Master of Management degree in the field of Digital Business, in the Wits Business School at University of the Witwatersrand.

### BACKGROUND:

2. Thandokuhle Ngcobo is currently employed in Transnet Engineering as a Senior Business Analyst, ( ) with 13 years of service at Transnet. The research topic is "*Adoption of digital transformation in logistics sector: A case of a state-owned enterprise in South Africa*". Research objectives include (1) *To assess current digital maturity level*, (2) *To identify the key drivers and barriers to digital transformation adoption in logistics SOE*, and (3) *To investigate the impact of digital transformation on organisational performance*.

3. Thandokuhle Ngcobo is a self-funded part-time student with the University of Witwatersrand and busy with master's degree Proposal for a Research module as a prerequisite to complete the degree.

### DISCUSSION:

4. Wits University ethics committee's requirement is that an approval letter from an organisation indicating that organization allows Thandokuhle Ngcobo to conduct such studies be submitted.

5. This study will be of voluntary participation and confidential information will not be divulged. Individual privacy will be maintained in all published and written data resulting from the study.

6. The information that will be provided by the employees of Transnet Freight Rail will be purely for academic purposes and cannot be used for any other purpose. The research findings will be shared with the Chief Information and Technology Officer upon the organization's request.

7. The study might benefit Transnet with the research findings and may adopt them for implementation.

Page 1 of 2

**FINANCIAL IMPLICATIONS:**

8. None.

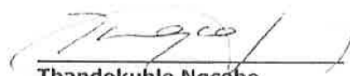
**BUDGET IMPLICATIONS:**

9. None


**RECOMMENDATIONS:**

10. It is therefore recommended that the Chief Executive approves the request for Thandokuhle Ngcobo to conduct research in Transnet Freight Rail, as part of his Master of Management: Digital Business degree.


**COMPILED BY**

  
\_\_\_\_\_  
**Thandokuhle Ngcobo**  
Snr Business Analyst  
Transnet Engineering  
Date: 17 / 04 / 2023

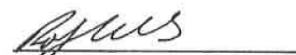
**RECOMMENDED/NOT RECOMMENDED**

  
\_\_\_\_\_  
Transnet Engineering  
Date: 19 / 04 / 2023


**RECOMMENDED/NOT RECOMMENDED**

  
\_\_\_\_\_  
Transnet Engineering  
Date: 20 / 04 / 2023

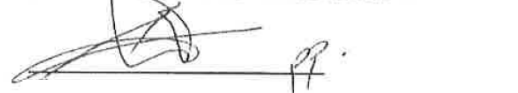

**RECOMMENDED/NOT RECOMMENDED**

  
\_\_\_\_\_  
Transnet Engineering  
Date: 2023 / 04 / 20

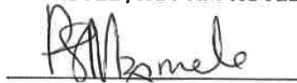
**RECOMMENDED/NOT RECOMMENDED**

  
\_\_\_\_\_  
Transnet Freight Rail  
Date: 24 / 04 / 2023

**RECOMMENDED/NOT RECOMMENDED**

  
\_\_\_\_\_  
Transnet Freight Rail  
Date: 25 / 04 / 2023 

**APPROVED/NOT APPROVED**

  
\_\_\_\_\_  
Transnet Freight Rail  
Date: 08 / 05 / 2023

## APPENDIX G – Digital Technologies currently in use

Software and systems	Supporting statements
<b>Rail operations and planning</b>	
<b>Train Execution Management System</b>	<i>'We have had OBC on board computers on locomotives we have had you, you are from Transnet Engineering. So, you would be more familiar also with the train definition units, TDUs that are found in most of the locomotives. So there for me is part of the approach that the organization had tried to come in and bring, you know, into the fold technology and technological interventions. But I must say it has been fragmented and inverted commas up until recently. But yes, the drive was there to digitize the space' (Participant3).</i>
<b>Wayside Readers</b>	<i>'So, with the wagons, for example, wagons and locomotives, some years ago we've installed what we call wayside readers. Uh, so as the wagon or the locomotive. Sorry the wagon and the locomotive will be tagged, uh, sort of a barcode tag or an ID tag. Call it an RFID. So as a wagon, with this tag passes a wayside reader, the reader will immediately send a signal to our reporting system that OK this wagon number, so and so and this locomotive number, so and so have now passed my location. So real time monitoring or tracking of where that locomotive or where that wagon is and it's made a huge, you know, improvement to the way we do things to the way we're able to plan, it's actually allowed us to even be proactive, you know when we get these early warnings about wagon being late. We can inform customers we can put together a plan B's on how do we recover or how do we minimize the impact of that train or that locomotive or that wagon being late' (Participant1)</i>

Software and systems	Supporting statements
	<p><i>'OK, if I can use track and trace as an example, where we record the movement of our assets. They are wayside readers that we have in place in the network, and they read RFID tags on the side of locomotives and wagons, we have Tritons that report in our leading locomotives that reports in the GPS position of the locomotive' (Participant8).</i></p>
<p><b>Blato Rail</b></p>	<p><i>'Blato Rail. It's more a planning tool than it is a digital tool, but I'm saying it's a digital because it's not manual utilized. It's a planning tool that they use in the coal line, so it enables the guys to just know at which mine do they need to send particular (wagon) empties. So it just put whatever input variables the number of trains maybe that needs to be ran, the number of mines and the locos that are available, the resources wagon crews and then it just produces an optimal plan for you that you actually can use to write your service and without any human intervention. So that to me is a form of a digital tool' (Participant5)</i></p>
<p><b>OBC and TDU</b></p>	<p><i>'We have had OBC on board computers on locomotives we have had you, you are from Transnet Engineering. So you would be more familiar also with the train definition units, TDUs that are found in most of the locomotives. So there for me is part of the approach that the organization had tried to come in and bring, you know, into the fold technology and technological interventions. But I must say it has been fragmented and inverted commas up until recently. But yes, the drive was there to digitize the space' (Participant3).</i></p>
<p><b>Mobile Apps</b></p>	
<p><b>People Management Apps</b></p>	<p><i>'Others would include utilization of apps for People management, where we can indicate people's pay, the salaries, people don't have to ask us or come to an office and drive long distances to see HR business partner for manual and elementary things like salary</i></p>

Software and systems	Supporting statements
	<i>statements, leave provision and applications for leave, absenteeism management in general, approval for that could go via workflow fairly quickly' (Participant4).</i>
<b>Power Apps</b>	<i>'We have power apps that we use to automate our manual forms' (Participant2).</i>
<b>Risk management</b>	<i>'We also have apps that we use, we've got an app for risk management' (Participant2).</i>
<b>Visitors Registration App</b>	<i>'We've got an app for visitors, and it was used mostly during COVID-19' (Participant2)</i>
<b>Asset Management</b>	
<b>Assets Management System (IATS)</b>	<i>'There was a big programme called Integrated Assets Management System (IATS), it's one of the programmes where we started digital transformation, that where we implemented technologies on the railway tracks, where were able to monitor the movement of trains and we are able to get it into the system and check, track and trace where the trains are. That programme had many elements to it, there were technologies that were implemented inside the trains where the drivers they would need to go in and capture the information of the train and then the trains are tagged with tags that are put with the wagons when they go through the railway lines there are readers that read the tags and we are able to pick up where the train is' (Participant6).</i>
<b>MAXIMO</b>	<i>'Maximo that we are using for rail operation and management of assets' (Participant2).</i>
<b>ROAM</b>	<i>'I have been involved in so the ones that are currently in execution is a programme that called ROAM, which is Rail Operations Asset Management programme which looks at difference streams within the business. We have got the stream of the rolling stock, which is your locos and wagons, we got crews and yards operations, and we got rail networks, so that programme</i>

Software and systems	Supporting statements
	<i>is looking at all the manually processes within those four streams and we are going to put in a solution to automate those as part of digital transformation' (Participant6).</i>
<b>Human Resources</b>	
<b>E-recruitment</b>	<p><i>'We started the digital process, but for some time now we've attempted to automate most of our labour intensive and manual systems. For example, on the recruitment is one that we all familiar with on the e-recruitment front, we've had e-recruitment for years, but there are still some of the processes that are quite heavily manual, and paper driven' (Participant4).</i></p> <p><i>'So those we have started automating those processes, where it's about how employees apply, how employees are being shortlisted and reducing the time for recruitment from 180 days to about 45 days' (Participant4).</i></p>
<b>Grievance management</b>	<i>'So, we have been engaged with those including on the ER (employee relations) front where we could track and manage the grievance management and things like that. Yes, so we've been involved with a few, obviously not all success to the same extent but we are busy with those' (Participant4).</i>
<b>Employee Self Service (ESS)</b>	<i>'The other one that I can add the mobile apps, so what we are trying to do is incorporating some of the systems into mobile applications, so that we make the life of the users easy. So that they are able to access things like your ESS (Employee Self Service) via an app, some of our customers got access to Transnet online where they can assess that via an app so that they are able to communicate with us and track their consignments' (Participant6).</i>
<b>Monitoring Systems</b>	

Software and systems	Supporting statements
<b>COMTRAC</b>	<p><i>'So TPT has a plant, which is just the tippers, the stackers as well as the stockpile area. So they've got vast equipment so that tool can just give you the stoppages in real time. How long did the stackers stop? How long did it take for it to start without filling any form of spreadsheet or paperwork? How long did the tippler stop? What was their offloading rate of this tippler? So it's called COMTRAC, so they use it quite immensely in all the TPT ports as a tool' (Participant5).</i></p>
<b>CS90</b>	<p><i>'The other tool that we have is the CS90, umm, it's communication system that was developed in 1990. It's basically a enables us to track, uh, the movement of trains and it also enable the guy to communicate between the personnel in the section and the CTC, which is the Centralized Traffic Control, umm, so that gets helps us track the movement of trains and wagons in the sections' (Participant5).</i></p> <p><i>'We have fiber in our network in our track CS90 system that reports on the movement of locomotive as it reverses it trip, there are number of hosts of other condition assessment systems and test systems, technology assessment systems like hard box detectors' (Participant8).</i></p>
<b>Vehicle identification system</b>	<p><i>'We got the VIS system which is some form of a digital system which is a vehicle identification system, it's built into a sort of compartment or systems that are planted along the network, and these readers that are attached to wagons so it can tell us when did this wagon actually pass, uh, through this reader, so that can also enable us to determine the cycle time or as input to our cycle times, because if a wagon has passed from a reader, that's in point A and reader that's in point B, you can determine the transit time between those two points through that VIS identification system' (Participant8).</i></p>

Software and systems	Supporting statements
<b>Digital technologies</b>	
<b>Big Data</b>	<p><i>'We do have a big data and we do have extremely large warehousing for that, uh, one is in Durban, I suspect TE or TPT might also be using, sharing that' (Participant4).</i></p>
<b>Cloud Computing</b>	<p><i>'Cloud computing is getting off the ground in the in TFR, some of our emails are already being stored there' (Participant4).</i></p> <p><i>'Cloud computing, those are some of the things we are getting into, we have a service provider on board now, and we have procured different modules that will enable machine learning and predictive analysis. So, we are actually in the execution stage for that we actually have a meeting this week where they will give us a brief, so we call also put together use cases that can test if this will really work for us' (Participant6).</i></p>
<b>Limited</b>	<p><i>'Not AI, we have a project called AIDA, its Artificial Intelligence, Data Analytics, we are still doing the groundwork' (Participant2).</i></p> <p><i>'So, we are still at the concept phase for AI and then for IoT we have some products that we have procured from a service provider' (Participant2).</i></p> <p><i>'Hmm, the AI, I definitely would say my knowledge, No. Umm, is it something that is being dreamt off? Even the most recent digital transformation strategy, you know, as a globular strategy that we're going out with number one and number 2, given the specification that we have had to draft on the basis of the new ITP tool. We have some element of artificial intelligence, although we are not referring to it as explicitly as that, but we've got elements of artificial intelligence built into the specifications. So that we get something out of it from that perspective. Robotics, umm, I'll need to think about it, but nothing comes to mind to honest</i></p>

Software and systems	Supporting statements
	<p><i>from a TFR perspective. I may be wrong, but I my mind doesn't leech on to anything robotics related from a TFR perspective. As things stand, no' (Participant3).</i></p> <p><i>'Some not all, some are informal, meaning it's not official business approved, for example, most of official communication with our CEO we do use AI, some of the AI tools, informally. In other words, it's not approved on the companies' platforms, but we do use that with the approval of our EXCO where we allow people to experiment and test. Some of those are very basic things like Grammarly, Read AI for meeting recordings or AI for PowerPoint presentations those are informally used. I even attended the meeting yesterday with the official tier of our Transnet meeting with the GCE and some government officials. In that meeting, I saw someone recording the meeting, not using the teams recording tool, but using Read AI for recording the meeting'(Participant4).</i></p> <p><i>'We really are limited in the fact that we still don't have officially approved AI technology in the business. And so, we are falling behind a bit there' (Participant4).</i></p>