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Chikirwa, Lloyd Michael

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A study into the identification of human factors in digital transformation in a South African rail logistics company

Student name: Lloyd Michael Chikwira

Student number (2427959)

Student email and mobile (2427959@students.wits.ac.za; 078 268 1000)

Research 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

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ABSTRACT

As world industries rapidly move towards digital transformation (DT), organisations are making concerted efforts to become more sustainable in the face of technological revolution. DT has become a compelling necessity for organisations looking for a competitive edge. However, understanding how human elements affect DT's adoption in South Africa's freight logistics industry remains largely unexplored. The investigation aimed to close this gap by inquiring into the human elements of DT, emphasising digital leadership, digital culture, digital talent, and DT relationships.

Over 180 senior management employees of Company X were surveyed. The responses were analysed, and the validity of the hypotheses was assessed utilising Statistical Package for Social Science (SPSS) Amos version 28 structural equation modelling (SEM). The results confirmed that digital leadership significantly impacted digital culture and talent. As such, digital leadership plays a central part in ensuring favourable outcomes for DT. While digital culture positively influenced DT, the same was not established for the impact of digital talent on DT. The result contradicted previous research findings and justified further study. Overall, the outcomes emphasise the value of human elements in successful DT. Consequently, organisations commencing with DT should prioritise digital leadership, culture, and talent as strategic levers for DT's success.

KEYWORDS: Digitalisation, DT, Determinants of DT, South African Rail Logistics Sector

DECLARATION

I, LLOYD MICHAEL CHIKWIRA, 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: LLOYD MICHAEL CHIKWIRA Signature: 

Signed at JOHANNESBURG

On the 28TH day of FEBRUARY 2024

DEDICATION

This research study is a dedication to my parents, wife, and children, for their steadfast support during my academic journey. I hope this achievement serves as an inspiration to them.

ACKNOWLEDGEMENTS

The research was fueled by the unfailing strength, courage, and hope the King of Kings and my Saviour, Jesus Christ, instilled in me. I am grateful to my supervisor, Professor Rene Pellissier, for guiding me through this journey. I am also thankful to Company X for opening its doors to my studies. Finally, to my awesome sister, Loreen, you were my biggest cheerleader and wisest mentor, and this journey would have been a disaster without you.

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LIST OF ACRONYMS

ACRONYM	TERM
41R	Fourth Industrial Revolution
CFA	Confirmatory Factor Analysis
DT	Digital Transformation
EU	European Union
EXCO	Executive Committee
GDP	Gross Domestic Product
GCDO	Group Chief Digital Officer
IFM	International Monetary Fund
NRI	Network Readiness Index
OD	Operating Division
SOE	State Owned Enterprise
SEM	Structural Equation Model

CHAPTER 1. INTRODUCTION

1.1 Statement of purpose

The study was a quantitative investigation of the potential human elements that contribute to a successful DT implementation in Company X, a South African state-owned enterprise (SOE).

1.2 Background of the study

The technological revolution brought innovative digital solutions (Chen et al., 2021; Vial, 2019). The global pandemic and resultant economic uncertainties accelerated the adoption of these innovative digital solutions in global rail systems and ports (Villalba, 2020). However, according to Malope et al. (2021), despite these global digital advancements, the same cannot be argued about South Africa's freight railway transport services. Carsten et al. (2020) emphasise digital technology use and uptake in every part of rail operations and process management to address the challenges faced by the industry. Moreover, the role of people is crucial and of strategic importance to ensure DT's success (Kane et al., 2019; Sousa & Rocha, 2019b).

Digitally transforming rail solutions in emerging markets like South Africa remains delayed despite the country’s recognition as one of Africa’s Network Readiness Index (NRI) leaders (Portulants Institute, 2022).

The NRI measures a country’s digital adoption level (Armstrong & Lee, 2023). Given the country’s capacity and high NRI, South Africa’s rail logistics industry has an opportunity to unlock substantial growth through adopting digital technologies.

1.2.1 *Context of digital transformation in Company X*

Company X plays the most critical and significant part of the freight logistics chain within South Africa. The company’s operations ensure the effective and efficient functioning of many key industrial supply chains (Company X, 2023).

Although the company strives to be globally competitive and create sustainable growth for the country's economy, the SOE found itself at an uncomfortable juncture (Board of Directors, 2022). Its contribution to improving freight and logistics performance, supply chain competitiveness, and other national growth and development imperatives lagged (Board of Directors, 2022). Due to the organisation's poor financial performance, infrastructure investments have been greatly limited. The company incurred an R8.7bn loss in 2021, and capital investment decreased by 16.8% in 2022. The poor financial performance weakened the freight system and posed a risk to the country's security of supply. (Board of Directors, 2022).

Hence, Company X appointed its first Group Chief Digital Officer (GCDO) in 2021 to bolster the reignition of effective customer cargo delivery utilising digital technology.

As an executive committee (EXCO) member, the GCDO was mandated to create a new group digital function required to provide strategic support in propelling the organisation to become a digital company (Board of Directors, 2022). The mandate also included coordinating all strategic DT initiatives executed in the geographically dispersed operating divisions (ODs) that support the company's digital journey (Board of Directors, 2022). In June 2023, the company adopted DT as a strategic priority to leverage digital solutions to drive efficiency (Company X, 2023).

1.3 Research problem

Despite Company X adopting DT as a strategic priority, adoption of digital technology across the South Africa rail logistics sector is slow including at Company X. Hence, the research investigated human elements on specific endogenous organisational aspects impacting digital technology adoption at Company X.

A vast body of research explores the human elements of DT that impact digital technology adoption (Al-Alawi et al., 2023; Frank et al., 2019; Guerra et al., 2023; Verhoef et al., 2021). While existing research explores the human elements of DT, limited research specifically examines these elements in a South African logistics sector. Therefore, this investigation builds upon existing research knowledge by focusing on the South African context, which might lead to different findings.

1.4 Research questions

The investigation addressed the below research questions.

1. How would leadership contribute to the DT?
2. To what extent does culture impact DT implementation?
3. How does human talent impact DT implementation?

1.5 Rationale

The potential benefits of DT for the South African freight logistics sector are widely recognised; however, successful implementation hinges on more than just technology. People design, implement, manage, and maintain digital technologies. Without humans, technology is inert. As such, their skills, attitudes, and behaviours significantly affect the effective execution of DT initiatives. The investigation focuses on understanding the critical role of leadership, culture, and human talent in ensuring the effective execution of DT initiatives within the South African freight logistics sector.

It was, therefore, imperative to examine specific human aspects such as leadership, digital culture and digital talent that could hinder or facilitate successful DT in Company X, highlighting the invaluable role of these elements in DT.

Management of Company X and the South African freight logistics sector may benefit by understanding, adopting, and leveraging influential human elements to ensure the effective execution of its DT initiatives.

Company X can develop targeted strategies to address challenges and maximise the benefits of DT. Furthermore, the investigation findings can provide valuable insights into the human aspects critical for successful DT implementation in Company X and for informing South African freight logistics sector-wide practices. Sharing the research findings with companies across the sector into how best to manage the human elements of DT might result in a more mature and practical human-centred DT industry landscape. Leveraging these insights, Company X can develop a strategic framework that guides the company's DT journey and responds effectively to ongoing technological advancements, thus ensuring that DT has strong employee support.

1.6 Delimitations of the study

The investigation centred on endogenous (internal) factors of DT within a South African freight logistics company. It examined the human aspects, specifically leadership, culture, and talent, including the challenges associated with employee support for DT in Company X. Data was collected from a single population of senior management employees of Company X via a survey over two months.

1.7 Definition of terms

Digitalisation uses digital technologies to alter processes and business models and produces alternate income streams and beneficial opportunities (Parida et al., 2019).

Digital Culture is behaviours, attributes and habits fostering DT endeavours, for example, willingness to take risks, experimental learning, customer focus, acceptance of change, flexibility, and employee autonomy (Trushkina et al., 2020).

Digital leadership is transformative leadership mixed with technology (Niu et al., 2022). It combines culture and digital competence to propel change and create value from digital technologies (Mihardjo & Sasmoko, 2019).

Digital Talent is defined by Kohtamäki et al., (2020) as digital age knowledge, skills, and the ability to use them.

Digital Transformation (DT) is the “reconfiguration of organisations' fundamental behaviour and nature, including individuals or societies. It is the sum of all organisational change efforts in response to technological change” (Armstrong & Lee, 2023, p. 10).

1.8 Assumptions

i. The respondents were honest and understood the issues engaged. This optimistic assumption encourages trust in the data collected despite the possibility of respondents answering in a manner they presume is acceptable but not necessarily honest. Anonymity was guaranteed before the participants participated in the survey to encourage honest responses. To ensure that the language was easy to understand, a pilot test was conducted with a smaller target population group before official distribution, and potential biases were addressed.

ii. Digital leadership is an ability that can be taught and acquired. The definition of leadership was provided in that specific leadership section of the survey to ensure that the participants have the same understanding.

1.9 Chapter Outline

Chapter 1 states the objective of the investigation, provides details on the research topic, research questions, problem statement, justification, study delimitations, and assumptions.

Chapter 2 summarises pertinent literature to place the upcoming research within pre-existing theoretical paradigms and highlights areas of further research.

Chapter 3 describes and justifies the research approach and data collection technique details with an emphasis on the population factors and boundaries.

Chapter 4 shows the quantitative results of the research in tabular and graphical format. Moreover, each hypothesis developed in Chapter 3 categorised the gathered research results to address the specific research questions.

Chapter 5 explains and situates Chapter 4’s results against existing literature. Furthermore, the chapter emphasises the importance and ramifications of the outcomes aligned with the study’s questions and hypotheses.

Chapter 6 gives explanation to the integration of the hypotheses outcomes and the study's inquiry. Furthermore, the data interpretation and conclusions drawn answer the research questions in Chapter 1.

CHAPTER 2. LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 Introduction

The chapter commences with a literature review synopsis and research topic details. Subsequently, the analytical framework is presented, and the hypotheses are developed. The literature review sought to contextualise the research by synthesising literature, presenting key arguments, and research findings on DT's influential factors in a rail logistics organisation. Contrary to most prior research studies that concentrated on the outcomes of DT on people, the study focused on the people variables that enable DT. The hypotheses considered the relationship between DT and its influential human factors.

2.2 Definitions of DT

There are various definitions of DT based on one's perspective (Nadkarni & Prugl, 2021). For example, DT is described as a transformation that goes beyond technology (Nadkarni & Prugl., 2021; Tabrizi et al., 2019; Verhoef et al., 2021; Vial, 2019).

Moreover, DT is referred to as a continual process used by organisations to adjust to turbulent changes by employing technology to produce novel business models, goods and solutions for their customers and markets (Vial, 2019).

Similarly, Kutnjak and Krizanic (2019) assert DT as a comprehensive reorganising of an organisation's processes, behaviours, and strategy to enable organisation-wide innovation. Armstrong and Lee (2023) define DT as a pronounced change in an organisation's form and nature resulting from aggregated organisational change efforts in response to technological change.

Taufani and Widjaja (2022) define DT in the logistics sector as the identification and assimilation of digital technology to improve organisational effectiveness, managerial abilities, and institutional management practices.

This study used definitions that consider DT as an organisational process beyond technology (Kane et al., 2019). These definitions enable Company X to understand the complexity and unpredictability of DT and its implementation beyond technology (Li, 2020; Sousa-Zomer et al., 2020).

2.3 Impact of DT on the growth of rail logistics organisations

A plethora of studies on the impact of DT confirms its value to organisations. The pandemic accelerated the digital shift, impacting traditional industries like rail logistics (Chen et al., 2021; Vial, 2019). Consequently, change is inevitable, hence, organisations must embrace DT or risk dying (Li, 2020). This rapid technological change has dramatically increased competition, requiring organisations to adapt and overcome pandemic-related challenges to survive (Apedo-Amah et al., 2020; Velikova, 2019). By offering appealing and optimised solutions, rail logistics businesses can stay relevant and competitive (Scordamaglia, 2019).

DT adoption changes how organisations fundamentally function, leading to improved performance and productivity (Llopis-Albert et al., 2021; Metselaar, 2021). Successful organisations adopt relevant technologies and adapt to change to achieve their goals and create value (Warner & Wäger, 2019). While various perspectives exist on DT's value, this research focuses on specific perspectives relevant to this research outlined below.

2.3.1 *Strategic Success Perspective*

In 2022, the top five most valuable companies were technology or technology-transformed companies (Armstrong & Lee, 2023). Authors Westerman et al. (2012), Kurz (2017), and the IMF (2019) provide evidence linking digitalisation to financial success, more surplus wealth, markups, and profits, thus supporting the idea that DT is linked to organisational success.

2.3.2 *Broad Strategic Perspective*

DT improves an organisation's capabilities to respond effectively to prevalent and rapidly changing technological and environmental changes (Armstrong & Lee, 2023). Furthermore, it increases the speed of response to market demand changes and enhances product or service quality, resulting in sustainable competitive advantages (Nazari & Musilek, 2023). Sustainable competitive advantages increase profit margins and boost the company's worth (Armstrong & Lee, 2023).

2.3.3 *Specific Strategic Perspective*

Anthony et al. (2017) and Stark (2020) argue that from a specific strategic perspective, DT transforms where organisations produce value through new business models, what they do (new goods, services, and markets), how business is done through improving processes and why they do business (social, and environmental imperatives consideration).

2.3.4 *Individual and Societal Success Perspectives*

Over the years, technological change has attracted new talent and awakened the interest of specialised professionals (Nexus Integra EN, 2023). Demand for digital skills across jobs has increased, thus affording workers attractive technology-related job opportunities and careers. Consequently, individual technological change has positive societal outcomes if correctly and responsibly appropriated (Armstrong & Lee, 2023).

2.4 Human influential factors of DT in rail logistics

Despite the various DT opportunities, many organisations struggle to accomplish the desired DT results due to emphasising technology more than other crucial factors (Frank et al., 2019). Organisations must understand the human influential factors of DT beyond technology to ensure success (Kane et al., 2019). In addition to technology, the aforementioned authors emphasise the need for organisations to adapt endogenous organisational aspects to succeed.

Similarly, numerous researchers argue that DT is more than technology and needs the support of endogenous factors such as strategic plans and people-related factors to succeed (Al-Alawi et al., 2023; Cortellazzo et al., 2019; Guerra et al., 2023; Verhoef et al., 2021). The study explored endogenous influential factors, especially the people challenge around the support of DT.

2.4.1 *Digital Leadership*

Leadership has become more complex than ever because of the significant and disruptive changes brought about by DT (Weber et al., 2022). Leadership with digital capabilities is crucial in managing this transformation process (Carlos et al., 2020). DT necessitates new effective leadership for the 4IR era, which is more complex but considerably flexible, known as digital leadership (Ford et al., 2021). This leadership is highlighted as a critical factor in enabling successful DT (Yli-Viitala et al. (2020).

DT has increased the need for digital leadership to ensure sound organisational management to navigate challenges brought about by rapid technology change (Kane et al., 2019). Digital leadership combines transformational leadership and technology use (Mihardjo & Sasmoko, 2019). Thus, to become a digitally sustainable company, businesses must recognise the importance of digital leadership in achieving commercial success (Mihardjo et al., 2019).

Accordingly, management must supplement some of their fundamental skills to navigate the digital world (Kane et al., 2019). Businesses need capable digital leadership to achieve DT (Bumman & Peter, 2019), a readiness to accept change and the essential means (Kane et al., 2019).

More often, leaders need to pay more attention to acceptable leadership fundamentals during a digital revolution. In consequence, the digital leadership traits summarised below are now more critical than ever (Kane et al.,2019).

2.4.1.1 Transformative leader and forward-thinking

Digital leaders have a clear transformational outlook and can guide the business in response to rapid technological change and trends (Klein, 2020). They make shrewd judgements to solve complex and ambiguous business problems in volatile times (Kane et al., 2019).

Digital executives understand DT drivers (Weber et al., 2022), hence drive the transformation (Zeike et al., 2019). They are forward-looking and know how technology affects business trends (Kane et al., 2019). Such leaders can spot or sense emerging digital trends before they impact the business by constantly assessing DT's risks and business possibilities (Prakasa et al., 2020). As a result, they continually question the state of DT to determine where modifications might be required (Weber et al., 2022).

2.4.1.2 Digital literacy

Understanding technology as opposed to hard-core technical skills is required from leadership and is crucial for successful DT (Kane et al., 2019). Executives must keep up with new digital advancements and emerging trends and understand how these add new value or are a threat (Effendy & Arquisola, 2022; Kane et al. 2019).

By understanding how technology works, leaders can make more informed decisions in an unpredictable environment (Anufrieva, 2022). According to Kane et al., (2019), helping business leaders become digitally literate is often easier and more effective than teaching technologists the necessary leadership skills.

2.4.1.3 Adaptability

Kane et al. (2019) state that digital leaders must be adaptable, which means they must be flexible, innovative, and open-minded. Adaptability enables leaders to adapt to environmental changes and alter direction when technological and market landscapes unexpectedly shift (Klein, 2020). A digital leader who adopts this mindset can continually update their knowledge in the face of technological advancements and prevent redundancy (Kane et al., 2019).

2.4.1.4 Visionary, communicator, and supportive

New technology drives DT, but it is only as important as the new business plans and practices it supports (Kane et al., 2019).

Before adopting any new technology, leaders must communicate the burning platform and imperatives for change (Kane et al.,2019). Capable leadership is essential to convey the vision of DT and its strategy, garner support from everyone, and appropriately allocate resources (Cortellazzo et al., 2019). Digital leadership turns the vision into reality, inspiring and getting people to follow without power (Armstrong & Lee, 2023).

However, influencing alone is not enough hence, leadership support that includes time, finances, and other resources is vital for DT initiatives (Kane et al., 2019).

2.4.1.5 Transformation ownership.

Senior management involvement and support in the transformation signals prioritisation and helps the organisation rally behind DT change (Kane et al., 2019). It becomes an organisational-wide endeavour, enabling a shift from merely implementing new technologies to becoming a more digital organisation (Kane et al., 2019). DT will likely fail when leadership delegates its responsibilities (Kane et al., 2019).

2.4.1.6 Ability to build talent.

Research conducted by MIT Sloan Management and Deloitte over five years since 2019 confirms that employee empowerment and enablement are central to digital leadership (Kane et al., 2019).

Research shows that 72% of respondents from organisations that give their employees the necessary means and chances to prosper in a digital environment reported successful digital programs (Kane et al., 2019). Likewise, 24% of respondents with no resources and opportunities reported successful digital programs (Kane et al., 2019).

DT is a bi-directional effort, hence the need for digital leaders to have the ability to foster collaboration across the organisation and consciously set up employees to flourish (Kane et al., 2019).

2.4.2 *The interplay of digital leadership, culture, and talent*

From a transformational and technological standpoint, digital leaders combine culture and talent (Amelda et al., 2021). The interplay among these factors drives change and creates value from digital technology. This 4IR era leadership nurtures the evolution of digital culture and improves workers' digital skills and competencies (Shin et al., 2023).

2.4.3 *Digital leadership's interaction with digital culture*

Researchers such as Yli-Viitala et al. (2020) established that digital leadership and culture advance DT. An organisation's digital leadership fosters a culture of continuous innovation, directly impacting DT by influencing how organisations digitally innovate (Benitez et al., 2022; Rizki et al., 2019)

While being enablers, leaders build agile, flexible, and empowering work environments for employees that support DT (Weber et al., 2022). They shift control by granting employees autonomy, increased responsibility, and decision-making power (Cheong et al., 2019; Potnuru et al., 2019). Shifting control towards employees fosters a culture of experimentation, encouraging trial-and-error learning and exploring new ideas (Weber et al., 2022).

Furthermore, these leaders promote collaborative, non-hierarchical, and diverse teams working together on shared goals (Weber et al., 2022). This teamwork-driven approach, established in the previous section as a core aspect of digital culture, drives DT. As a result, acclimatisation to digital culture is only possible with digital leadership (Araujo et al., 2021).

2.4.4 *Digital leadership's interaction with digital talent*

Organisations in the DT age need digitally adept leaders to shape the development of employee capabilities, particularly digital capabilities (Shin et al., 2023). Researchers confirm that interaction between digital leadership and organisational and employee aptitudes exists (El Sawy et al., 2020).

Employee competencies reinforce the importance of these leaders on digital processes, products, and services (Shin et al., 2023). As a mentor, the digital leader makes a concerted effort to identify and understand their employees' strengths and shortcomings in the digital era (Weber et al., 2022). Leaders can support employees by providing adequate training and rotating employees to learn and collaborate with other co-workers (Weber et al., 2022). Employees frequently lack the time and expertise to learn new working methods, so giving them time and space to adapt is vital.

Likewise, this ensures that the essential learning is manageable in addition to their job commitments (Kane et al., 2019). In addition to adopting strategies to deal with DT, digital leaders must have a coherent workforce reskilling strategy to meet the needs of DT (Kane et al., 2019). Expecting employees to engage in new processes from adopting new technology without equipping them will lead to DT failure (Kane et al., 2019). Hence, empowerment and enabling workers to execute novel initiatives are fundamental to good digital leadership.

2.4.5 *Digital Culture*

Tortorella et al. (2020) define digital culture as organisations' elementary guidelines and beliefs to solve various endogenous and exogenous issues regarding Industry 4.0. Digital culture is described as attributes that enhance DT endeavours and it is crucial in driving DT in organisations (Tulip, 2023). These attributes include the will to take risks, experimental learning, customer focus, change acceptance, agility, innovation, and employee freedom (Teichert, 2019). Therefore, organisations must develop an atmosphere where these attributes flourish. The complexity and impact of DT generally require a significant restoration in the mentality and behaviour of the organisation (Nexus Integra EN, 2023). However, when organisational processes are inadequate, and employees lack the necessary ethos to change, DT will accentuate those issues. To adapt, organisations must fundamentally alter how business is run, be open to cultural change, and re-evaluate the status quo (Tabrizi et al., 2019).

A digital culture better equips employees to collaborate, innovate, and offer customers access to goods, services, and support via digital technologies. Moreover, these organisations strongly emphasise ongoing learning, flexibility, and good communication. (Martínez Caro et al., 2020; Tulip, 2023). Effective and seamless communication between the organisation's managerial and non-managerial levels is critical to DT (Bag et al., 2021). Effective communication is essential and was identified as a key attribute of leadership in the prior section (Blanka et al., 2022).

According to Rehman et al., (2019), an innovative culture encourages learning from past mistakes while emphasising the future with novel concepts, risk tactics, and innovation that would otherwise be disregarded. It is fluid, adaptable and has an external focus (Viltard & Acebo, 2020).

Kane et al. (2019) suggest failing forward, which is rewarding learning that comes with unsuccessful efforts to actively encourage a culture of experimentation. Seeking unconventional paths to the ideal, adopting a positive outlook when responding to unfamiliar challenges, persistence, and nurturing the belief of endless possibilities are examples of good practices that innovative cultures observe (Viltard & Acebo, 2020). Furthermore, these are examples of innovative cultural practices for adjusting and countering a volatile environment (Al-Khatib et al., 2021).

2.4.6 *People: Digital Talent*

Businesses need flexible, adaptable, and ultimately human systems to survive in an ever-changing world (Nazari & Musilek, 2023).

Kane et al. (2019) emphasise the criticality of understanding the potential of technology to transform organisations but assert that leadership and people remain the biggest challenges of DT. Digital talent and capabilities are crucial to developing strategies and execution and addressing the challenges and opportunities associated with DT (Nazari & Musilek, 2023).

DT occurs using computers; therefore, organisations must employ computer-skilled employees to carry it out. Knowledge, skills, and their ability to be used in specific situations becomes crucial to DT (Kohtamäki et al., 2020). DT's strategic importance has changed organisations' distribution and scope of capabilities. Before the digital world, relevant low-level employees regularly interacted with digital technologies, but now executives regularly encounter similar technologies (Martínez Caro et al., 2020).

Sousa and Rocha's (2019b) research confirms that organisations should be conscious of the criticality of people and their capabilities in DT. Accepting human capital as a critical actor in DT that conveys digital capabilities and how to use them changes their roles (Cetindamar et al., 2021; Vial, 2019). Organisations must take advantage of this digital mindset to strategically invest in digital talent. They must develop strategies to deal with DT but also require a well-rounded workforce reskilling strategy (Kane et al., 2019). As interest in digital skills, such as digital literacy, continues to grow, its importance cannot be ignored (Forster, 2019). Businesses that depend on competent staff to be competitive in the digital age are significantly affected by digital literacy skills (Farrell et al., 2021).

A digitally enabled workforce will achieve the most significant digital breakthroughs and differentiation (Villalba, 2020). DT's instant and total impact on an organisation has extended the variety of competencies. Therefore, businesses must be creative and innovative, move with agility and think differently as technologies are no longer a sustainable competitive advantage (Kane et al., 2019). This can only be done with the right talent in place. Thus, the need for digital skills has become a critical dynamic capability for DT in organisations (Cetindamar et al., 2021).

Organisations must act strategically to attract and retain that talent to make this transformation possible. The inability to draw and keep digital talent is a critical risk of technological disruption (Kane et al., 2019). South African logistics companies must endeavour to attract and retain employees across all levels with the relevant digital skills to make DT a reality. Therefore, competent talent is significant in addressing railway freight challenges through the latest digital technologies (Carsten et al., 2020).

2.5 Analytical Framework

2.5.1 *Theoretical Framework*

The study adopted Teece et al.'s (1997; 2007; 2012) dynamic capabilities framework as a lens to explore DT and the human factors required for successful DT in a South African freight logistics company.

Teece (2012) referred to redeploying and repurposing capabilities to achieve new forms of competitiveness as dynamic capabilities. *Dynamic* is the capability to refresh skills and knowledge to establish alignment with a shifting landscape (Armstrong & Lee, 2023). Innovative reallocation of capabilities is crucial when technological change is rapid and agility and responsiveness to this technological change are required (Armstrong & Lee, 2023). *Capabilities* “emphasise strategic management's intentional nature and role to adequately transform, combine, and reshape internal and external organisational skills, resources, and functional competencies to meet the changing external environment's requirements” (Armstrong & Lee, 2023, p. 250). The theoretical framework has three critical characteristics namely sensing, seizing, and transformation as known as reconfiguration capabilities.

The framework was chosen because DT, at its core, is about adapting to a constantly evolving digital landscape. The dynamic capabilities theory emphasises an organisation's ability to be adaptable, which is necessary for DT. Hence, the framework is good fit for studying this phenomenon. Moreover, acclimation to technological change has frequently been researched through a dynamic capabilities’ perspective (Teece, 2007; Warner & Wäger, 2019).

Given the significant continued impact that digital technologies have on organisational outcomes, dynamic capabilities offer a consistent framework for its evaluation (Warner & Wäger, 2019). DT maintenance of dynamic capabilities necessitates acquiring, motivating, and deploying resources and capabilities (Teece, 2011).

DT transforms where organisations produce value, what they do, how business is done and why they do business (Stark, 2020) to be competitive. Teece (2010b) emphasised that dynamic capabilities are in an organisation's beliefs, culture, and collective capacity to implement these changes swiftly.

In this study, focus is placed on the later evolution of the framework (Teece et al., 2012). Figure 1 highlights three critical characteristics of the framework: sensing, seizing, and transformation or reconfiguration capabilities, which are emphasised explicitly from a DT perspective.

2.5.1.1 Digital Sensing

Drawing from Teece (2014), digital sensing refers to digital leadership identifying and assessing an opportunity or threat if the organisation does not adapt. Its purpose is to identify and shape new opportunities through continual search and exploration of different technologies and markets (Teece, 2007).

Digital leadership builds knowledge about DT technologies, keeps up with new digital advancements and emerging trends and understands how the business can capitalise on them (Fatorachian & Kazemi, 2021; Kane et al., 2019).

Organisations need employees who can spot digital trends affecting their industry to advance in the digital age (Kane et al, 2019). Employees with a digital mindset are more likely to be aware of new technologies, evolving customer needs, and innovative industry practices (Cetindamar et al., 2021). This awareness allows the company to sense both digital threats and opportunities. Therefore, leaders must prioritise training programs that teach employees to identify these trends. This proactive approach allows organisations to sense and respond effectively to efficiency-enhancing technologies in a culture that embraces new ideas and technologies.

2.5.1.2 Digital Seizing

Teece (2012) argues that digital seizing entails resource mobilisation by digital leaders to capitalise on a new opportunity and maximise its value to attain a competitive advantage. To seize capabilities, the organisation must sustain and exploit new possibilities (Teece, 2012). Organisations sense possibilities but do not capture the value for various reasons, including lack of commitment, fear of taking risks and financial constraints (Teece, 2007).

Commitment, risk acceptance, experimental learning, change acceptance, agility, innovation, and employee freedom are attributes of digital culture (Teichert, 2019). Digital cultures with such characteristics are more likely to succeed in embracing change and seizing new opportunities emanating from DT (Teece, 2007). A culture that values innovation, collaboration, and experimentation encourages employees to explore and develop new digital solutions, accelerating the process of seizing digital opportunities (Al-Khatib et al., 2021).

Therefore, digital leaders can champion and drive DT initiatives by fostering a culture that embraces these crucial attributes. It should also be noted that new competencies are required resulting from active employee participation in seizing digital opportunities (Kohtamäki et al., 2020; Martínez Caro et al., 2020). Therefore, cultural alignment as well as top talent (digital talent in this context) are crucial in seizing (Teece, 2019).

2.5.1.3 Digital Reconfiguration

Digital reconfiguration also known as transforming refers to the ongoing regeneration of the organisation with DT in mind (Daniel et al., 2022). Transforming capabilities relies heavily on management leadership skills (Teece, 2019). Therefore, to keep ahead of the competition, digital leaders must continually upgrade the organisation's capabilities (Teece, 2019).

The reconfiguration of resources to capitalise on new opportunities arising from DT is supported by digital talent. This is because digital talent possesses the skills and knowledge to utilise digital technologies to improve operations and collaboration (Warner & Wäger, 2019). Thus, the need for digital skills has become a critical dynamic capability for DT in organisations (Cetindamar et al., 2021).

Where an organisation encourages a culture of continuous learning and provides opportunities for employees to develop digital capabilities, employees will more readily adapt to the new digital tools and processes introduced by DT (Benitez et al., 2022). Employees become more receptive to learning new skills and taking on new roles needed for the transformation process.

A digital culture promotes agility and adaptability, allowing the efficient prioritisation and reallocation of resources to support DT initiatives.

Strong leadership commitment to DT not only enhances the organisation's sensing, seizing, and reconfiguration but also creates a positive influence on digital culture and digital talent. This leadership commitment helps firms sense and seize digital opportunities and reconfigure necessary resources to support DT endeavours. From the above sensing, seizing and reconfiguration perspective, the following hypotheses were developed:

2.5.2 *Hypothesis 1: Digital leadership positively influences digital culture*

2.5.3 *Hypothesis 2: Digital leadership positively influences digital talent*

2.5.4 *Hypothesis 3: Digital culture positively impacts DT*

2.5.5 *Hypothesis 4: Digital talent positively impacts DT*

2.5.6 *Conceptual Framework*

Based on the dynamic capabilities model, *figure 2* depicts the key variables studied and their relationship with DT. The individual variables were measured using the indicators defined in the survey.

2.6 Literature Review Conclusion

While literature review revealed considerable research on the value derived from DT by organisations and its influencing factors beyond technology, this study focussed on the human elements.

Three research questions were developed to understand how human factors support DT in a South African logistics organisation. A conceptual framework shown in Figure 2 depicting key variables to be studied was created from the dynamic capabilities framework and literature review. Finally, the following list of hypotheses was deduced from the dynamic capability theory.

2.6.1 *Hypothesis* 1: *Digital leadership positively impacts digital culture*

2.6.2 *Hypothesis 2: Digital leadership positively impacts digital talent*

2.6.3 *Hypothesis 3: Digital culture positively impacts DT*

2.6.4 *Hypothesis 4: Digital talent positively impacts DT*

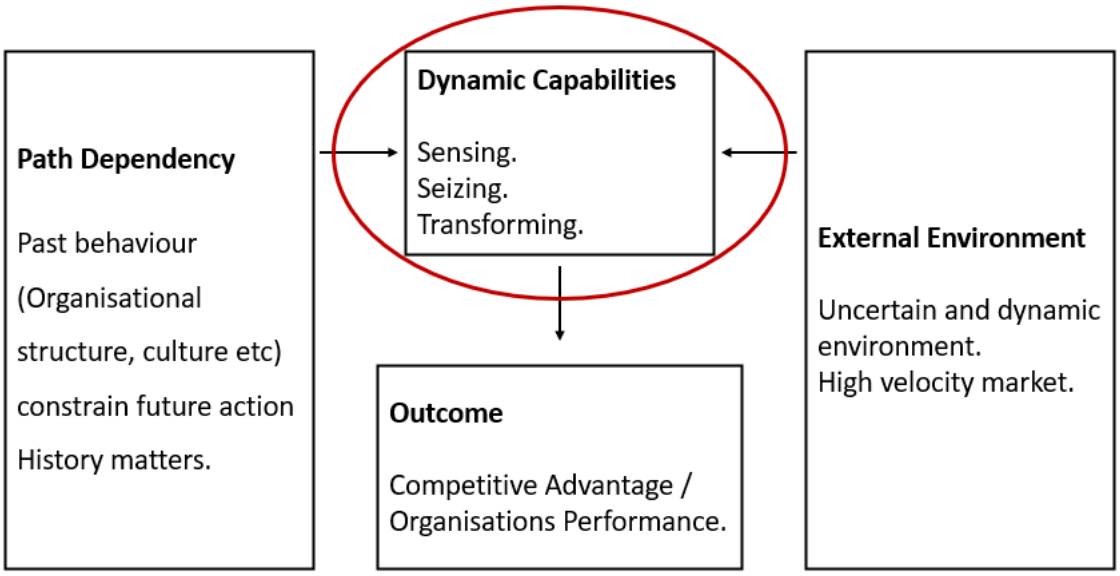


Figure 1: The Dynamic Capabilities Framework

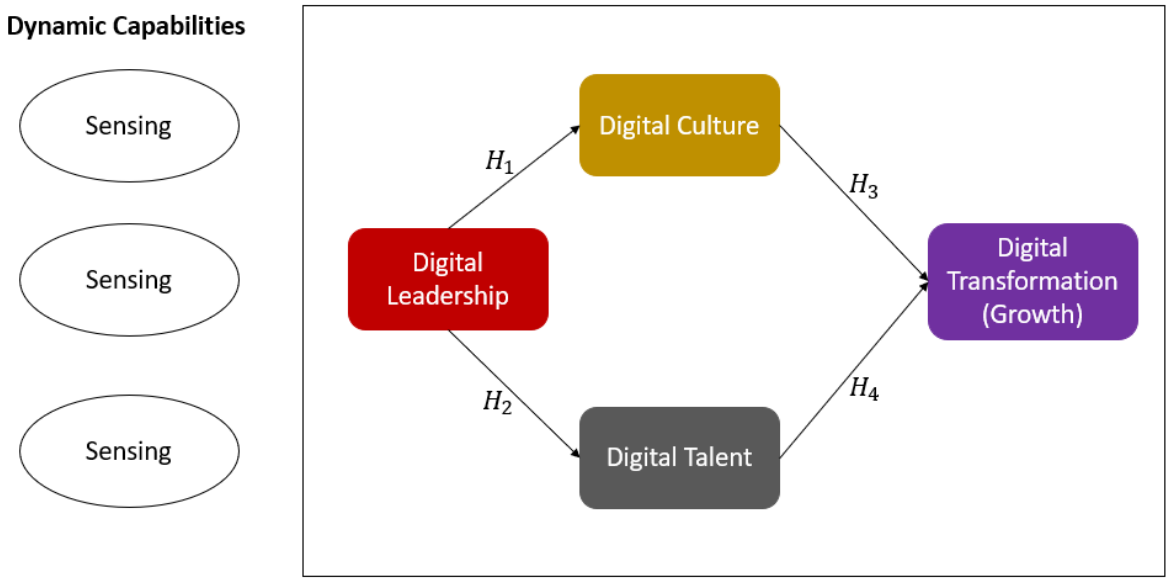


Figure 2: Proposed Conceptual Framework

CHAPTER 3. RESEARCH METHODOLOGY

3.1 Introduction

The research approach is explained in this chapter, specifically how use data to test the hypotheses and verify factors influencing DT outlined in the literature section. Furthermore, the research design, collection of data, and sampling, including data evaluation and interpretation are explained. Finally, the quality assurance section critically discusses methodologies used to deal with issues of how reliable and valid the results of the research were.

3.2 Research approach

This research adopts the post-positivist worldview, which is mediated by human perception and interpretation, enabling and assuming the objective measurement of reality through a quantitative study (Creswell, 2009; Taguchi, 2018).

Accordingly, the researcher should remain neutral by acknowledging their biases and subjectivity and approach the truth objectively through critical inquiry (Creswell, 2009). Post-positivism recognises the part the researcher plays in moulding research outcomes through data, evidence, and rationale. Additionally, post-positivism draws from the social constructionist view of the researcher's part within the study (Fox, 2008).

The author's experiences, biases, and knowledge of the organisation were brought into the study as the author was an employee of Company X.

Furthermore, post-positivism allows various perspectives and interpretations of reality while realising its limitations (Bryman, 2016).

The research questions developed identified and assessed factors influencing DT, aligning with the post-positivist deterministic perspective of assuming that causes probably determine outputs or results (Park et al., 2020). The study developed ideas into small discrete variables like post-positivism's reductionistic nature. Hence, statistical and hypothesis testing could analyse the data collected.

3.3 Research design

In line with the research approach, the cross-sectional survey design was utilised, which allowed data to be collected at a specific time from a sample of the organisation's management population (Field & Hole, 2003). Considering the large size and dispersion of the target audience across the organisation's geographic footprint, this survey design was an economic tool of choice (Sue & Ritter, 2011). The survey was administered over two months.

Specific questions were designed to collect data on each stated hypothesis to answer each research question (Babbie, 1990). Data collection via an online questionnaire was quick, cost-effective, and completed at the respondents' convenience (Creswell, 2009). More importantly, the anonymity of respondents was maintained, which may have fostered honesty in responses (Marshall & Rossman, 2011).

3.4 Data collection method

Data was gathered via an online questionnaire as a primary research tool administered to the target population via email. The questionnaire specified descriptive questions followed by inferential questions relating to exogenous and endogenous variables. Basic and inferential analysis were applied to the data gathered for each research question via predetermined closed questions.

3.5 Population and sample

The target population was the organisation's management employees. A single population was used for this study. Sections 3.5.1 and 3.5.2 provide a comprehensive discussion of the target population and sample sizes, respectively.

3.5.1 *Population*

The target population size was 374 senior management employees stratified based on their grade levels of A to C. See Table 1 for the population stratum sizes. Level A are senior leaders within Company X including the Group Chief Executive (GCE) and Digital Officer. Levels B and C are general managers and executive managers, respectively. The target population was chosen due to the strategic part they play in the company. These employees drive the achievement of the organisation's strategic outcomes.

3.5.2 *Sample and sampling procedures*

A stratification sampling procedure was utilised to choose participants for the study. The researcher ensured that specific characteristics of participants, i.e., all management levels, are represented in the sample stratum and that the sample reflects the actual proportion of the population of individuals at all management levels (Fowler, 2002). Individuals were chosen using random tables (Gravetter & Wallnau, 2000) from an Excel database provided by the company's people management department. For data analysis and stratification purposes, completing a demographic section was a prerequisite for the questionnaire. Table 1 depicts the required total sample size of 190 calculated using a 95% confidence interval, 5% margin of error and 50% anticipated response rate (Bryman, 2016; Sample size calculator, 2023).

Table 1: Population and Sample Size

Population Stratum	Population Size	Sample Size Calculation	Sample Size
Grade A	25	$(25/374) \times 190$	13
Grade B	111	$(111/374) \times 190$	56
Grade C	238	$(238/374) \times 190$	121
Total	**374**	**190**	**190**

3.6 The research instrument.

An online questionnaire developed for the investigation was utilised to collect data. Qualtrics created, disseminated the online questionnaire, and generated the results. A rating scale with strongly disagree to strongly agree as extremes was used on the majority of the questions. At least three indicators were assigned to constructs to avoid recognition issues (Hair et al., 2019).

The survey was initially tested on a small group of management employees deemed experts and adjusted based on feedback before final distribution to the target population. This was done to ensure relevance and effectiveness of the instrument. See Table 2 for the constructs, source, description, and questions used. See also Appendix A, B, and C for the cover letter and the instrument.

3.7 Data collection procedure

Salant and Dillman's (1994) four-step approach was used to administer the online questionnaire. The first step was an advance email informing participants of the study, the selection rationale, and the upcoming online questionnaire.

Secondly, an email was sent with the web-based questionnaire link. A third email was administered to all specified management employees, reminding them of the upcoming deadline for doing the survey. The fourth email was a personalised email and the questionnaire to all non-respondents a week after the third email. Email intervals were adjusted according to the rate of response.

Table 2: Table of Constructs

Construct	Source	Description	Closed ended Statements
Digital Leadership	Mihardjo & Sasmoko, (2019); Niu et al., (2022)	A transformative leadership mixed with technology that combines culture and digital competence to propel change and create value from digital technologies.	1. There is defined, accountable leadership for digital transformation in the organisation.
			2. Digital transformation is one of leadership's top strategic priorities of the organisation.
			3. There is strong organization-wide coordination for digital transformation led from leadership.
			4. Leadership shares a common vision of the digital future of our organisation and the digital transformation journey to get there.
Digital Culture	Trushkina et al., (2020)	Behaviours, attributes, and habits fostering DT endeavours, for example, willingness to take risks, experimental learning, customer focus, acceptance of change, flexibility, and employee autonomy.	1. The culture of digital innovation and change takes part as a natural process.
			2. There is a clear orientation to digital technology changes inside the company's culture.
			3. We involve customers in our innovation processes.
			4. The teams collaborate cross functionally across operating divisions in innovation and digital transformation initiatives.
			5. There is no bureaucracy in submitting innovative ideas.
			6. We accept risk and tolerate failure in the pursuit of innovation and transformation
Digital Talent	Kohtamäki et al., (2020)	Digital age knowledge, skills, and the ability to use them.	1. We understand the role of digital skills in our organisation.
			2. We actively recruit and appoint new talent with strong digital skills.
			3. Strong digital skills are embedded throughout the organisation in strategic areas and programs.
			4. Our employees have basic digital literacy skills to enable them to participate in organisational digital activities.
			5. Digital upskilling/reskilling is a top priority for our organisation.
DT Value (Growth)	Armstrong & Lee, (2023)	The reconfiguration of organisations' fundamental behaviour and nature. It is the sum of all organisational change efforts in response to technological change	1. Digital transformation can assist the organisation to be more successful.
			2. Digital transformation enhances the organisation's profitability.
			3. Digital transformation fosters higher organisational productivity.
			4. Digital transformation can assist our organisation to be more innovative.

3.8 Data evaluation strategies and interpretation

The number of respondents and non-respondents was tallied and reported. Descriptive analysis was used on the data gathered. Measures of location and dispersion were calculated as part of the basic statistical analysis.

SPSS Amos 28 was employed to facilitate statistical conclusions from the sample data to the population by testing the stated hypotheses. Confirmatory factor analysis (CFA) was employed to explore and depict the relationships among the measurement variables. Due to causality being a concern, structural equation modelling (SEM) determined the impact of predictor variables on outcome variables. The hypotheses results and overall ramifications were interpreted. Hypotheses outlined in the beginning were supported or rejected based on the conclusions drawn (Creswell, 2009).

The below is a list of steps followed to analyse the data:

i. **Data cleaning**
    - Missing cases were removed.

ii. **Confirmatory Factor Analysis was conducted (Measurement Model Assessment)**
    - Examined factor loadings (factors loading < 0.4 filtered)
    - Assessed model fit.
    - Improved model fit by respecifying the model.
    - Conducted indicator factor reliability.
    - Determined variable correlations.
    - Conducted model reliability assessment (AVE).

- Conducted model validity assessment (HTMT – preferred over Fornell and Larcker Criterion).
- Assessed final measurement model for Normality and Outliers.

iii. **Structural Model Assessment**

- Conducted multicollinearity assessment on final measurement model
- Assessed model fit.
- Significance of relationships assessed via bootstrapping (p-values)
    - P-value < 0.05 means significant results and the alternate hypothesis (H_a) is confirmed
- Estimated path coefficients
- Assessed explanatory power (R-square)

3.9 Quality assurance

The concepts of model validity and reliability, including external validity (i.e., generalisability), were discussed in this section.

3.9.1 *External validity*

Company X recently had a leadership change. The leadership change brought a transformative change, providing unique characteristic settings for the participants. State ownership of the company and time specificity of the results further added to the unique setting.

Considering the above, results can be generalised to South African freight logistics companies with similar settings as Company X. Additional studies in new settings or at later times need to be replicated to check if similar results are attained (Crewell, 2008; Reichardt & Mark, 1998; Shadish et al., 2002).

3.9.2 *Internal validity*

As DT's process custodian, the organisation's digital team predisposes the individuals to specific outcomes. The participants were randomly selected to ensure that these characteristics had the probability of being equally distributed among the sample group (Creswell, 2009). Following Crewell (2008), Reichardt & Mark (1998) and Shadish et al. (2002), a larger sample was recruited to compensate for possible study dropouts, as their outcomes were unknown.

3.9.3 *Construct validity (Convergent & Discriminant)*

Construct validity was determined by assessing both the convergent and discriminant validity. Convergent validity was measured by multiple-item correlations within a construct that agree and the degree of distinction among unobserved variables (Hair et al.,2019). The indicator average variance extracted (AVE) values should exceed the requirement of 0.5 (Hair et al.,2019; Huang et al., 2013). Discriminant validity was also evaluated by assessing the unique representation of items of a construct in comparison to the degree of association of the construct items to the other construct items in the model using the heterotrait monotrait ratio of correlations (HTMT) (Hair et al., 2019). Ideal HTMT values must be less than 0.85 (Hair et al., 2019).

3.9.4 *Reliability*

Scales tested in previous studies were used to ensure instrument reliability. In addition, multi-item scales with more than three questions on each latent variable were developed (Creswell, 2009).

Firstly, indicator reliability was established by squaring the indicator loadings (Hair et al., 2022). Hair et al., (2022) suggests that indicator above 0.4 as acceptable. Construct reliability checks were then determined using the Cronbach alpha statistic, composite reliability (CR) and maximal reliability (MaxR(H)) (Hair et al., 2022). Cronbach alpha and CR coefficients greater or equal to 0.7 are recommended for an ideal research instrument (Streiner, 2003).

3.10 Ethical considerations

Data gathering and analysis were conducted after receiving ethical approval from Company X and the University's ethics committee. See Appendix D and E for the approvals.

Voluntary participation, rights to withdraw and anonymity were explained to the participants. Furthermore, participants were briefed on the confidentiality upheld and a contact person should they feel the research study was unethical. This information was contained in the participant information sheet in Appendix B. All laws that control data access and use in South Africa were adhered to.

Table 3: Consistency Table: Research questions, Hypotheses, Data collection and Data analysis

RQ #	Research Question	Hyp #	Hypotheses	Data collection detail	Data analysis method
1	How would leadership contribute to the DT?	1	Digital leadership positively influences digital culture	Questionnaire Likert statement. Section 2: Q1 to Q5	1. Descriptive Statistics 2. Confirmatory Factor Analysis 3. Structural Equation Modelling
		2	Digital leadership positively influences digital talent	Questionnaire Likert statement. Section 4: Q1 to Q5	
2	To what extent does culture impact DT implementation?	3	Digital culture positively influences DT	Questionnaire Likert statement. Section 3: Q1 to Q6	
3	What are the human talent attributes required for DT implementation?	4	Digital talent positively influences DT	Questionnaire Likert statement. Section 4: Q1 to Q5	

CHAPTER 4. PRESENTATION OF RESULTS

4.1 Introduction

The chapter delves into presenting and describing the quantitative outcomes of the research. The aggregated outcomes were categorised by each hypothesis shown in Table 3 of Chapter 3 to address the specific study questions. Furthermore, the outcomes of the hypotheses were presented and described using tables and graphs.

A 26-item Likert scale questionnaire comprising of items obtained from various scales in literature was used for data collection. The questions covered demographic, digital leadership, digital culture, digital talent, and DT sections. See the sample questionnaire in Appendix C. New variables were derived from the mean of the relevant scale items after the items' reliability and validity were achieved. Normality and outlier assessments were completed to select suitable statistical methods for the structural model assessment.

4.2 Basic Statistics

Two hundred and two responses were collected from willing employees across the management levels.

As shown in Table 4, Grade A had the lowest response rate per sample strata of 54%, followed by Grade B with a 95% response rate. Grade C had the highest response rate of 101%.

A similar response pattern as stated above is depicted in Figure 3 of the total valid responses. Executive Managers (Grade C), General Managers (Grade B), and Group Executives (Grade A) had responses of 67%, 29% and 4%, respectively. 79.7% of participants had 20 years or less of managerial experience at Company X, while approximately 20% had more than 20 years of experience.

Table 4: Demographics, Sample Size and Responses

Demographics		**Sample Size**	**Responses**	**Percentage (%) Response Rate**
Management Level	Grade A	13	7	54
	Grade B	56	53	95
	Grade C	121	123	101.7
	Total	**190**	**183**	**96.3**
Total Responses		**202**	**183**	**91**
Management Years at the Organisation	1 - 10		74	40.4
	11 - 20		72	39.3
	21 - 30		34	18.6
	30 - 40		3	1.6
	Total		**183**	**100**

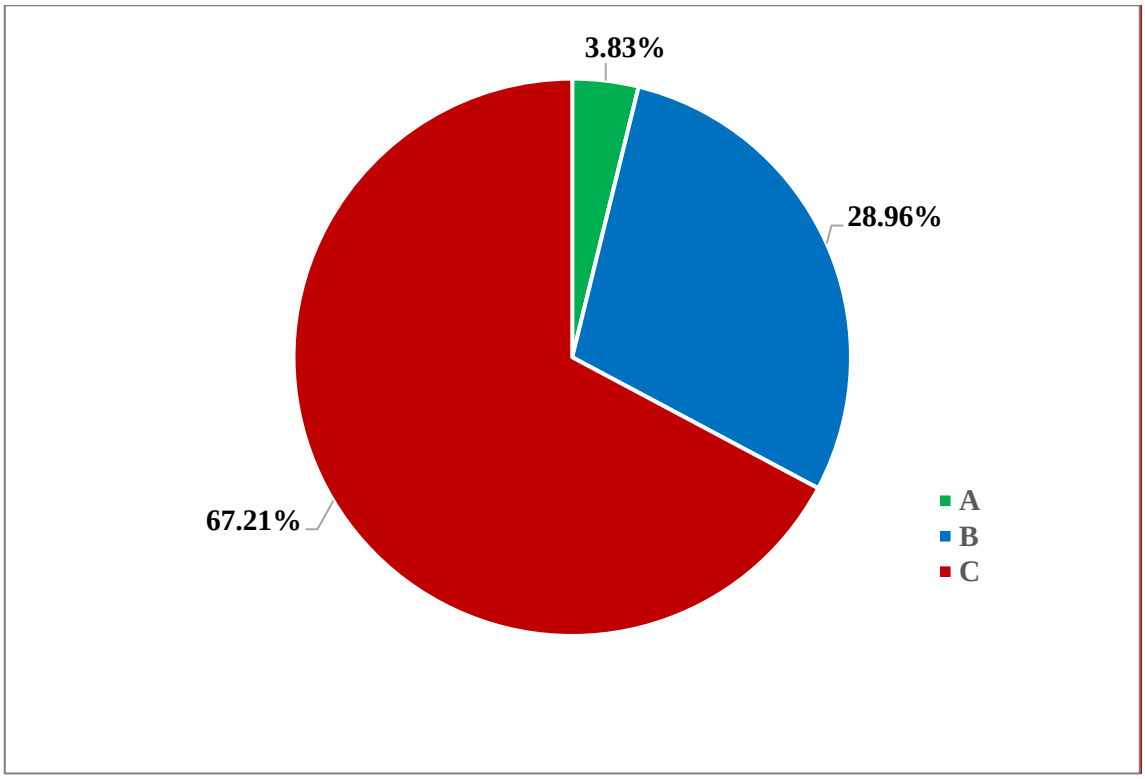


Figure 3: Total Percentage Responses by Management Level

Figure 4 and Table 5 provide the variable and indicator average response scores. Digital leadership had the highest variable score of 4.654, and digital culture had the lowest score of 3.661.

Moreover, OG1 achieved the top score of 6.69, and DT3 scored the least (3.37) among the indicator responses. See Appendix F for the OG1 and DT3's responses.

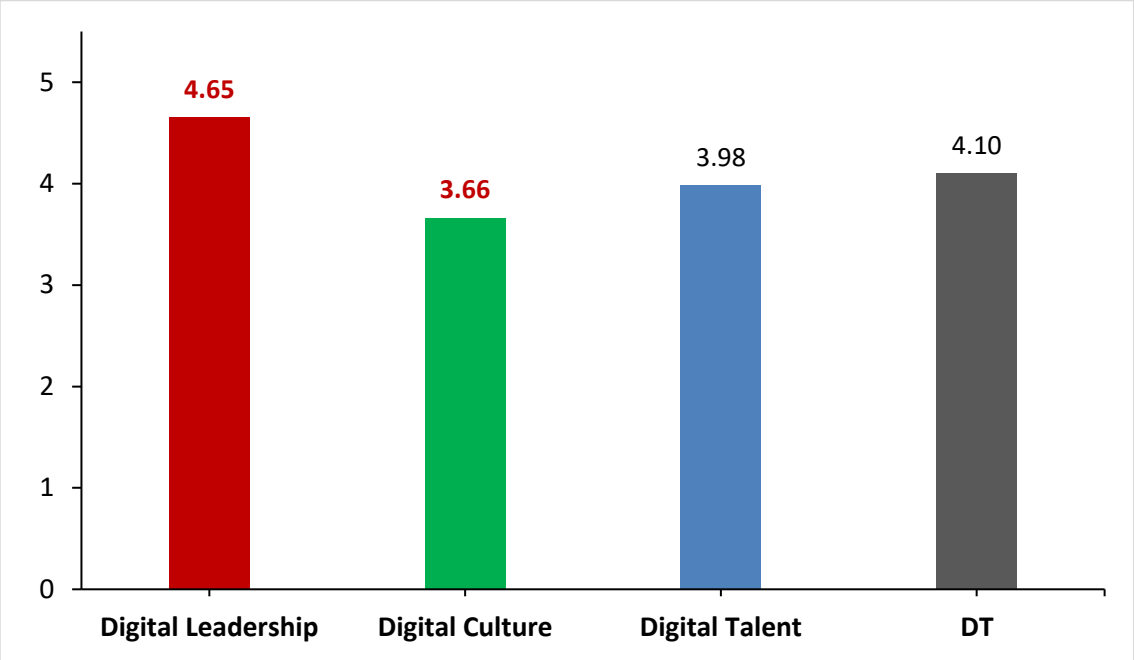


Figure 4: Variable Average Response Scores

Table 5: Indicator Average Response Scores

Indicator	Score	Indicator	Score	Indicator	Score
DL1	4.98	DC2	3.79	DT3	3.37
DL2	5.21	DC3	3.73	OG1	6.69
DL3	4.15	DC4	3.6	OG2	6.36
DL4	4.27	DT1	4.75	OG3	6.41
DC1	3.53	DT2	3.82	OG4	6.54

4.3 Structural Equation Modelling (SEM)

SEM comprising of a reflective measurement model and structural model was employed to examine the hypothesised model.

4.4 Research Model: Model measurement assessment

4.4.1 *Measurement of the digital leadership variable*

Four items assessed using a seven-response option rating scale measured digital leadership. Section two of Appendix C shows that the subsequent sample item was used for digital leadership: "There is defined, accountable leadership for digital transformation in the organisation".

4.4.2 *Measurement of the digital culture variable*

Six items assessed on a seven-response option rating measured digital culture. Section three of Appendix C shows that the following sample item was used for digital culture: "We involve customers in our innovation processes".

4.4.3 *Measurement of the digital talent variable*

Five items were assessed on a seven-response option rating scale that measured digital talent.

Section four of Appendix C shows that the following sample item was used for digital talent: "We actively recruit and appoint new talent with strong digital skills".

4.4.4 *Measurement of the DT variable*

DT was measured using four items on a rating option similar to the one used for the other variables. Section five of Appendix C shows that the following sample item was used for DT: "Digital transformation can assist the organisation to be more successful".

4.4.5 *Confirmatory Factor Analysis (CFA)*

Employing CFA SPSS AMOS 28 in an exploratory way retained four variables and nineteen items with significant (regression weight p-values < 0.01) loadings ranging from 0.52 to 0.92. See initial model factor structure in Figure 5 and standardised regression weights in Table 6.

4.4.6 *Model fit assessment*

Modification values were utilised to improve the fit for the model in Figure 5 based on the magnitude change of chi-square.

Error terms e1 and e2, e5 and e6 and e11 and e14 shown in the model structure of Figure 5 were covaried. Table 7 provides the initial and final modification index values.

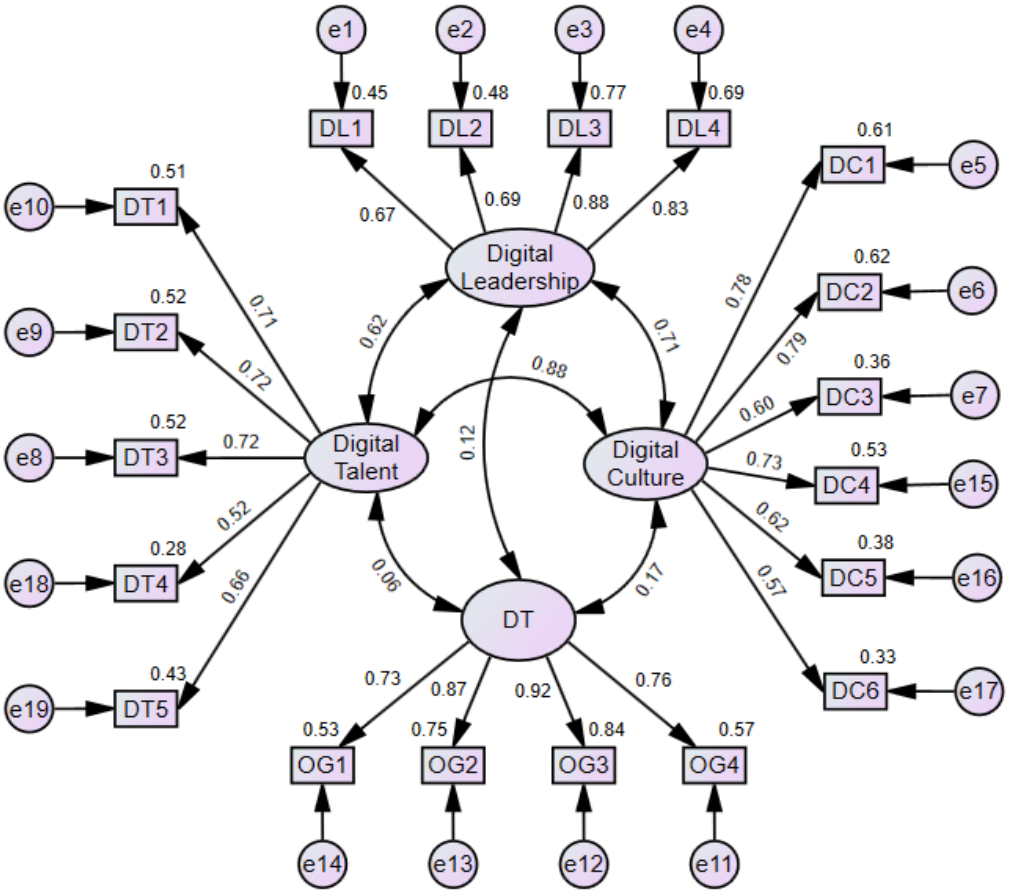


Figure 5: Initial Measurement Model Factor Structure

4.4.7 *Model reliability and validity*

The indicator reliability, construct reliability, and the model's validity were assessed.

Cronbach's alpha coefficient, Composite Reliability (CR), and maximal reliability (MaxR(H)) values of the model were measured in the assessment. Average variance extracted (AVE), Maximum Shared Variance (MSV) and Heterotrait monotrait ratio of correlations (HTMT) values were also measured. Indicator communality, Cronbach's alpha coefficient, CR and MaxR(H) were analysed for indicator and construct reliability.

Two items (DC6 and DT4) with low indicator reliability were filtered. Table 8 shows four variables and seventeen items with indicator reliability ranging from 0.4 to 0.84 were retained. Table 9 depicts the model's overall Cronbach's alpha, computed from the final seventeen items, was 0.889. CR and MaxR(H) values for construct reliability ranged from 0.754 to 0.884 and 0.754 to 0.882, respectively. AVE, MSV and HTMT values were also analysed for convergent and discriminant validity.

Filtering two items (DC5 and DT5) further modified the model fit and improved the values of AVE. Figure 6 depicts the final CFA model. AVE, MSV, and HTMT values ranged from 0.503 to 0.659, 0.035 to 0.889 and 0.047 to 0.717, respectively, as shown in Tables 10 and 11. The bold diagonal values that range from 0.711 to 0.812 are the AVE square root values for the unobserved variables.

Table 6: Standardised Regression weights

Factors	<---	Variable	Estimate	P
DL1	<---	Digital Leadership	0.67	***
DL2	<---	Digital Leadership	0.692	***
DL3	<---	Digital Leadership	0.876	***
DL4	<---	Digital Leadership	0.834	***
DC1	<---	Digital Culture	0.78	***
DC2	<---	Digital Culture	0.788	***
DC3	<---	Digital Culture	0.603	***
DC4	<---	Digital Culture	0.726	***
DC5	<---	Digital Culture	0.616	***
DC6	<---	Digital Culture	0.573	***
DT1	<---	Digital Talent	0.713	***
DT2	<---	Digital Talent	0.72	***
DT3	<---	Digital Talent	0.721	***
DT4	<---	Digital Talent	0.525	***
DT5	<---	Digital Talent	0.656	***
OG1	<---	DT	0.727	***
OG2	<---	DT	0.866	***
OG3	<---	DT	0.757	***
OG4	<---	DT	0.917	***

Table 7: Summary of Measurement Model Fit Values

Fit Index Description	Fit Index	Initial Model	Final Modified
Chi-Square	X^2	239.5	110.1
Chi-Square Probability Value	p-value	0.000	0.018
Degrees of freedom	df	146	81
Chi-Square/degrees of freedom	X^2/df	1.640	1.359
Goodness of Fit Index	GFI	0.883	0.928
Adjusted Goodness of Fit Index	AGFI	0.846	0.893
Standard RMR	SRMR	0.050	0.0413
Root Mean Square Error of Approximation	RMSEA	0.059	0.044
Normed Fit Index	NFI	0.871	0.928
Comparative Fit Index	CFI	0.945	0.979
Incremental Fit Index	IFI	0.945	0.980
Tucker Lewis Index	TLI	0.935	0.973
Parsimony Adjusted NF1	PNFI	0.744	0.716
Parsimony Adjusted CFI	PNCFI	0.806	0.756

Table 8: Indicator Reliability

Factors	<---	Variable	Estimate	Indicator Reliability
DL1	<---	Digital Leadership	0.67	0.45
DL2	<---	Digital Leadership	0.692	0.48
DL3	<---	Digital Leadership	0.876	0.77
DL4	<---	Digital Leadership	0.834	0.70
DC1	<---	Digital Culture	0.78	0.61
DC2	<---	Digital Culture	0.788	0.62
DC3	<---	Digital Culture	0.603	0.36
DC4	<---	Digital Culture	0.726	0.53
DC5	<---	Digital Culture	0.616	0.38
DT1	<---	Digital Talent	0.713	0.51
DT2	<---	Digital Talent	0.72	0.52
DT3	<---	Digital Talent	0.721	0.52
DT5	<---	Digital Talent	0.656	0.43
OG1	<---	DT	0.727	0.53
OG2	<---	DT	0.866	0.75
OG3	<---	DT	0.757	0.57
OG4	<---	DT	0.917	0.84

Table 9: Overall Model Cronbach's Alpha Coefficient

Construct	Alpha Value	Items
Digital leadership, digital culture, digital talent	0.889	17

Table 10: Model Reliability and Validity Analysis

	CR	AVE	MSV	MaxR(H)	Digital Leadership	DT	Digital Culture	Digital Talent
Digital Leadership	0.845	0.582	0.548	0.882	**0.763**			
DT	0.884	0.659	0.035	0.923	0.118	**0.812**		
Digital Culture	0.801	0.503	**0.889**	0.808	0.74	0.188	**0.709**	
Digital Talent	0.754	0.506	**0.889**	0.755	0.677	0.057	0.943	**0.711**

Table 11: HTMT Discriminant Validity Analysis

	Digital Leadership	DT	Digital Talent	Digital Culture
Digital Leadership				
DT	0.109			
Digital Talent	0.530	0.047		
Digital Culture	0.573	0.143	0.717	

4.4.8 *Variable correlations*

The correlation values of the variables shown in Figure 6 range between 0.057 and 0.943. See Table 12 for the summary of the correlation coefficients.

Table 12: Variable Correlations

Parameter			Estimate
DT	<-->	Digital Leadership	.118
DT	<-->	Digital Culture	.188
Digital Talent	<-->	Digital Leadership	.677
Digital Talent	<-->	DT	.057
Digital Talent	<-->	Digital Culture	.943
Digital Leadership	<-->	Digital Culture	.740

4.4.9 *Digital leadership reliability and validity*

Figure 6 depicts digital leadership factor loading values ranging between 0.63 and 0.92. In addition to CR = 0.845 and MaxR(H) = 0.882, Cronbach's alpha test was performed for the construct scales to evaluate the scales' internal consistency. These scales were derived from the various Likert scale questions relating to the digital leadership construct.

Cronbach's alpha value for the digital leadership variable was 0.857, with individual item-totals ranging between 0.791 and 0.835 and AVE = 0.582. Digital leadership HTMT values with other variables in Table 11 range from 0.109 to 0.573. See Table 13 for digital leadership reliability and validity statistics.

4.4.10 *Digital culture reliability and validity*

Figure 6 shows digital culture factor loading values ranging between 0.65 and 0.76, CR was 0.801, and MaxR(H) was 0.808, as represented in Table 14. Cronbach's alpha test was performed in SPSS using scales derived from the various Likert scale questions relating to the digital culture construct. The Cronbach's alpha value equalled 0.818, item values ranged from 0.742 to 0.814 and AVE = 0.503. HTMT values with other variables range between 0.143 and 0.717. See Tables 11 and 14 for the reliability and validity values.

4.4.11 *Digital talent reliability and validity*

Digital talent factor loading values were all 0.72, as depicted in Figure 6. In addition, CR = 0.754 and MaxR(H) = 0.754. The individual item-total values ranged between 0.623 and 0.711, resulting in Cronbach's alpha value for the digital talent variable equalling 0.755. AVE was 0.506 and HTMT values with other variables ranged from 0.047 to 0.717. Tables 11 and 15 show the reliability and validity statistics for digital talent.

4.4.12 *DT reliability and validity*

Figure 6 shows DT factor loading values ranging between 0.67 and 0.90. In addition, the CR and the MaxR(H) values were 0.884, and 0.923, correspondingly. Item values were between 0.826 and 0.878, DT construct's Cronbach's alpha value was 0.888.

AVE = 0.659, and HTMT values ranged from 0.047 to 0.143. See Tables 11 and 16 values.

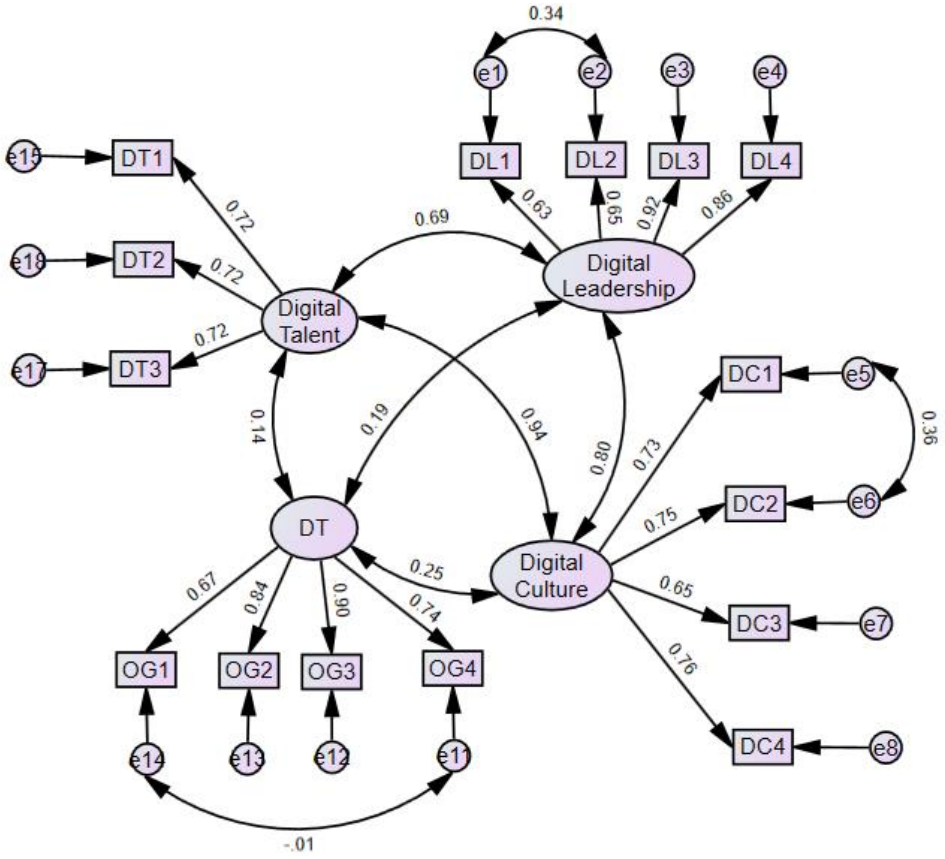


Figure 6: Final Measurement Model Factor Structure

Table 13: Digital Leadership Reliability and Validity Statistics

Construct	Item	Alpha Value		N of Items		CR	MaxR(H)	AVE
Digital Leadership	DL1	0.835	0.857	1	4	0.845	0.882	0.582
	DL2	0.827		1				
	DL3	0.791		1				
	DL4	0.814		1				

Table 14: Digital Culture Reliability and Validity Statistics

Construct	Item	Alpha Value		N of Items		CR	MaxR(H)	AVE
Digital Culture	DC1	0.748	0.818	1	4	0.801	0.808	0.503
	DC2	0.742		1				
	DC3	0.814		1				
	DC4	0.775		1				

Table 15: Digital Talent Reliability and Validity Statistics

Construct	Item	Alpha Value		N of Items		CR	MaxR(H)	AVE
Digital Talent	DT1	0.711	0.755	1	3	0.754	0.754	0.506
	DT2	0.623		1				
	DT3	0.681		1				

Table 16: DT Reliability and Validity Statistics

Construct	Item	Alpha Value		N of Items		CR	MaxR(H)	AVE
DT	OG1	0.878	0.888	1	4	0.884	0.923	0.659
	OG2	0.847		1				
	OG3	0.826		1				
	OG4	0.865		1				

4.4.13 *Normality and Outlier assessment*

Following the achievement of the final measurement model, fitness indices, reliability, and validity; normality, and outlier tests were conducted. A normality assessment evaluating the shape of the distribution was conducted. 10,000 bootstrap samples at 95% confidence intervals were employed in SPSS Amos version 28.

Table 17 shows that the lowest and highest scores were similar for all variables. The lowest and highest critical ratio (C.R) values of the skewness and kurtosis were -23.293: 2.02 and -2.978: 81.318, respectively. The multivariate critical ratio value was 30.957.

The bootstrap maximum likelihood estimator in Table 18 shows that for a sample size of 10,000, the sample mean was 101.358, and the standard error (SE) was 0.233. The maximum and minimum distribution limits were 41.494 and 219.005. Supplementary information in Appendix G shows potential outliers identified by assessing the distance of each observation from the centroid, known as the Mahalanobis distance.

The probabilities of a potential outlier (p1) and similar extremity would occur given a multivariate normal population (p2) ranged from 0 to 1. Seven potential outliers were identified.

Table 17: Normality Assessment of Final Measurement Model

Items	Lowest	Highest	Skew	C.R	Kurtosis	C.R
DC4	1	7	0.366	2.02	-0.794	-2.193
DC3	1	7	0.154	0.849	-0.579	-1.598
DC2	1	7	0.035	0.194	-0.999	-2.76
DC1	1	7	0.363	2.002	-0.931	-2.571
DT3	1	7	0.354	1.953	-0.697	-1.925
DT2	1	7	0.02	0.111	-0.692	-1.91
DT1	1	7	-0.705	-3.892	-0.417	-1.151
OG1	1	7	-4.218	-23.293	29.449	81.318
OG2	1	7	-2.232	-12.329	7.713	21.298
OG3	1	7	-2.476	-13.674	10.343	28.56
OG4	1	7	-2.902	-16.026	14.151	39.077
DL4	1	7	-0.301	-1.665	-0.887	-2.45
DL3	1	7	-0.126	-0.698	-1.078	-2.978
DL2	1	7	-1.037	-5.725	0.252	0.696
DL1	1	7	-1.105	-6.104	0.482	1.33
Multivariate					103.358	30.957

Table 18: Bootstrap Distribution – Maximum Likelihood Discrepancy

		|----------		
	41.494	|*	142.929	|****
	54.173	|**	156.608	|**
N = 10000	66.853	|*******	168.288	|*
Mean = 101.358	79.532	|**********	180.967	|*
S.E. = .233	92.212	|**********	193.647	|*
	104.891	|**********	206.326	|*
	117.570	|**********	219.005	|*
	130.250	|********		|----------

After employing the Bollen-Stine bootstrap method to the data, the model fitted better in 6682 bootstrap samples but failed to fit in 3318. Lastly, the bootstrap p-value was 0.332.

4.5 Research Model: Structural model assessment

The structural model (Figure 7) depicts DT (dependent variable) is predicted by digital culture and talent (two independent variables). Both digital culture and digital talent (dependent variables) were predicted by digital leadership (independent variable). DL1, DL2, DL3, and DL4 describe digital leadership. DC1, DC2, DC3, and DC4 describe digital culture. Lastly, three observed variables (DT1, DT2 and DT3) described digital talent.

4.5.1 *Multicollinearity*

A multicollinearity assessment was employed on Figure 7 to understand the impact of correlations of the predictor variables. The tolerance and valence inflation factor (VIF) values in Table 19 ranged from 0.480 to 1 and 1 to 2.067, respectively. Moreover, the eigenvalue and condition index value ranges in Table 20 were 0.026 to 2.196 and 1 to 10.502, respectively.

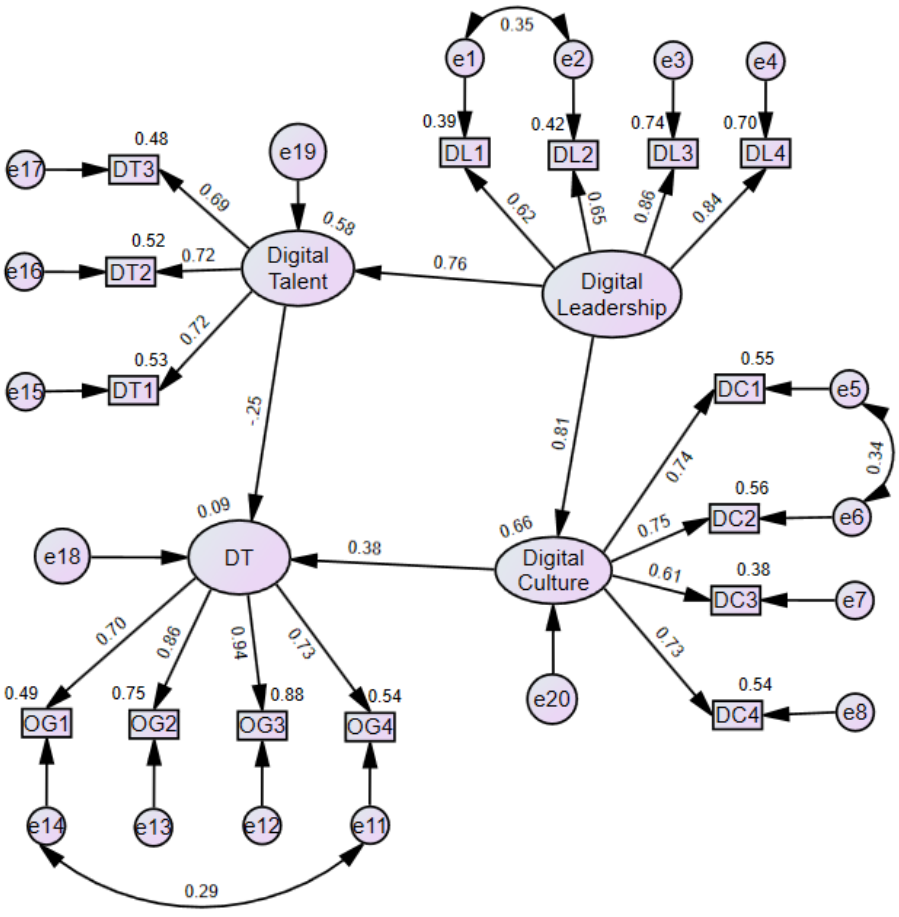


Figure 7: Structural Model

Table 19: Multicollinearity Statistics

Model		Statistics (Coefficients [a])		
		Tolerance	VIF	a. Dependent Variable
1	Digital Leadership	1.000	1.00	Digital Culture
2	Digital Leadership	1.000	1.00	Digital Culture
3	Digital Culture	0.484	2.067	DT
	Digital talent	0.484	2.067	

Table 20: Multicollinearity Diagnostics

Diagnostics [a]							
Model		Eigenvalue	Condition Index	Variance Proportions			
				(Constant)	Digital Leadership	Digital Culture	Digital Talent
1	1	1.962	1.000	0.02	0.02		
	2	0.038	7.201	0.98	0.98		
	a. Dependent Variable: Digital Culture						
2	1	1.962	1.000	0.02	0.02		
	2	0.038	7.201	0.98	0.98		
a. Dependent Variable: Digital Culture							
3	1	2.916	1.000	0.01		0.01	0.01
	2	0.057	7.136	0.93		0.24	0.06
	3	0.026	10.502	0.06		0.76	0.94
	a. Dependent Variable: DT						

4.5.2 *Model fit assessment*

The depiction in Figure 7 was evaluated for model fit. A good model fit was achieved: X^2 = 167.1, X^2 /df = 2,014, CFI = 0.941, IFI = 0.942, SRMR = 0.0701, and RMSEA =0.075. Table 21 illustrates the structural model fit values.

Table 21: Summary of Structural Model Fit Indices

Fit Index Description	Fit Index	Model Value
Chi-Square	X^2	167.1
Chi-Square Probability Value	p-value	0.000
Degrees of freedom	df	83
Chi-Square/degrees of freedom	X^2/df	2.014
Goodness of Fit Index	GFI	0.899
Adjusted Goodness of Fit Index	AGFI	0.854
Standard RMR	SRMR	0.0701
Root Mean Square Error of Approximation	RMSEA	0.075
Normed Fit Index	NFI	0.890
Comparative Fit Index	CFI	0.941
Incremental Fit Index	IFI	0.942
Tucker Lewis Index	TLI	0.925
Parsimony Adjusted NF1	PNFI	0.704
Parsimony Adjusted CFI	PNCFI	0.744

4.5.3 *Hypotheses testing*

SPSS AMOS 28 Structural Equation Model (SEM) employing 10,000 bootstrap samples at 95% confidence intervals was used to test the hypotheses. As depicted in Figure 7, the coefficient of determination (R^2) for DT, digital culture and digital talent was 0.09, 066 and 0.58, respectively.

The outcome of the two-tailed tests in Table 22 show that the variables' path coefficient estimates, and confidence intervals (CI) were from - 0.245 to 0.810 and - 0.793 to 0.542, respectively, with p-values between 0 and 0.099.

Table 22: Two-Tailed Significance Tests

Parameter			**Estimate**	**Lower**	**Upper**	**P**
Digital Culture	<---	Digital Leadership	0.810	0.542	0.976	0.000
Digital Talent	<---	Digital Leadership	0.762	0.506	0.919	0.000
DT	<---	Digital Culture	0.381	0.108	0.907	0.009
DT	<---	Digital Talent	-0.245	-0.793	0.056	0.099

4.6 Digital leadership and digital culture relationship

- Null Hypothesis ($H1_{o)}$: Digital Leadership and Digital Culture are not related.
- Alternate Hypothesis ($H1_{a)}$: Digital Leadership positively impacts Digital Culture.

4.6.1 *Hypothesis 1: Digital leadership positively influences digital culture*

From Table 22, digital leadership significantly impacted digital culture (β = 0.810, CI: 0.542; 0.976, p = 0.00). Therefore, the null hypothesis ($H1_o$) was rejected. There was sufficient evidence that digital leadership positively influences digital culture.

4.7 Digital leadership and digital talent relationship

- Null Hypothesis ($H2_{o)}$: Digital Leadership and Digital Talent are not related.
- Alternate Hypothesis ($H2_a$): Digital Leadership positively impacts Digital Talent.

4.7.1 *Hypothesis 2: Digital leadership positively influences digital talent*

From the results in Table 22, digital leadership significantly affected digital talent (β = 0.762, CI: 0.506; 0.919, p = 0.000). Consequently, the null hypothesis ($H2_o$) was rejected. Sufficient statistical evidence exists supporting that digital leadership positively impacts digital talent.

4.8 Digital culture and DT relationship.

- Null Hypothesis ($H3_{o)}$): Digital Culture and DT are not related.
- Alternate Hypothesis ($H3_{a):}$ Digital Culture positively impacts DT.

4.8.1 *Hypothesis 3: Digital culture positively influences DT*

As depicted in Table 22, digital leadership significantly affected digital talent (β = 0.381, CI: 0.108; 0.9079, p = 0.009). Hence, the null hypothesis ($H3_o$) was rejected. The conclusion was substantial evidence that supports that digital culture positively influences digital DT.

4.9 Digital talent and DT relationship.

- Null Hypothesis ($H4_{o)}$): Digital Culture and DT are not related.
- Alternate Hypothesis ($H4_{a)}$: Digital Culture has a positive impact on DT.

4.9.1 *Hypothesis 4: Digital talent positively influences DT*

Table 22 analysis shows that digital talent had a statistically insignificant impact on DT (β = - 0.245, CI: -0.793; -0.165, p = 0.099). The analysis indicated that the data supported the null hypothesis ($H4_o$). There was no sufficient evidence that digital talent positively influences DT.

4.10 Summary of the results

SPSS AMOS CFA was employed to display the indicator structure of the observed variables, leading to reduced factors. Fifteen factors with p-values < 0.01 and good indicator or factor loadings above 0.05 were retained. The model fit was improved using modification indices. Covarying prioritised error terms of the same construct improved the model fit. The priority was based on the magnitude change of the chi-square values.

The required reliability and validity were established by assessing the model's construct reliability and validity (both convergent and discriminant). Consequently, a good model fit was achieved by further modifying the AVE values. Normality for every variable in the data set was attained via the Bollen-Stine bootstrap method. It was established that multicollinearity did not pose potential issues after conducting collinearity tests. The hypotheses were tested utilising SPSS AMOS 28 SEM employing 10,000 bootstrap samples at 95% confidence intervals. A good structural model fit was also attained.

For the first hypothesis, the analysis concluded that there is sufficient evidence that digital leadership positively affects digital culture. The analysis resulted in the null hypothesis ($H1_o$) being rejected. Moreover, the evaluation of the second hypothesis observed that digital leadership positively influences digital talent. Hence, the null hypothesis ($H2_o$) was rejected. The third null hypothesis ($H3_o$) was also rejected, thus confirming that digital culture positively influences DT. Lastly, analysis pertaining to the relationship between digital talent and DT established that digital talent has no impact on DT and acceptance of the null hypothesis ($H4_o$).

See Table 23 and Figure 8 for the summarised outcome of the hypotheses.

Table 23: Hypotheses Outcomes

Hypothesis	P-Value	Outcome
$H1_o$: Digital leadership and digital culture are not related	0.00	Rejected
$H2_o$: Digital leadership and digital talent are not related	0.000	Rejected
$H3_o$: Digital Culture and DT are not related	0.009	Rejected
$H4_o$: Digital Talent and DT are not related	0.099	Accepted

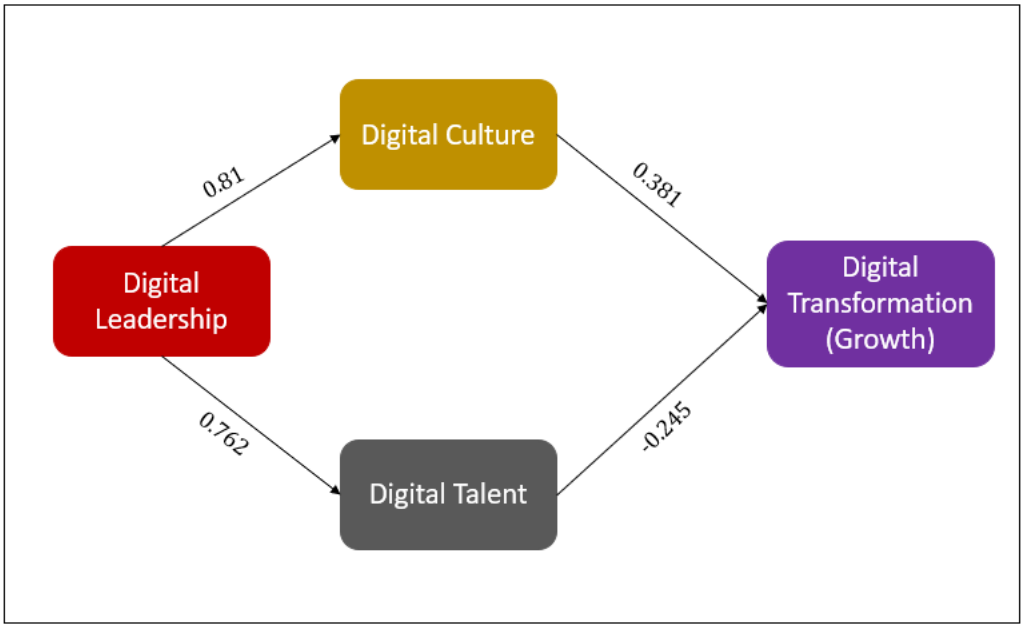


Figure 8: Hypothesis Testing Model Results

CHAPTER 5. DISCUSSION OF THE RESULTS

5.1 Introduction

The chapter delves into and situates the results of Chapter 4 against existing literature. Furthermore, the outcome importance and implications are examined within the context of the investigation’s inquiry and hypotheses.

The relationships between outcomes and the predictors were evaluated in the preceding chapter. Digital leadership's effect on both digital culture and digital talent was found to be statistically significant. Similarly, digital culture had a positive effect on DT. However, there was insufficient evidence that digital talent had a statistically significant relationship with DT.

5.2 Basic Statistics

Out of 202 responses received, only 183 were validated for analysis. Nineteen responses were discarded, resulting in 91% usable data.

The low strata response rate of 54% for Grade A, shown in Table 4, was attributed to the resignations of Company X's EXCO members due to poor company performance (Board of Directors, 2023). Despite the resignations, the distribution of the employee responses showed that respondents were adequately represented across the management levels.

Appendix F presents DL2, DL4, OG1 and DT3 indicator responses. Nearly all respondents agree (96.7%) that DT fosters higher organisational productivity (OG1). However, 25.1% of respondents agreed (74.9% were neutral or disagreed) that strong digital skills are embedded in strategic areas and programs of Company X (DT3). These percentages explain why OG1 and DT3 had the highest and lowest average response scores, respectively, as shown in Table 5.

5.3 Structural Equation Modelling (SEM)

The theories around the influential human factors of DT were tested using SEM (Hair et al., 2019). The software efficiently estimates and models multiplex interactions of dependence relationships concurrently (Hair et al., 2019). Consequently, this yields an accurate assessment of the relevant theories in the study (Cole & Preacher, 2014).

In accordance with Hair et al. (2019), the directional lines in the model connect from unobserved constructs to the measured indicators and each measured indicator has error terms. The measurement model assessed is predicated on the concept that measured indicators are caused by unobserved constructs (reflective measurement theory) (Hair et al., 2019). Moreover, it allows the use of several indicators to measure a variable. The structural model then links the independent and dependent variables based on theoretical concepts and past experiences (Hair et al., 2019).

5.4 Research Model: Measurement model Assessment

5.4.1 *Confirmatory Factor Analysis (CFA)*

CFA serves as a hypothesis-driven methodology (Brown, 2015) that seeks to validate a theoretical model with actual data (Alavi et al., 2020). These attributes made CFA an appropriate approach for this study.

Brown (2001), Schmitt (2011) and Watson et al. (2013) assert that, in essence, CFA is exploratory when used in conjunction with modification indices. However, further exploratory factor analysis should be considered if a good-fitting CFA model still needs to be achieved (Schmitt, 2011). Hair et al. (2019) argue that factor loadings ≥ 0.4 with significant regression weights ($p < 0.05$) are adequate for a sample size of 200. Hence, items were filtered from the initial nineteen items, as shown in Figure 4. Table 3 depicts only fifteen items with adequate loading and significant regression weights that were retained (Hair et al., 2019).

5.4.2 *Assessment of model fit*

The standardisation technique with covariances equalised to 1.0 (Teo, 2013) was employed to assess the model fit. Parameter and fit indices were estimated using the Maximum Likelihood (ML) method. Various researchers recommend X^2, X^2/df, GFI, AGFI, SRMR, RMSEA, CFI and TLI as model fit indices (Anderson & Gerbing, 1988; Glynn et al., 2011; Teo, 2013). To thoroughly evaluate the model's fit, five absolute (X^2, p-value, GFI, RMSEA, SRMR), four incremental (AGFI, NFI, CFI and TLI), and one parsimonious fit indicator (X^2/df) were examined.

As shown in Appendix H, a comparison of the model indices to the recommended values confirms that an overall CFA good model fit was achieved: X^2 = 110.1, X^2/df = 1.359, GFI = 0.928, AGFI =0.893, SRMR = 0.0413, and RMSEA =0.044, NFI = 0.928, CFI = 0.979, IFI = 0.98 and TLI = 0.973. No further exploratory factor analysis was required (Schmitt, 2011).

A model's chi-square (X^2) evaluates the deviation of a suggested model from the data (Glynn et al., 2011). The X^2 value is highly impacted by sample size (Garson, 2015), and a chi-square probability value (p-value) > 0.05 (non-significance) shows an acceptable model fit (Meyers et al.,2005). The attainment of a low p-value (0.000) lower than 0.05 implies significant deviations between the model and the data, hence showing a model inadequate fit. However, Garson (2015) recommends utilising the quotient of chi-square (X^2) and degrees of freedom (X^2/df) as an alternate fitness index unaffected by sample size. Values of X^2/df less than 2.5 are deemed suitable (Hair et al., 2019). Therefore, the X^2/df index of 1.359 for the model was good. The analysis yielded GFI and AGFI statistics higher than 0.8, confirming a good fit and, therefore, acceptable (Chau, 1997; Segars & Grover, 1993).

Sample size does not affect the SRMR and RMSEA values, but both are affected by incorrect model specifications (Teo, 2013). The proposed model's SRMR (0.0413) and RMSEA (0.044) values were adequate, as both values did not exceed the 0.09 and 0.08 threshold levels (Hair et al., 2009; Meyers et al., 2005). A goodness of fit threshold index beyond 0.9 for NFI, IFI, CFI and TLI indices are acceptable (Hooper et al., 2008). All index values were higher than 0.9. Therefore, proposed model indices met the requirements and were admissible.

5.4.3 *Reliability and validity*

Indicator reliability was evaluated and calculated by squaring the indicator loading, thereby calculating the indicator's variance. It is advised to use indicator loadings larger than 0.7 since they suggest that the underlying concept explains above half of the variance in the indicator. However, with new scales, indicator reliability is often less than 0.7 (Hulland, 1999). Hence, indicator loadings above 0.4 are acceptable (Hair et al., 2022). Utilising these stated limits, two items with indicator reliability lower than 0.4 were filtered. As a result, indicator reliability results in Table 7 were accepted.

Construct reliability refers to “whether scores of items on an instrument are internally consistent” (Creswell, 2009, p. 9). It measures how good scale items measure the same underlying concept or variable (Steiner, 2003). The reliability of the unobserved variable or construct was appraised by measuring the Cronbach's alpha coefficient, CR and MaxR(H). Cronbach's alpha has similar thresholds as the composite reliability. It is an adequate approximation of reliability despite its simplifying assumption of all equal factor loadings across the population. (Trizano-Hermosilla & Alvarado, 2016). Coefficients greater or equal to 0.7 are recommended for an ideal research instrument (Streiner, 2003). Values above 0.90 and 0.95 are undesirable as they reduce construct validity and trigger exaggerated correlations among the indicator error terms within the measurement model (Diamantopoulos et al., 2012).

Despite the Cronbach alpha coefficients of less than 0.7 for two digital talent indicators, all individual variable coefficient values were above 0.7. From Table 9, the overall coefficient for the final fifteen individual item scores was 0.878.

The individual and overall Cronbach alpha coefficient values suggested an excellent variable and overall instrument reliability for the sample (Tavakol & Dennick, 2011).

CR and MaxR(H) values for construct reliability in Table 10 were above the 0.7 threshold which is the minimum requirements for both values, thus corroborating the excellent construct reliability (Huang et al., 2013). Furthermore, Hair et al. (2019) suggest the computation of convergent and discriminant validity to assess the constructs further. Convergent validity measures multiple-item correlations within a construct that agree (Ab et al., 2018). All AVE values in Table 10 exceeded the requirement of 0.5 (Hair et al.,2019; Huang et al., 2013). Significant standardised factor loadings of variables ($p < 0.000$), AVE and CR values validated the study's construct and convergent validity (Hair et al., 2019).

Assessing the degree of association of items in a construct with items of other constructs in the model is known as discriminant validity. It is the empirical measure of the degree of distinction among unobserved variables (Hair et al., 2016). In accordance with Hair et al. (2016), a contrast of AVE square roots to correlations of the latent or unobserved variables was made to examine discriminant validity. Fornell and Lacker (1981) and Hair et al. (2019) recommend that for every variable in the model, the AVE square root value must exceed 0.5 and the inter-latent degree of association. Additionally, the AVE values must exceed the maximum shared variance values for every unobserved variable (Rebelo-Pinto et al., 2014). Contrary to recommendations, not all variables in Table 9 satisfied these conditions.

The AVE square root value for digital culture and digital talent was lower than the absolute value of the correlations with other factors.

Furthermore, the AVE values for digital culture and talent were lower than their respective MSV values. The results indicated discriminant validity potential issues.

Henseler et al. (2015) postulate that Fornell and Lacker's (1981) preceding requirements for discriminant validity must be revised when construct factor loadings slightly differ. Similarly, the factor loadings of the proposed model in Figure 5 ranged from 0.64 to 0.94 slightly differ. Radomir and Moisescu (2019) assert that Fornell-Larcker's criteria frequently fail to accurately identify discriminant validity issues in real-world applications. As a result, discriminant validity was then evaluated using the HTMT analysis as an alternative method with Henseler et al.'s (2015) recommended HTMT values lower than 0.9 for adequate discriminant validity. Values of all latent variables in Table 11 range from 0.047 to 0.717, hence satisfying the discriminant validity requirements. With both convergent and discriminant validity found to be adequate, construct validity was confirmed.

5.4.4 *Variable correlations*

The model variable correlations are shown in Table 12. With correlation coefficients > 0.70, digital culture had strong correlations with both digital talent (0.943) and digital leadership (0.740) (Dancey & Reidy, 2004). However, a high correlation greater than 0.9 between digital culture and digital talent indicates possible collinearity issues (Hair et al., 2019) that were examined later in the multicollinearity section.

The digital talent and digital leadership correlation coefficient (0.677) was within the 0.40 to 0.69 interval, showing a moderate degree of association of the variables (Dancey & Reidy, 2004). According to Dancey and Reidy (2004), DT had negligible relationships with digital leadership (0.118) and digital culture (0.188), as their coefficients were within the 0.1 to 0.3 threshold.

5.4.5 *Normality and Outlier assessment*

Normality is the most basic presumption necessary in using F and t statistical tests (Hair et al., 2018). Therefore, all tests resulting from significant deviation from the normal distribution are deemed invalid (Hair et al., 2018).

Hair et al. (2019) posits that SEM assumes data follows a normal bell curve distribution. Therefore, assessing the item distribution in the measurement model output becomes critical before proceeding with the structural model (Hair et al., 2019).

Table 17 presents the normality assessment outcome to analyse the distribution's shape. According to Hair et al. (2019), this shape is characterised by empirical estimates of skewness and kurtosis. Additionally, the scholars refer to skewness as a measure of the distribution's balance: right shift (negative skew) or left shift (positive skew) and centred or symmetrical (Hair et al., 2019). Kurtosis describes the flatness of the distribution's shape in comparison to a standard bell curve (Hair et al., 2019). The absolute skewness values of 1.0 or less and skewness critical ratios of less than 8.0 confirm that the data is normally distributed. However, seasoned researchers recommend absolute skewness values of 3 for large sample sizes to proceed with further SEM analysis (Collier, 2020).

Collier (2020) recommends absolute kurtosis values of less than 10 for large samples, indicating normal distribution. The results of a sample of 183 shown in Table 17 show some absolute skewness, and CR values exceeded the 3.0 and 8.0 thresholds, respectively (Collier, 2020). Moreover, not all absolute kurtosis values were less than the acceptable value of 10 (Collier, 2020). As a result, normality for all variables in the dataset was not achieved and needed to be sufficient to proceed with further SEM analysis (Collier, 2020). Proceeding may result in higher chi-square values, which could prompt unwarranted model revisions (Collier, 2020). Accordingly, model fit estimates might seem higher than they are (Collier, 2020).

Sufahani and Ahmad (2012) advocate bootstrapping techniques to normalise data deviations from a bell curve distribution. Therefore, the technique was utilised to address the non-normality of the model's dataset (Efron, 1979). Bootstrapping is a way of re-sampling the existing distribution dataset, utilising the sampling with a replacement approach (Davison & Hinkley, 1997). The method bases its determination of statistical significance entirely on the sample of the data, not on statistical inferences about the population (Hair et al., 2019). Before further analysis, Collier (2020) recommends determining if the model fits the data by selecting the maximum likelihood discrepancy (MLE) method via Bollen-Stine bootstrapping. If the model's chi-square is within the maximum likelihood discrepancy distribution range, the selected bootstrap sample size is suitable.

A recommended sample size of ten thousand was chosen (Streukens & Leroi-Werelds, 2016) for the bootstrapping.

The Bollen-Stine bootstrapping generated a new sampling distribution of 10,000 samples, with a mean of 101.358 and a standard error of 0.233. The model's final chi-square value (X^2) of 110.1 in Table 7 was between the minimum (41.494) and maximum (219.005) attained distribution limits shown in Table 17. The results confirmed the improvement of the fit of the model.

The Bollen-Stine bootstrap p-value (0.332) exceeded 0.05, signifying evidence supporting no significant deviation from normality of the bootstrapped sample distribution and the model's correctness. The identified potential outliers were evaluated and found to have unique population characteristics; hence, these outliers were retained (Hair et al., 2019).

5.5 Research Model: Structural model assessment

5.5.1 *Multicollinearity*

The structural model was evaluated for possible multicollinearity problems. Multicollinearity refers to the predictor variables' lack of independence or the extent to which the impact of a variable in the analysis which may be attributed to other constructs (Dormann et al., 2013; Hair et al., 2019). Standard errors (SE) and point estimates can be skewed by high correlations of each set of independent variables or predictors (Sarstedt & Mooi, 2019). It tends to exaggerate regression parameter variance, which may incorrectly identify significant exogenous variables in a model (Dormann et al., 2013).

The VIF, tolerance, eigen and condition index values were computed to check multicollinearity. Independent variable scores were used to calculate VIF values.

Generally, VIF values > 5 indicate possible multicollinearity problems. However, when VIF is between 3 and 5, multicollinearity problems can arise but may be insignificant (Becker et al., 2015; Mason & Perreault, 1991). Structural model valence inflation factor indices in Table 19 are less than the conservative value of 2.5 for all variables, proving multicollinearity is not a possible problem (Midi et al., 2010).

Tolerance is the proportion of the variance in an exogenous variable that cannot be attributed to other exogenous variables (O'Brien, 2007). Tolerances close to zero (< 0.2) indicate significant multicollinearity, resulting in overstated standard error of the regression coefficients (O'Brien, 2007). Similarly, eigenvalues close to 0 signal strong intercorrelated independent variables and slight data value changes may result in significant changes in coefficient estimates (Belsley et al., 2004). Despite low eigenvalues, neither tolerance nor eigenvalues in Tables 19 and 19 were close to zero, showing no critical collinearity issues.

Additionally, condition index values were also analysed for possible multicollinearity. The condition indices are calculated as the square root of the quotient of the greatest eigenvalue and each subsequent eigenvalue. Values higher than 15 indicate the likelihood of multicollinearity problems (Mason & Perreault, 1991), and they are more significant if values are greater than 30 (Belsley et al., 2004). Considering the VIF, tolerance, eigen and condition indices of the variables of the structural model in Tables 19 and 20, multicollinearity was not a problem.

5.5.2 *Assessment of model fit*

The actual fit index values to the recommended values comparison in Appendix H confirm that an overall good model fit was achieved: X^2 = 167.1, X^2/df = 2.014, GFI = 0.899, AGFI =0.854, SRMR = 0.0701, and RMSEA =0.075, NFI = 0.890, CFI = 0.941, IFI = 0.942 and TLI = 0.925.

A model's chi-square (X^2) evaluates the deviation of a suggested model from the data (Glynn et al., 2011). The X^2 value is highly impacted by sample size (Garson, 2015), and a chi-square probability value (p-value) > 0.05 (non-significance) suggests an acceptable fit of the model (Meyers et al.,2005). The suggested p-value of the model was below 0.05, indicating significant deviation thus an inadequate fit. As explained, an alternate index (X^2/df) unaffected by sample size was used to assess model fitness (Garson, 2015). The model's X^2/df index of 2.014 was adequate as it was less than the 2.5 threshold value (Hair et al., 2019). The computed GFI (0.899) and AGFI (0.854) indices were both greater than 0.8, confirming a good fit and, therefore, acceptable (Chau, 1997; Segars & Grover, 1993). The proposed model's SRMR and RMSEA indices were adequate since SRMR was below 0.09 and RMSEA was below the 0.08 requirement (Hair et al., 1999; Meyers et al., 2005). A goodness of fit threshold value greater than 0.9 for NFI, IFI, CFI and TLI indices was attained and thus admissible (Hooper et al., 2008).

5.5.3 *Hypothesis testing*

The structural paths in Figure 7 were examined for significance and relevance using bootstrapping at similar sample size and confidence intervals as the normality assessment in section 5.4.5. The bootstrapping confidence intervals in Table 21 used the bias-corrected method (Hayes & Preacher, 2013). The confidence intervals and the p-values in Table 22 were tested for significance (Hair et al., 2019).

When a confidence interval for an estimated coefficient included zero, the null hypothesis (no relationship) was accepted with 95% confidence, and non-significance ($p > 0.05$) was assumed (Hair et al., 2022). The significant path coefficients were also assessed for intensity and direction of the variable associations (Hair et al., 2022). The coefficients of determination or R-squared (R^2) of 0.66 (digital culture), 0.58 (digital talent) and 0.09 (DT) are depicted in Figure 7.

R^2 values denote the proportion of the outcome's variation attributed to the variation of the model's exogenous variables (Hair et al., 2022). Therefore, 66% of digital culture variance can be explained by digital leadership. 58% of digital talent variance can be explained by digital leadership. Similarly, the 9% DT variance can be explained by digital culture and digital talent. According to Shmueli and Koppius (2011), R-squared is an indicator to assess the explicatory strength of the model and should be between 0 and 1. To account for the number of model predictors relative to data size, R^2 is modified to Adjusted R^2 (Theil, 1961).

Although high values signify a higher explanatory capacity, acceptable values depend on the circumstances of the study, similar studies, and model complexity (Hair et al., 2022). Accordingly, the R^2 values of our model were accepted.

The total paths of the three exogenous variable in Figure 7 were inspected to comprehend the overall standardised effects of digital leadership, digital culture, and digital talent (Hair et al., 2022). As a result, digital leadership strongly affected digital culture (0.810) and digital talent (0.762). Furthermore, digital culture had the strongest effect on DT (0.381) while digital talent had no effect on DT.

5.6 Digital leadership and digital culture relationship.

The hypothesis testing results showed sufficient evidence that digital leadership directly and positively impacted digital culture. Furthermore, the high path coefficient (β = 0.810) confirms that digital leadership in Company X strongly affects digital culture.

The results complemented recent research by Puliwarna et al. (2023) and Shin et al. (2023), confirming that leadership in the digital age positively impacts digital culture. These studies suggest that digital leadership is a strategic resource that constantly drives organisational cultural change, fostering positive attitudes and an open-minded approach to organisational transformation. Furthermore, the scholars emphasise digital leadership as a dynamic capability. It promotes an organisational culture that is flexible and quick to seize opportunities from an ever-changing landscape (Teece, 2012).

The success of digital leadership in fostering a digital culture at Company X could be attributed to two main reasons. Firstly, the appointment of an external GCDO with a strong vision for the company's digital future might have played a role. Furthermore, adopting DT as a strategic priority, with a specific goal of eliminating Company X's OD silo cultures, likely contributed to the positive outcome. The survey results in Appendix F support the above. Over half of the participants (53.6%) concurred that there is a common vision for the organisation's digital future and a clear road map. Three quarters of the respondents (75.4%) believed that DT is leadership's top priority. Overall, this suggests a strong belief in the direct contribution of digital leadership to building a digital culture within Company X.

Kane et al. (2019) suggest that appointing a Chief Digital Officer (CDO) can champion DT across the organisation. The CDO champions DT by coordinating various DT initiatives that support clear vision for the organisation's digital journey. A clear vision provides a purpose and direction and encourages employees to work as a collective towards a common objective (Kane et al., 2019). In this regard, a CDO is viewed as a proactive change agent promoting cross-functional collaboration within a company (Buchwald & Lorenzo, 2020). This collaboration is critical to building a strong digital culture (Warner & Wäger, 2019). In summary, the direct and positive influence of this leadership type on Company X's digital culture affirms the progress made by the company's leadership in fostering a culture that thrives in a digital age.

5.7 Digital leadership and digital talent relationship.

From the hypothesis testing results, there was sufficient evidence that digital leadership significantly and positively impacted digital talent in Company X. The path coefficient of 0.762 confirmed the strong effect of digital leadership on digital talent.

The outcome is consistent with research studies by El Sawy et al. (2020) and Weber et al. (2022). Both studies found that digital leadership is essential in enabling digital talent, such as employee development investment and equipping employees with the latest digital tools and technology.

The new GCDO's clear vision also impacted Company X's digital talent. The clear vision attracted and retained skilled talent and aligned employee skills with the company strategy. According to Kane et al. (2015), a clear vision motivates digital talent, directing their abilities and efforts towards specific strategic objectives. The appointment of personnel in the digital function structure was completed in June 2023 (Board of Directors, 2022), and where possible, digital roles were filled internally. This commitment to building digital talent aligns with findings from Kane et al. (2019) and Nazari and Musilek (2023), who emphasise the importance of attracting and retaining talent for successful DT.

Company X's leadership actively sought diverse expertise and encouraged internal mobility in recruitment. In this process, leadership demonstrated a key leadership trait that Weber et al. (2022) identified as building a workforce ready for the digital age.

Overall, the strong digital leadership at Company X had a positive impact on attracting, motivating, and developing digital talent required for success.

5.8 Digital culture and DT relationship.

There was substantial evidence that digital culture directly and positively impacted on DT. The path coefficient (β = 0.381) confirmed the strong effect of digital culture on DT. With the highest path coefficient between the independent variables, digital culture was the primary driver of DT in Company X. The culture fostered by the new digital leadership improved knowledge sharing, innovation, and collaborative problem-solving across ODs, leading to more effective DT initiatives (Al-Alawi et al., 2023).

Analysis of the digital culture responses in Appendix F showed that 32.8% of participants reported improved cross-functional collaboration specifically related to innovation and DT initiatives across ODs since the appointment of the new digital leadership. Therefore, from the above, the digital culture of Company X impacted DT. The results corroborated previous research findings.

According to studies by Al-Alawi et al. (2023), a weak digital culture can hinder DT. The study by Alawi et al. (2023) mainly focussed on the DT of human resources management. Furthermore, a Delphi research by Carolina et al. (2023) and a principal components of culture investigation in media by Deuze (2006) established that digital culture was one of the crucial elements in achieving the outcomes of DT.

5.9 Digital talent and DT relationship

While prior studies established a positive effect of digital talent on DT, this study did not yield sufficient evidence to confirm this.

Shin et al. (2023) and Tunggul et al. (2023) found that digital talent, termed employee digital competencies, significantly and positively impacted DT, contrary to the outcome of this study. However, assertion that the time from the completion of the appointment of digital talent in June 2023 in Company X to when the study was carried out was inadequate for digital talent to impact DT is plausible. Generally, new employees in DT need time to learn how to navigate its uncertainties and adapt quickly (Li, 2020; Sousa-Zomer et al., 2020). Beyond understanding Company X's unique cultural nuances, employees may need to gain the specialised knowledge required for the selected DT initiatives.

According to Alshammari and Alshammari (2023), moderating variables or indirect effects, though not part of this study, significantly influence the outcome of that relationship. Webber et al. (2022) emphasise that the effectiveness of digital talent also relies upon other factors such as resource availability, alignment of skills, change resistance, and leadership commitment. For this reason, digital talent alone may not be adequate to impact DT positively (Davenport & Redman, 2020).

Despite leadership prioritising DT and recognising the importance of digital skills in Company X, as shown by agreement from 69.9% of respondents, 74.9% of employees disagreed that strong digital skills are embedded into the company's strategic areas and programs. This discrepancy suggests a potential gap between DT's vision, valuing digital talent, and its practical implementation, raising concerns about the execution of DT initiatives within the company.

Drawing from the research of Kane et al. (2019), successful DT hinges on the right talent executing the DT vision. Consequently**,** insufficient talent could limit DT progress, while excess talent may not result in any DT success (Kane et al.,

2019; Yoo et al., 2012). Inefficiencies coupled with opposing priorities from having excessive talent may cause DT progress to stall (Yoo et al., 2012). Moreover, high levels of digital talent might be linked to aversion to change among current employees. Employees with established skills and processes might feel threatened by the potential disruption caused by DT, leading to resistance to change. The resistance might stem from employee fears such as job loss, disruption to established routines, and unclear potential transformation benefits (Kotter, 2014). From this context, a threshold level of the right digital talent may be required for successful DT. The relationship between digital talent and DT may be more complex than initially hypothesised.

5.10 Conclusion

The study successfully identified significant associations between variables investigated. The outcomes show that digital leadership directly and positively shapes an organisation's digital culture. In addition, there is sufficient evidence that digital leadership influences digital talent, and that digital culture is essential for any successful DT**.** However, the conclusion drawn regarding the association of digital talent and DT infer that digital talent has no impact on DT in Company X. This outcome, in part, may be attributed to the insufficient resources and misalignment of the company's digital talent to the current DT initiatives. It should be noted that Company X's digital journey was new when data was collected, and resource allocation to DT was limited due to the company's poor financial performance.

CHAPTER 6. CONCLUSIONS & RECOMMENDATIONS

6.1 Introduction

The chapter is a culmination of the preceding analyses, aggregation of outcomes presented in the earlier sections and answering the research questions initially set out in Chapter 1.

The study's primary research question was: "How do human factors support digital transformation in a South African logistics company?". The below secondary questions were explored to get a nuanced comprehension of the primary research question:

1. How would leadership contribute to the DT?
2. To what extent does culture impact DT implementation?
3. How does human talent impact DT implementation?

Data interpretation and conclusions were used to answer the sub-questions, clearly showing how human factors influence DT in this context.

6.2 Conclusion: Research question 1

The study’s results and conclusions showed that digital leadership contributes to successful DT in a South African logistics company. However, digital leadership’s impact on DT is indirect through positively influencing both digital culture and talent. The conclusion is supported by previous researchers.

It can be argued that Company X's leadership exhibited several digital leadership traits mentioned in Chapter 2 that positively impacted digital culture and talent. Therefore, digital leadership was central to digital culture and talent in driving DT in a South African freight logistics organisation. However, there is limited research on digital leadership's contribution to DT in a South African freight logistics context. Research studies beyond this context is predominantly focussed on the direct association of digital leadership and DT. The investigation revealed the complexity of digital leadership, acting through mediating factors such as digital culture and talent to impact DT.

Scholars assert that good digital leaders have the skills and adaptability to reorganise their business environments through digital culture and strategic allocation of resources. This sustains a business through a transformation. Through empirical measurement, the study established that digital leadership is a core variable mediated by digital culture and talent in driving DT in a South African logistics context.

6.3 Conclusion: Research question 2

In a bureaucratic logistics company such as Company X, a strong digital leadership embracing digital culture played a vital role in successfully implementing DT initiatives.

The digital culture of Company X had a direct positive effect on DT, resulting in more innovative DT initiatives. Over thirty per cent of the surveyed employees believed that the company seamlessly adapts to digital improvements and shifts.

Company X's leadership actively fostered a culture that valued innovation and risk-taking, allowing for quicker adaptation to disruptions brought on by DT. Furthermore, open, and transparent communication and strong teamwork unlocked knowledge sharing and collaboration during DT project implementation. This collaboration transcended Company X's departmental and OD boundaries, highlighted in the preceding chapter.

Visionary leadership, who understood the power of digital culture and its significance in transformations, actively shaped the overall positive impact of digital culture on DT adoption. The above demonstrates that even in a bureaucratic organisation like Company X, embracing a digital culture with strong leadership support can significantly facilitate successful DT.

6.4 Conclusion: Research question 3

Many studies found human talent to impact DT positively and significantly. However, this study surprisingly showed insufficient evidence that digital talent affected DT, contradicting extant research findings. Specifically, the study excluded moderating factors identified from the hypothesised model that can influence this relationship. Additionally, internal factors within Company X, such as the appointment of digital leadership (a central digital function headed up by a GCDO was the first in the company), early stages of DT implementation, and skill misalignment with DT initiatives, may have influenced the outcome of this relationship. Therefore, although past research generally supports a positive relationship between digital talent and DT, this study highlights that simply having talented people does not automatically guarantee immediate success.

Considering moderating factors and specific organisational contexts is crucial for understanding the link of digital talent and DT.

6.5 Recommendations

DT is crucial for South African logistics companies to improve efficiency and adopt innovative ways of working. The study results emphasise a strategic approach that interconnects essential human skills and characteristics for successful DT adoption with the South African logistics context.

The valuable insights from the study are relevant to executives in South African companies with similar characteristics to Company X, including SOEs such as the South African Post Office and the Passenger Rail Agency with diverse logistics portfolios, and private companies like Bidvest Freight and Grindrod Logistics offering international freight services. However, executives must be mindful that private companies are managed or run differently from SOEs. The study identified critical strategic human factors that executives can leverage to implement DT initiatives and improve organisational performance successfully. In addition, the results provides an opportunity for executives to collaborate in developing a framework with practical guidelines and best practice to enhance leadership support in adopting DT within the sector.

The need for executives to understand and evaluate digital leadership, culture, and talent to make informed strategic choices for successful DT implementation is emphasised in the study.

To sustain, the positive influence of digital leadership on culture outcome, Company X needs to prioritise leadership development by investing in training which will equip current leaders with digital capabilities to promote a culture of continuous learning. Furthermore, they must recruit and retain leaders with strong digital skills and a mindset of innovation and collaboration. Providing digital leaders with autonomy and the resources they need is essential to drive this transformation. The GCDO's vision for the company and workforce actions must be clearly communicated and aligned to drive change.

Leadership has to proactively identify and address potential cultural barriers to digital technology adoption within specific teams, functions, and ODs in Company X. Targeted interventions that encourage digital collaboration, experimentation, and risk-taking are required to effectively deal with these cultural barriers. In addition, cultural initiatives must be measured, adjusted based on data and reported on to fully assess cultural change and their impact on DT outcomes.

From the unexpected finding on digital talent, further studies to comprehend the specific nuances of digital talent's impact on DT under different contexts and industries including alternative factors that might influence the relationship are required. Management can leverage data analytics in identifying competencies and behaviours that correlate with successful DT initiatives. Leaders must also build trust and transparency throughout the transformation process to alleviate employee resistance and fear. They need to create programs that furnish employees with the digital capabilities required for their evolving roles and responsibilities associated with DT implementation.

6.6 Limitations and challenges

The limitations and challenges in this study were:

Despite an overall reasonable response rate of 91% and an adequate distribution of the responses across the management levels, the resignations of Group Executives resulted in a low response (54%) of the Level A population stratum. These resignations and non-respondents possessing different characteristics from those of the reflected target population could have resulted in sample bias.

Due to time constraints, the use of a quicker and more straightforward research instrument (cross-sectional survey design), meant the study's results were time specific to when the investigation was conducted.

6.7 Further research suggestions

The study highlights valuable insights that present opportunities for continued research on human factors and DT in South African freight logistics. However, some limitations were identified that warrant further exploration. The research focused on a single company in its DT infancy. Therefore, further research across diverse contexts is needed to broaden the generalisability of these outcomes to varying DT maturity levels or industries

Understanding the dynamic nature of DT requires capturing changes over time. Future studies can benefit from longitudinal research to understand evolving relationships between variables.

Examining additional variables and their combined influence on the relationship between digital talent and DT can provide valuable insights into this relationship. While the study explored digital leadership as a central variable, further research can identify and analyse other leadership-related variables to further understand its influence on DT outcomes.

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APPENDIX A: Participant Information

Participant Information Sheet (PIS)



Dear Sir / Madam

My name is Lloyd Michael Chikwira I am a Masters student in Digital Business at the University of the Witwatersrand, Johannesburg. My supervisor is Prof. Rene' Pellissier. I am conducting a research study about Digital Transformation. The study title is the identification of huma factors in digital transformation (DT) in a South African rail logistics company.

I am inviting you to take part in completing an online questionnaire. If you decide to take part, your participation in this research study will last about 20 minutes maximum. The questionnaire will be online via a MS form or Qualtrics link that can be completed at your convenience

With your permission, I would like to gather your response as data for my study. Only the researcher will have access to the data.

During the research activity, I will need to ask for some personal information about you, including your age, gender, operating division, department, job position, grade level, number of years in your organisation, highest educational qualification, and your experience level with digital transformation.

The questionnaire will be confidential and anonymous. When I share the results of the research study, I will not include your name or anything else that could identify you.

If you decide to take part in the research study, it should be because you want to volunteer. You do not have to take part. You can stop being in the study at any time. You do not have to answer any questions if you do not want to. You will not get any direct benefits if you choose to join the research study. You will not lose any services, benefits, or rights you would normally have if you decide not to join. Taking part in the research study will not cost you anything. You will not be paid for being in this research study.

The risks for this research study are no more than what happens in everyday life.

This research study will be written up as a research report. If you would like to receive a summary of this report, I will be happy to send it to you.

If you have any questions during or afterwards about this research study, feel free to contact me or my supervisor on the details listed below. If you have any concerns or complaints about the ethical procedures of this research study, you are welcome to contact the University Human Research Ethics Committee (Non-Medical), telephone +27(0) 11 717 1408, email hrecnon-medical@wits.ac.za.

Yours sincerely,

Researcher:
Lloyd Michael Chikwira, 2427959@students.wits.ac.za, 078 268 1000

Supervisor:
Professor Rene' Pellissier, rene@pellissier.co.za, 060 668 4503

APPENDIX B: Participant Agreement



PARTICIPANT AGREEMENT FORM

A study into the identification of human factors in digital transformation (DT) in a South African rail logistics company: Lloyd Michael Chikwira

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 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 questionnaire (depending on their own ethics clearance being obtained) but my name and any personal information will not be used or passed on	YES	NO

…… (signature)
…… (name of participant)
…… (date)

APPENDIX (C) Questionnaire for Quantitative Studies

1. Demographic measurement section	
Research Questions	**Response**
Operating Division	1. TCC, 2. TFR, 3. TPT, 4. TNPA, 5. TPL, 6. TP, 7. TE
Management Grade Level	1. A, 2. B, 3. C
Gender	1. Male, 2. Female, 3. Other
Age	1. (20-24), 2. (25-34), 3. (35-44), 4. (45-54), 5. (55+)
Number of Management Years at the organisation	1. (1-10), 2. (11-20), 3. (21-30) 4. (30-40)
Highest Educational Qualification	1. Matric Certificate, 2. Undergraduate Diploma/ Degree, 3. Post Graduate Degree
Research Questions	**Response**
2. Digital Leadership (DL) impact on digital transformation section	
1. There is defined, accountable leadership for digital transformation in the organisation. **2.** Digital transformation is one of leadership's top strategic priorities of the organisation. **3.** There is strong organization-wide coordination for digital transformation led from leadership. **4.** Leadership shares a common vision of the digital future of our organisation and the digital transformation journey to get there.	1."Strongly Disagree" 2. "Disagree" 3. "Slightly Disagree" 4. "Neither Disagree/Agree" 5. "Slightly agree" 6. "Agree" 7. "Strongly Agree"
3. Digital Culture (DC) impact on digital transformation section	
1. The culture of digital innovation and change takes part as a natural process. **2.** There is a clear orientation to digital technology changes inside the company's culture. **3.** We involve customers in our innovation processes. **4.** The teams collaborate cross functionally across operating divisions in innovation and digital transformation initiatives.	1."Strongly Disagree" 2. "Disagree" 3. "Slightly Disagree" 4. "Neither Disagree/Agree" 5. "Slightly agree" 6. "Agree" 7. "Strongly Agree"

5. There is no bureaucracy in submitting innovative ideas. **6.** We accept risk and tolerate failure in the pursuit of innovation and transformation	
4. Digital Talent (DT) impact on digital transformation section	
1. We understand the role of digital skills in our organisation. **2.** We actively recruit and appoint new talent with strong digital skills. **3.** Strong digital skills are embedded throughout the organisation in strategic areas and programs. **4.** Our employees have basic digital literacy skills to enable them to participate in organisational digital activities. **5.** Digital upskilling/reskilling is a top priority for our organisation.	1.“Strongly Disagree” 2. “Disagree” 3. “Slightly Disagree” 4. “Neither Disagree/Agree” 5. “Slightly agree” 6. “Agree” 7. “Strongly Agree”
5. DT Value on organisational growth section i.e., achievement of its strategic goals	
1. Digital transformation can assist the organisation to be more successful. **2.** Digital transformation enhances the organisation’s profitability. **3.** Digital transformation fosters higher organisational productivity. **4.** Digital transformation can assist our organisation to be more innovative.	1.“Strongly Disagree” 2. “Disagree” 3. “Slightly Disagree” 4. “Neither Disagree/Agree” 5. “Slightly agree” 6. “Agree” 7. “Strongly Agree”

APPENDIX (D) Organisation Permission letter

1 August 2023
Mr. Lloyd Chikwira
[redacted]
Email: [redacted]

Dear Lloyd Chikwira

Re: Request for permission to conduct research at [redacted] Limited

Your email of request for permission to conduct research at [redacted] on "The support of digital transformation of the South Africa [redacted] logistics sector at [redacted] is acknowledged.

We note the conditions of the study to be for strict academic purposes, that the results of the study will be submitted to [redacted], and the research will be confidential and that anonymity for both respondents and the organisation is guaranteed. Should you or name of University of the Witwatersrand want to publish the study in any other manner than the final assignment, [redacted] will be approached for permission to do so.

Based on the above conditions, your request to conduct the research study in [redacted] is granted. We are looking forward to the outcome and recommendations of your study and the positive contributions towards performance of ports at [redacted].

Yours sincerely,

[redacted]
Chief of People Management & Learning
[redacted]
Date: 2 August 2023

APPENDIX (E) WBS Ethics Committee Approval

Graduate School of Business Administration
University of the Witwatersrand, Johannesburg

Wits Business School

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

Ethics Clearance Certificate

Ethics protocol number: WBS/DB2427959/976
This certificate is only valid with a legitimate ethics protocol number and signed by the Researcher (below)

Project title	The human factor in digital transformation in a South African rail logistics company
Investigator / Researcher	Mr Lloyd Chikwira
Nature of Project	MM (Digital Business)
Decision of the Committee	Approved, provided stakeholders and participants are guaranteed confidentialty.
Issue Date of Certificate	2023/10/16
Expiry date	Date of submission of the project / research report
Chairperson	Dr Pius Oba ☎ +27 11 717 3976 +27 82 733 6587 pius.oba@wits.ac.za

Declaration by Researcher

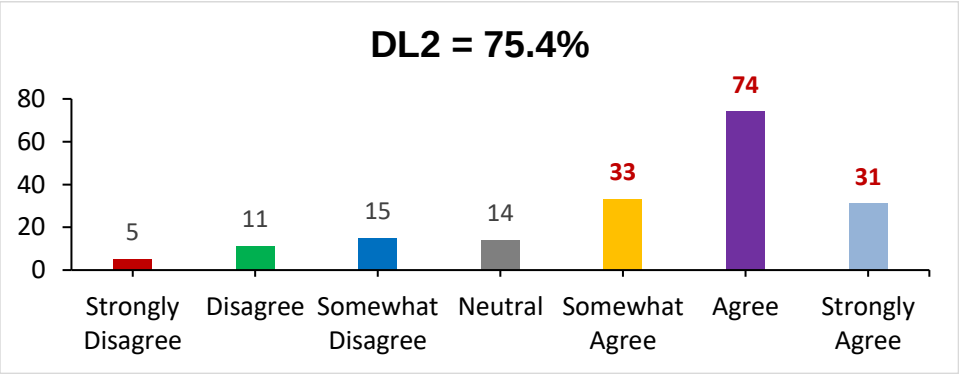
One copy must be signed by the Researcher and returned to the Chairperson of the Wits Business School Ethics Committee.

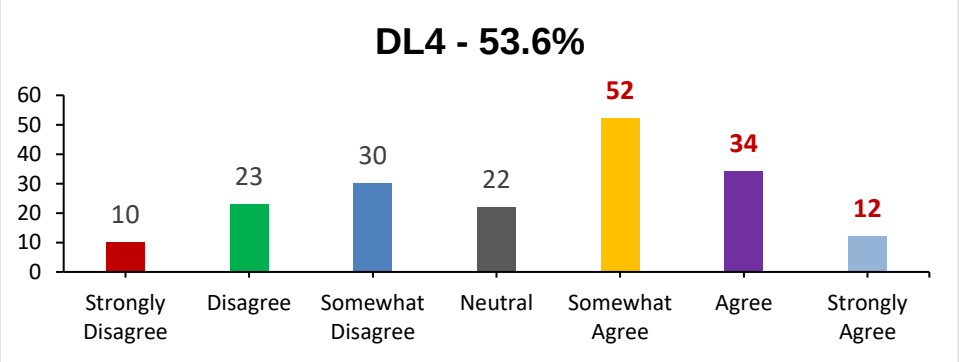
I fully understand the conditions under which I am authorized to carry out the abovementioned research and I guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I undertake to resubmit the protocol to the Committee.

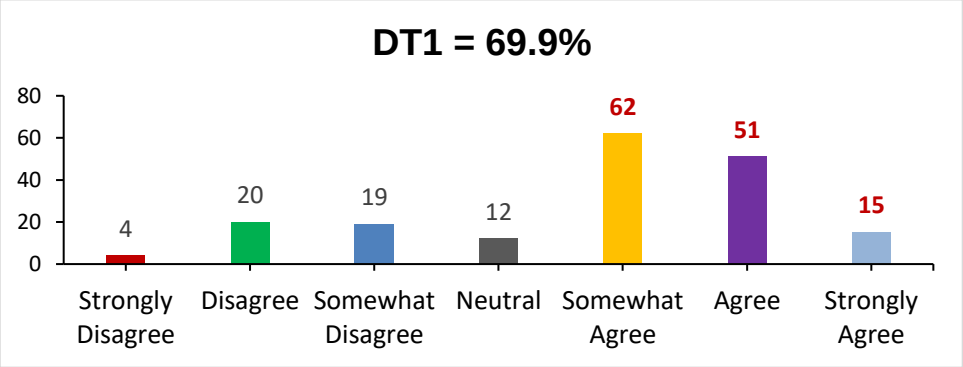
Signature

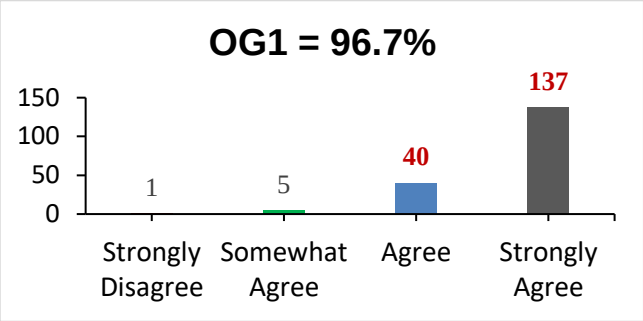
16/10/2023
Date:

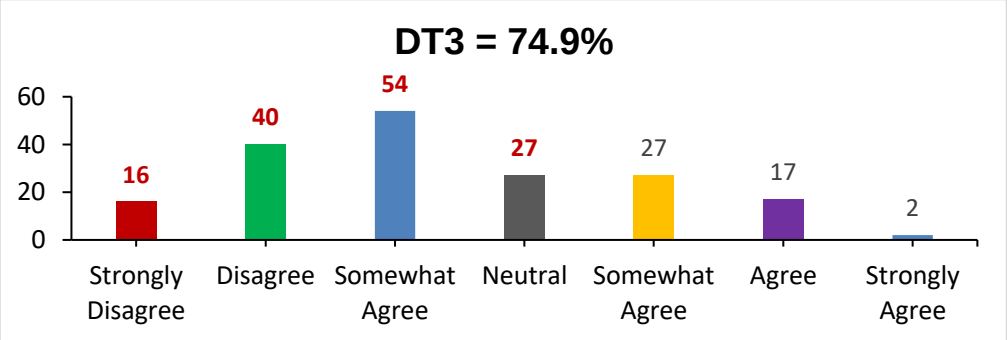
APPENDIX (F): INDICATOR RESPONSES

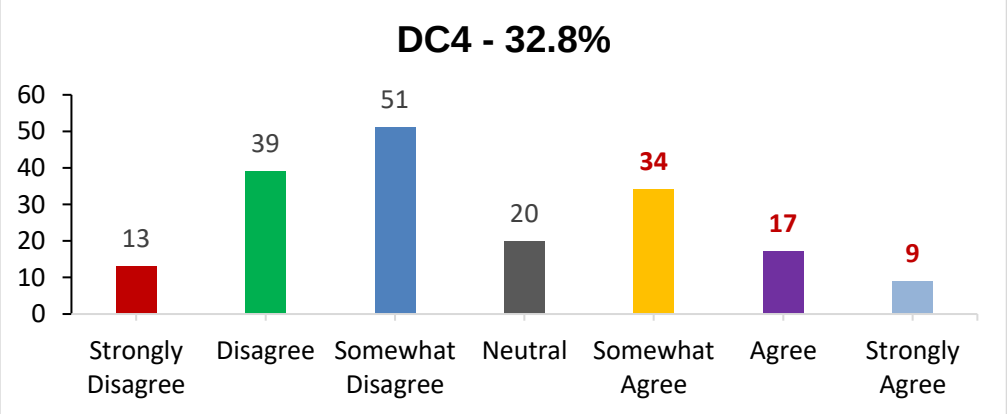


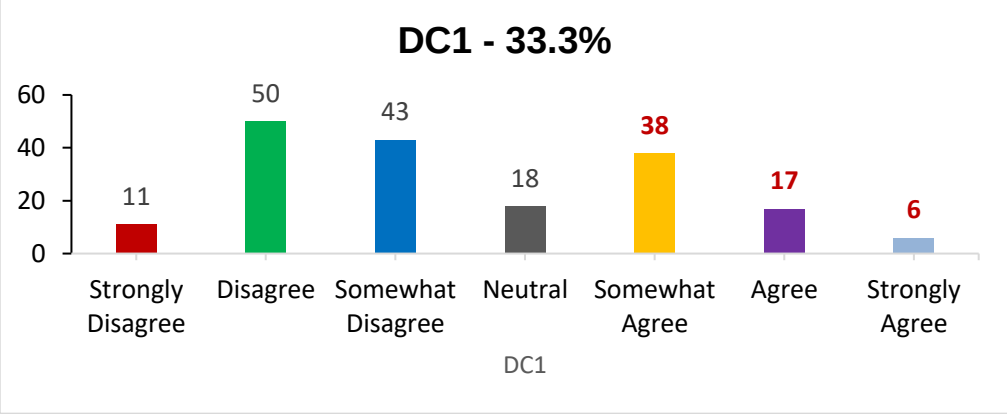





OG1 = 96.7%
150
100
50
0
1
5
40
137
Strongly Disagree
Somewhat Agree
Agree
Strongly Agree


DT3 = 74.9%
60
40
20
0
16
40
54
27
27
17
2
Strongly Disagree
Disagree
Somewhat Agree
Neutral
Somewhat Agree
Agree
Strongly Agree


DC4 - 32.8%
60
50
40
30
20
10
0
13
39
51
20
34
17
9
Strongly Disagree
Disagree
Somewhat Disagree
Neutral
Somewhat Agree
Agree
Strongly Agree


DC1 - 33.3%
60
40
20
0
11
50
43
18
38
17
6
Strongly Disagree
Disagree
Somewhat Disagree
Neutral
Somewhat Agree
Agree
Strongly Agree
DC1

APPENDIX (G) Observations farthest from centroid (Mahalanobis distance)

Observation number	Mahalanobis d-squared	p1	p2	Observation number	Mahalanobis d-squared	p1	p2
107	87.999	0	0	**52**	15.785	0.397	0.977
88	75.429	0	0	**51**	15.695	0.403	0.977
129	56.486	0	0	**143**	15.163	0.44	0.998
62	43.885	0	0	**7**	15.147	0.441	0.997
177	42.161	0	0	**114**	15.119	0.443	0.996
175	41.672	0	0	**9**	15.111	0.443	0.994
89	40.648	0	0	**109**	15.071	0.446	0.992
41	38.704	0.001	0	**182**	14.855	0.462	0.996
145	38.396	0.001	0	**120**	14.769	0.468	0.997
5	36.939	0.001	0	**4**	14.68	0.475	0.997
35	35.508	0.002	0	**116**	14.627	0.479	0.996
19	34.701	0.003	0	**168**	14.55	0.484	0.996
76	31.711	0.007	0	**80**	14.399	0.495	0.998
132	31.379	0.008	0	**69**	14.35	0.499	0.997
181	31.224	0.008	0	**58**	13.917	0.532	1
180	28.624	0.018	0	**16**	13.836	0.538	1
36	28.4	0.019	0	**26**	13.723	0.547	1
54	27.031	0.028	0	**173**	13.561	0.559	1
170	25.777	0.04	0	**8**	13.543	0.56	1
64	25.544	0.043	0	**39**	13.505	0.563	1
146	25.052	0.049	0	**121**	13.133	0.592	1
65	24.631	0.055	0.001	**70**	12.968	0.605	1
106	24.609	0.055	0	**117**	12.874	0.612	1
156	24.45	0.058	0	**105**	12.67	0.628	1
179	24.113	0.063	0	**66**	12.644	0.63	1
78	23.683	0.071	0.001	**123**	12.623	0.631	1
47	23.176	0.08	0.002	**15**	12.418	0.647	1
40	23.076	0.083	0.001	**95**	12.323	0.654	1
171	21.925	0.11	0.028	**172**	12.314	0.655	1
68	20.525	0.153	0.367	**84**	12.23	0.662	1

127	20.355	0.159	0.377	**124**	12.197	0.664	1
48	19.822	0.179	0.586	**134**	12.081	0.673	1
91	19.582	0.189	0.641	**159**	12.006	0.679	1
133	19.494	0.192	0.616	**104**	11.941	0.683	1
82	19.451	0.194	0.567	**162**	11.935	0.684	1
101	19.39	0.197	0.528	**23**	11.931	0.684	1
3	19.252	0.203	0.534	**22**	11.914	0.686	1
144	19.209	0.204	0.486	**135**	11.866	0.689	1
102	19.158	0.207	0.444	**42**	11.841	0.691	1
90	19.061	0.211	0.429	**150**	11.787	0.695	1
27	18.952	0.216	0.423	**93**	11.694	0.702	1
46	18.663	0.229	0.527				
169	18.531	0.236	0.539				
72	18.426	0.241	0.535				
17	18.058	0.26	0.691				
148	17.897	0.268	0.721				
136	17.775	0.275	0.731				
142	17.631	0.283	0.753				
50	17.599	0.284	0.716				
140	17.278	0.303	0.827				
164	17.217	0.306	0.811				
81	17.21	0.306	0.767				
165	17.094	0.313	0.778				
96	16.765	0.333	0.88				
167	16.739	0.335	0.855				
6	16.62	0.342	0.866				
63	16.018	0.381	0.979				
28	15.941	0.386	0.978				
87	15.851	0.392	0.979				

APPENDIX (H) Comparison of Measurement, Structural Model Indices to Threshold Values

Fit Index Description	Fit Index	Threshold	Measurement Model	Structural Model
Chi-Square (CMIN)	X^2	Relative to df	110.1	167.1
Chi-Square Probability Value	p-value	p > 0.05	0.000	0.000
Chi-Square/degrees of freedom	X^2/df	<2.5	1.359	2.014
Goodness of Fit Index	GFI	>0.8	0.928	0.899
Adjusted Goodness of Fit Index	AGFI	>0.8	0.893	0.854
Standard RMR	SRMR	<0.09	0.0413	0.0701
Root Mean Square Error of Approximation	RMSEA	<0.08	0.044	0.075
Normed Fit Index	NFI	>0.9	0.928	0.890
Comparative Fit Index	CFI	>0.9	0.979	0.941
Incremental Fit Index	IFI	>0.9	0.98	0.942
Tucker Lewis Index	TLI	>0.9	0.973	0.925