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Challenges imposed by legacy systems on digital transformation in Gauteng national departments

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

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ABSTRACT

The digital transformation of government institutions is critical for improving service delivery, operational efficiency, and citizen engagement. However, legacy systems characterised by outdated technologies, limited interoperability, and high maintenance costs pose significant challenges to modernisation efforts. This study explores the impact of legacy systems on digital transformation within Gauteng national departments, identifying key barriers and strategies employed to mitigate these challenges.

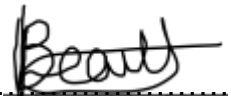
Using a qualitative research approach, the study gathered insights from senior IT officials and digital transformation leaders through semi-structured interviews. The findings reveal that legacy systems impacts digital transformation by limiting system interoperability, creating bottlenecks and escalating operational expenses. Additionally, cultural resistance to change, inadequate leadership buy-in, and insufficient interests in modernisation efforts. Despite these obstacles, national departments have implemented various strategies, including phased system upgrades, the adoption of cloud computing, middleware solutions for integration, and digital skills development programs.

The study highlights the crucial role of leadership, and stakeholder engagement in driving successful digital transformation. It offers strategic recommendations for IT leaders to enhance governance, improve interoperability, and ensure a smoother transition from legacy systems to modern digital infrastructures. The research contributes to the broader discourse on public sector digital transformation, providing insights that can inform policy and implementation strategies in government institutions beyond Gauteng. Future research should explore the use of AI in sustaining digital transformation initiatives and managing the challenges imposed on the journey.

DECLARATION

I, Reneilwe Ramonyai, declare that this research study is my own original work and has not been submitted for any degree or examination at any other institution. All sources used in this study have been duly acknowledged and referenced in accordance with academic integrity standards. I affirm that this work is a true reflection of my research efforts, and any assistance received has been fully disclosed.

Name: Reneilwe Ramonyai



……..

Signature

Signed in Birch Acres on 24 May 2025

DEDICATION

I dedicate this to my children Rebone, Letago, Kabelo and Karabo, I want you to know that no dream is too big, and no challenge is too great when you believe in yourself and put in the effort. Let this journey inspire you to always chase your dreams with courage and determination. Know that I have walked this path not only for myself but to set an example for you—so that you may always strive for excellence, embrace learning, and never give up, no matter how tough the road may seem.

Above all, I give thanks to God, whose grace, wisdom, and guidance have carried me through every step of this process. Without His blessings, none of this would have been possible. I am deeply grateful for His endless love and the strength He has provided me to complete this work.

This achievement is not mine alone, it is a reflection of the love, faith, and support that I have been blessed with.

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First and foremost, I extend my deepest gratitude to my supervisor, Kiru Pillay, for your invaluable guidance, support, and encouragement throughout this research journey. Your insights, patience, and dedication have been instrumental in shaping this work, and I am truly grateful for your mentorship.

To my love, Matsobane Ramonyai, thank you for your unwavering support, understanding, and encouragement. Your belief in me, even during the most challenging times, has been a source of strength and motivation. I could not have done this without your love and reassurance.

To my mother Sarah Mamatlepa, your sacrifices, wisdom, and prayers have paved the way for me to reach this milestone. Your constant calls checking if I'm still of sound mind and belief in my abilities have been my foundation, and I am forever grateful for the values and lessons you have instilled in me.

To the Selowa, the Mamatlepas, the Jibililis, the Myenis, the Tshothelis, the Makhurpetsis, and the Patlakes, the Mohales, the Baloyis, the Masilelas, your love and support have been my anchor. Thank you for always being there, cheering me on, and reminding me of the bigger picture. Your faith in me has kept me going, and I am truly blessed to have you by my side.

KEYWORDS

i. Digital Transformation
ii. Legacy Systems
iii. National Departments
iv. Technology Trends

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LIST OF ACRONYMS

4IR	Four Industrial Revolution
AI	Artificial Intelligence
API	Application Programming Interfaces
CIO	Chief Information Officers
DPSA	Department of Public Service and Administration
GWEA	Government-Wide Enterprise Architecture
HR	Human Recourses
ICT	Information Communication Technology
IoT	Internet of Things
IT	Information Technology
NDP	National Development Plan
PGC	Post-Graduate Committee
POPIA	Protection of Personal Information Act
SITA	State Information Technology Agency
TOE	Technology organization environment
WBS	Wits Business School

CHAPTER 1. INTRODUCTION

1.1 Statement of purpose

The purpose of this study is to explore how national departments navigate the challenges imposed by legacy systems when undergoing their digital transformation journey.

1.2 Background of the study

Globally, there is a drive to modernise operations and enhance efficiency, driven in part by the technologies encapsulated under the concept of the Four Industrial Revolution (4IR). These digital transformation projects are essential for organisations aiming to enhance their service delivery and operational efficiency, meeting the growing demand for high quality digital services from citizens (Hafseld *et al*., 2022). Digital transformation involves the adoption of advanced technologies to improve business processes, increase efficiency, and drive innovation according to Andrade and Gonçalo (2021).

Digital transformation also involves integrating digital technologies into all areas of an organisation, fundamentally changing how the business operates and delivers value to customers (Tsai *et al*., 2022). Globally, private sector organisations and governments are actively pursuing digital transformation to enhance operational efficiency and service delivery, often driven by the increasing pressure from citizens, civil society, and businesses for more effective public services (Manda, 2022).

According to Vărzaru *et al.* (2023), digital transformation also has the potential to revolutionise national department management by enabling government institutions to integrate these advanced digital technologies with legacy systems to enhance operational efficiency, transparency, and revenue collection capabilities. The decentralised nature of local governments demands innovative

approaches to meet the growing expectations of citizens for more efficient, transparent, and responsive public services (Mahula *et al*., 2022).

It is essential for developing countries to catch up with more advanced economies and enhance their global competitiveness. Over the past decade, South Africa has made great strides towards its goal of becoming a digital, smart, and connected society by utilising the socioeconomic advantages of the F4IR. These efforts have included implementing frameworks and standards like the Government Wide Enterprise Architecture (GWEA) and the Minimum Interoperability Standards, as well as enhancing governance models, citizen satisfaction, transparency, and system interoperability (Manda, 2022). Despite challenges such as leadership commitment and coordination issues, the South African government continues to push forward with its digital transformation initiatives to build a smart, digital society by 2030 (Manda, 2022).

The journey to digital transformation is seen on the European Commission's "Path to the Digital Decade" policy programme. This initiative aims to achieve the ambitious objectives set out in the 2030 Digital Compass, focusing on key areas such as skills development, infrastructure enhancement, business digitalisation, and the provision of online public services ("European Commission Welcomes Political Agreement on the Digital Decade Policy Programme Driving Successful Digital Transformation in Europe," 2022). International and local support has played a crucial role in this digital transformation, where organisations such as the World Bank and UNESCO have provided financial assistance, digital devices, and technical training to facilitate remote learning in other regions.

Digital transformation is dependent on what is termed 'modern systems; which are systems that incorporate emerging technologies and have the ability to integrate with organisation's business processes and other systems (De Angelis et al., 2024). Adrade and Goncalo (2021) stated that the development of strategic capabilities, such as dynamic and integrative capabilities, was essential for leveraging digital transformation effectively. This transformation initiative is particularly complex for organisations with legacy systems, which, while once

effective, now often hinder efficiency and adaptability due to their inflexibility in integration and interoperability (Tsai *et al*., 2022).

Legacy Systems

While organisations embark in the transformation journey, they are faced with challenges posed by legacy systems. According to Irani *et al*. (2023), legacy system included both technical and social elements, such as software, skills, and business processes, which were no longer adequate for current business model or requirements.

The journey of modernising legacy systems is a critical aspect in many large organisations, especially those with extensive and old IT infrastructures and systems that are embedded in business critical processes and pose significant challenges due to their outdated hardware and software components (Cao & Iansiti, 2022). This can make it difficult to migrate the functionality processes and integrate them into new systems that meet updated requirements and a variety of organisational functions (Tsai et al., 2022).

Their inherent complexity and outdated technology poses challenges such as substantial security risks and obstructing innovation, thus modernisation efforts becomes costly (Irani *et al*., 2023). Many of these old systems from large organisations, are very difficult to upgrade or replace, because they are mission critical and handle important business processes (Cao & Iansiti, 2022).

Irani et al. (2023) argued that legacy systems present significant challenges to digital transformation initiatives, as they impede the seamless interoperability across institutions due to the complexities associated with them, such as that they are developed non-sequentially and in silos and have data incompatibility when integrating them with modern systems. They contribute to architectural inertia, making it difficult for organisations to re-architect and fully commit to digital transformation initiatives (Cao & Iansiti, 2022). These systems play an important role in many organisations but tend to complicate interoperability and integration with other systems due to their outdated technologies and lack of upgrade

support (Irani et al., 2023). Velimeneti (2016) argued that legacy systems had custom built, monolithic architectures that bundle business logic and data access components, which created significant redundancy in services and data, posing a challenge for migration. This research paper will explore how national departments navigate around the challenges imposed by legacy systems when undergoing digital transformation journey.

Challenges

According to Bakar *et al*. (2022), the process of modernising legacy systems involves enhancing existing systems beyond their maintenance capabilities by employing proper approaches with key steps that include reverse engineering to understand and extract old system requirements, and requirements engineering to gather and create new requirements. Achieving successful outcome of legacy systems modernisation is challenging due to the need to balance between organisation's operations and the organisation's efforts to digitally transform (Tsai et al., 2022).

One example that illustrates these challenges is from South Africa's national department of Home Affairs which stores every citizen's personal information such as date of birth, place of birth, home address and identify number. However, the municipalities are unable to retrieve such data into their systems because of the lack of interoperability amongst the systems (Mayedwa & Van Belle, 2021).

Modernising these systems often requires ensuring that they can effectively communicate and integrate with contemporary technologies and new systems (Bakar *et al*., 2022).

1.3 Research problem

Andrade and Gonçalo (2021) argues that countries are often at different stages of adopting 4IR technologies and digital transformation. As South Africa is working on developing Information Communication Technology (ICT) ecosystems and innovative capabilities, there are challenges hindering the effective implementation of digital transformation strategies (Andrade & Gonçalo, 2021). A major hurdle in this process is the complexity and cost associated with modernising legacy systems and integrating them with new digital technologies.

Existing literature highlights the struggles of various organisations with legacy systems, while critical to daily operations, they continue to impede progress due to their complexity and lack of interoperability with modern systems (Cao & Iansiti, 2022; Irani *et al*., 2023). These systems incur exponentially increasing maintenance costs as they age, and their replacement is not only resource intensive demanding time and specialised skills; but also risky, given the high potential for operational disruption (Irani et al., 2023). Furthermore, Irani et al. (2023) document cases such as the UK's National Programme for IT (NPfIT), which failed due to severe cost overruns, reaching over £20 billion, nearly triple the original estimate. Similarly, in the Netherlands, efforts to modernise systems incurred a total cost of ownership nearing €1.5 billion.

Though frameworks such as the GWEA have been implemented to promote system interoperability in South Africa (Manda, 2022), legacy systems present significant challenges on a global scale, thereby hindering improvements in operational efficiency, transparency, and service delivery (Cao & Iansiti, 2022; Irani *et al*., 2023).

There is a perceived lack of comprehensive understanding of how South African national departments manage the challenges imposed by these legacy systems during their digital transformation journeys. This research aims to fill this gap by exploring the specific challenges encountered by national departments in South Africa and the strategies employed to navigate around these challenges.

1.4 Research objectives

The main objectives of this study include:

1. To explore the technological, organisational, and environmental factors related to legacy systems that influence digital transformation in national departments
2. Explore the extent to which legacy systems are impacting digital transformation initiatives
3. To explore how national departments navigate the challenges imposed by legacy systems

1.5 Rationale

The digital transformation of organisations has been a subject of growing interest among scholars globally. Numerous studies have explored various aspects of this phenomenon, offering insights into the transformative journeys undertaken by organisations. For instance, scholars such as Maremi et al. (2022) and Manda (2022) have examined the digital transformation process, highlighting the strategic approaches and methodologies employed by organisations to navigate this complex transition. Additionally, researchers like Irani et al. (2023), Cao and Iansiti (2022) and Mantyi (2020) have delved deeper into identifying and analysing the myriad challenges that can impede successful digital transformation.

A significant body of literature also addresses the specific challenges posed by legacy systems during digital transformation efforts (Manda, 2022) and (Mistry, 2022). These studies underscore the inherent difficulties that legacy systems present, including issues related to interoperability and integration, which can

significantly hinder the progress of digital transformation initiatives (Manda, 2022).

This study aims to contribute to the existing body of knowledge by focusing on how the South African national departments navigate around the challenges imposed by legacy systems on digital transformation strategies. The research aims to provide a detailed understanding of the challenges encountered during digital transformation and how these institutions navigate around them. This study will lead to the development of more robust strategies to overcome digital transformation hindrances, improve interoperability, and ultimately foster a more transparent and responsive government. Additionally, by focusing on a specific regional context, the study can address unique local challenges, contributing to the broader discourse on digital transformation in developing economies and helping South Africa leverage the socioeconomic benefits of 4IR.

1.6 Delimitations of the study

This study is confined to the South African national departments, specifically examines the Gauteng province, excluding other provinces in South Africa or other countries. It focuses on how the national departments navigate around the challenges presented by legacy systems on digital transformation efforts and excludes non legacy systems or newly implemented systems.

The study employs a qualitative research methodology, which includes interviews and studies. Quantitative methods, such as surveys or statistical analysis, are not utilised in this research.

1.7 Definition of terms

Term	Definition

Digital Transformation	The adoption of novel strategies and business models enabled by new information technologies, involving shifts in representation, connectivity, and aggregation of business processes (Furr *et al*., 2022).
Fourth Industrial Revolution (4IR)	Refers to the rapid automation of conventional manufacturing and industrial processes through the use of digital technologies (Benyera, 2021).
Legacy Systems	Obsolete information technology systems that continue to be used because their data cannot be converted to other formats, and their application programs cannot be updated (Irani et al., 2023).

1.8 Assumptions

This study assumes:

That the national departments have undergone a digital transformation process, during which they came across challenges imposed by legacy systems.

Technological interoperability issues are a major hurdle. Legacy systems often have difficulty communicating with newer systems, which complicates data sharing and process integration.

These legacy systems, by virtue of their outdated technology and design, pose significant challenges to digital transformation efforts, primarily due to issues of compatibility and integration with modern digital technologies.

CHAPTER 2. LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 Introduction

The digital transformation of national departments presents unique challenges and opportunities, particularly when contending with legacy systems. This review critically examined the literature surrounding digital transformation in national departments, with a specific focus on how they navigated around these challenges. Key studies have explored the broader implications on digital transformation across various sectors, highlighting the challenges of integrating advanced technologies to enhance operational efficiency and service delivery (Andrade & Gonçalo, 2021; Tsai et al., 2022). However, less attention has been given to how these national departments navigate around the challenges, especially under the constraints of legacy systems.

According to Perez (2009), each technological revolution gives rise to a techno-economic paradigm (TEP), a shared set of technological, organisational, and institutional practices that define the prevailing common sense for efficiency and innovation. Legacy systems are artifacts of such earlier paradigms optimised for the logic of their time, but increasingly misaligned with the demands of modern digital infrastructures. Perez (2009) highlights that resistance to new techno-economic paradigms is embedded in established institutional structures. This helps explain the persistent reliance on outdated systems in national departments, despite widespread adoption of newer digital platforms elsewhere.

In the South African context, where national departments are pivotal in delivering critical services, the effective modernisation of legacy systems is crucial for successful digital transformation (Manda, 2022). The literature suggests a significant gap in understanding how these institutions navigate the digital transformation process amid such constraints (Cao & Iansiti, 2022; Irani et al., 2023). This review sought to bridge this gap by examining how legacy systems

influence digital transformation initiatives, focusing on the challenges they impose, and organisational strategies that help minimise the impact.

Firstly, this review aimed to establish a foundational understanding of digital transformation and legacy systems by exploring various definitions and scholarly perspectives that delineate its scope and significance in the national department. It highlighted the intricate ways in which legacy systems impact these definitions and the practical application of digital transformation. This section set the stage for a deeper exploration of how these systems shape the operational realities of national department entities, particularly within the unique context of South African national departments.

Secondly, the review examined the specific impacts of legacy systems on the ability of national departments to undertake digital transformation. It focused on the challenges and barriers these outdated systems present, such as issues with interoperability, integration and organisational strategies, which are crucial in understanding the broader implications for service delivery and governmental efficiency. Through this exploration, the study sought to highlight the strategic changes necessary for overcoming these challenges.

By synthesising insights from various disciplines and studies, this literature review aimed to offer a comprehensive overview of the challenges and strategies involved in navigating digital transformation in national departments constrained by legacy systems. The analysis also proposed pathways to successful transformation strategies, thereby enriching the existing body of knowledge and offering practical insights for policymakers and administrators.

2.2 Definition of topic

2.2.1 *Digital Transformation*

According to Irani et al. (2023), digital transformation in public administration involves the strategic implementation of digital technologies to fundamentally

reform and enhance government operations and services. This process goes beyond simple digitization, embedding digital technology at the core of governmental activities to improve efficiency, service delivery, and governance (Irani et al., 2023). The definition by Irani et al. (2023) emphasises the nature of digital transformation as not just an adoption of new technologies but as a fundamental reimagining of how public services operate and deliver. Furthermore, this transformation involves not only technological changes but also requires a shift in organisational culture and processes.

Hong et al. (2022) states that digital transformation in the national department involves leveraging digital technologies and applications to enhance and streamline the operational processes and services provided by public entities (Hong et al., 2022). While Rusu et al. (2023) argue that digital transformation entails the thorough incorporation of digital technology across all business aspects, significantly altering operational and customer value delivery methods. Both the definitions provided underscores the role of digital technologies in evolving the functional landscape of public services. Both the papers underpin an approach that transforming government operations and enhancing service delivery to meet contemporary demands is critical.

Digital transformation is the change between different states of digital maturity, which is easier to measure than digital transformation itself (Hamberg, 2022). The paper suggests that digital transformation may not be very different from other organisational changes, and that the terms digital and digital maturity may become less commonly used in the future, with effectiveness being a more common term. The definition highlights both the technological and strategic shifts are necessary for organisations, especially within the national department, to adapt and thrive in a digital era. The emphasis on strategic change being as crucial as technological integration is particularly relevant. In national departments, where processes and norms are deeply entrenched, this dual requirement poses a significant challenge.

2.2.2 *Legacy Systems*

Tsai et al. (2022) defines legacy systems as older information technologies that, despite their obsolescence, remain crucial to organisational operations. Bakar et al. (2022) defining them as fundamental and valuable assets within organisations, recognised for their prolonged utility and significant business worth. Tsai et al. (2022) further states that even though they are characterised by outdated technologies, they are often embedded within the core operational processes of the institutions. The definition of legacy systems provided highlights their deep integration into workflows that are vital to the organisation's functions, even as their outdated nature becomes a significant liability.

Irani et al. (2023) define legacy systems as outdated corporate information systems that are retained within organisations due to their ongoing operational adequacy. They function at a basic level, posing substantial challenges to technological integration, driven by issues like interoperability with other systems, elevated maintenance expenses, and difficulties in achieving seamless interaction with more modern systems (Irani et al., 2023). The definition delves more on the operational sufficiency of legacy systems which justifies their continued use despite technological advancements. This perspective is crucial when considering the challenges these systems pose to digital transformation because of their cruciality in organisational operations.

Legacy systems definitions despite mention the outdated and basic functionality, there is an emphasis on them still performing their primary functions, even though often they become hindrances to the integration and interoperability of new digital technologies.

2.3 To explore factors influencing digital transformation in national departments

Digital transformation has emerged as a pivotal force in reshaping business operations and organisational processes. Factors like technological, economic,

and policy drivers play a major role in influencing digital transformation. Additionally, government significantly influences digital transformation by use of fiscal tools, policy interventions, and infrastructure investments to support the digital economy (Jin & Pan, 2023). Government policies and regulations act as strong drivers of digital transformation. Institutional mandates, such as sustainability regulations and digital infrastructure development incentives, enable organisations to innovate (Zhang et al., 2023). According to Maazmi et al. (2024), governance structures provide the foundation for clear decision-making processes, effective resource allocation, and compliance with regulatory and ethical standards. Furthermore, leadership governance is one of the key dimensions influencing digital transformation outcomes.

Zhang et al (2023) also states that organisations with adaptive cultures are better positioned to align their processes and workforce with digital transformation goals and fosters openness, innovation, and continuous learning significantly influences employees' receptiveness to digital initiatives.

2.3.1 *Digital transformation*

Beyond the mere implementation of technology, digital transformation in the national department requires a refined understanding of the interplay between power, politics, and institutional structures (Manda, 2022). The impulse for digital transformation within the national department is strongly justified given the rapid technological advancements and societal shifts towards digital interactions. As public institutions strive to meet the heightened expectations of citizens and the business, they encounter the challenge of balancing technological modernisation with maintaining or improving service quality. Manda (2022) further explores how these elements contribute to or hinder the adoption and effective use of digital technologies in government processes. Elsafty and Yehia (2023) emphasise that successful digital transformation requires not only technological upgrades but also addressing behavioural and organisational challenges. Furthermore, a successful digital transformation that contribute positively to governance is

deeply entangled with the ability to navigate and manage these elements and ensuring that digital initiatives align with broader institutional reforms (LAREGO, ENCG, Cadi Ayyad University et al., 2024).

The growing expectation for digital transformation in the national department is driven by increasing demands from citizens, civil society, and businesses for more efficient service delivery. Governments leadership is implementing digital transformation strategies to improve operational efficiency and service delivery (Manda, 2022). As national departments aim to meet these expectations, they are compelled to implement digital solutions that not only enhance service efficiency but also ensure environmental, economic, and social sustainability, thus contributing to a higher quality of life for citizens (Gudmundsdottir et al., 2024).

The process of reviewing and initiating digital transformation projects becomes critical but often flawed. The strategic objectives set by national departments, aim to enhance ICT structure and manage risks but fall short in implementation due to a lack of coherence with practical, on-the-ground needs and capabilities (Mayedwa & Van Belle, 2021).

While the expectations for digital transformation are clear in national departments, the actual implementation within the national department often faces significant challenges such as budget constraints, resistance to change among employees, and legacy systems that are difficult to overhaul (Gudmundsdottir et al., 2024).

2.3.2 *Factors influencing digital transformation*

a. *Regulations and Policy*

The governmental frameworks emphasises the dual necessity of adopting digital technologies to enhance public sector service efficiency and maintaining organisational stability (Faro et al., 2022).

The integration of artificial intelligence in government services is underscored by regulatory frameworks in China and these policies emphasises the need for AI-driven innovations like chatbots to streamline government functions, improve public accessibility, and foster transparency (Guo & Peng, 2024). Frameworks and governance structure serve as a comprehensive roadmap for digital transformation focusing on regulation to emphasise coordination across sectors and levels to enhance seamless implementation and monitoring of digital strategies (Savuth & Sothea, 2023).

b. ***Technological trends***

Digital transformation plays an essential role in improving the operational effectiveness and efficiency of national department organisations. Integrating advanced digital technologies like the Internet of Things (IoT), big data analytics, and cloud computing into municipal operations enables public entities to respond more dynamically to changing needs and challenges (Cao & Iansiti, 2022).

The evolution of trends are shaping the digitization of public services, focusing on personalisation, proactive assistance, and real-time responsiveness to user needs and public service delivery (Guo & Peng, 2024). Emerging technologies like blockchain offer transformative potential by enhancing transparency, decentralisation, and operational efficiency in public services (Mahula et al., 2022). The role of digital transformation emphasises how integrating digital technologies into municipal systems facilitates more responsive and adaptable governance structures. By leveraging these technologies, national departments can improve service delivery, engage citizens more effectively, and ensure a more sustainable management of resources (Van Der Hoogen et al., 2024).

2.4 The extent to which legacy systems are impacting digital transformation initiatives

In the rapidly evolving landscape of digital technology, national departments are increasingly growing the need for modernisation of legacy systems to achieve

operational efficiency (Tsai et al., 2022). Legacy systems typically resist modifications and updates, a behaviour rooted in their outdated architectural designs and the complex, often obsolete processes they support. This resistance to change is further complicated by their integration with broader public administration processes that are likewise resistant to change due to regulatory, compliance, and bureaucratic frameworks (Irani et al., 2023).

These systems frequently pose technical challenges that hinder innovation initiatives in many national departments. Maintaining these systems has become problematic and does not align with the requirements of digital transformation in the national department. Because these systems are crucial, they cannot be simply abandoned. Completely redesigning these old systems involves a lengthy development period, substantial costs, and the potential loss of essential service features (Bakar et al., 2022).

For national departments to successfully address and overcome these challenges imposed by legacy systems, they need to achieve a significant degree of digital maturity. Digital maturity refers to an organisation's ability to utilise digital technologies effectively to meet its business and operational objectives. In the national department, this concept goes beyond merely implementing new technologies. It entails a comprehensive transformation of processes, organisational culture, and capabilities, aiming to improve service delivery and responsiveness (Gökalp & Martinez, 2022).

Irani et al. (2022) identifies that transformations are more likely to succeed when there is a clear strategy for dealing with the varying levels of system complexity and when there is an alignment between the technology upgrades and the public administration’s operational and policy needs.

2.4.1 *Legacy systems challenges*

As governments globally progress with their digital transformation initiatives, there has been a growing necessity to integrate large organisations current

systems with new trends. Consequently, the integration of these systems has become a focal point within the information and communications technology community, particularly in complex organisational structures (Irani et al., 2023).

Legacy systems cause significant operational drags due to their inflexible processes and high maintenance costs, necessitating modernisation to meet the evolving information needs of organisations in a turbulent environment (Tsai et al., 2022).

A significant barrier to digital transformation is the lack of interoperability between legacy systems and modern technologies. Issues such as incompatible communication protocols and data inconsistencies hinder the efficient exchange of information (Venâncio et al., 2023). Integration, particularly concerning legacy systems and modern systems, entails the seamless combination of traditional systems' functionalities and data with contemporary production systems (Cao & Iansiti, 2022).

This integration is essential for improving decision-making capabilities and adjusting to evolving operational demands, requiring effective data transfer between old and new systems (Bitsch et al., 2023). Both the concepts integration and interoperability focus on the need to maintain operational continuity while transforming organisations, as any disruption caused by integration efforts can have significant implications.

To obtain a successful modernisation in national departments which results in legacy systems that can easily integrate and communicate with newer, more advanced systems, involves overcoming interoperability barriers such as incompatible communication protocols and misaligned data formats (Venâncio et al., 2023). Integrating old systems with modern architectures often results in a complex system architecture with hidden dependencies. This not only increases technical debt but also complicates maintenance and future upgrades.

In another study, a discussion on how legacy systems, due to their deep integration and entrenchment in organisations, create high levels of technical and

social inertia that make these systems difficult to replace (Rinta-Kahila et al., 2023). It further states that failure to fully modernise legacy systems often results in complex system architectures that include outdated components. These architectures harbour hidden dependencies that can lead to increased maintenance costs and higher risk of system failures.

Legacy servers, particularly those maintained under third party maintenance arrangements, significantly hinder the coherence of an organisation's data architecture. This lack of coherence poses challenges in integrating large scale data streams across different locations and business functions, leading to inefficiencies in data related cocreation processes (Cao & Iansiti, 2022).

Bakar et al. (2022) has created a roadmap that is designed to address the challenges posed by complex, outdated systems by providing a structured, phased approach that balances technical upgrades with organisational change management. The roadmap includes structured steps like initial assessment to evaluate legacy systems, followed by engaging stakeholders to align expectations and support. A tailored modernisation strategy must be defined, implementing changes incrementally to manage risks and adapt as needed. Rigorous testing and quality assurance ensure the systems meet required standards, while comprehensive training and change management facilitate smooth transitions for users and staff.

2.4.2 *Proposition 1 (P1)*

Legacy systems present challenges to digital transformation by resisting modifications and complicating integration with modern systems.

2.5 How national departments navigate the challenges.

The profound impact of digital technologies on global industry and society has significantly altered the operational landscape of national departments. In the realm of public administration, the embracement of modern technologies is not

just beneficial but essential for sustaining competitive government services globally (Danaeefard et al., 2024). As these institutions serve as the primary interface between citizens and government, their role in managing technological transformations is crucial (Mahula et al., 2022).

Maremi et al. (2022) argue that transitioning towards a digital governance is a critical endeavour aimed at enhancing service delivery and operational efficiency but is often hindered by several institutional, technical, and socio-economic barriers. Legacy systems in national departments pose significant challenges due to their inflexibility, high maintenance costs, and incompatibilities with modern technologies (Maremi et al., 2022).

A significant aspect of navigating legacy system challenges involves understanding the power dynamics within institutions. According to Manda (2023), the alignment of political will with digital transformation goals is paramount, as resistance to change often stems from deeply entrenched power structures within national departments. Gökalp and Martinez (2022) argues the importance of digital maturity in national departments is paramount for the effective navigation and overcoming of challenges imposed by legacy systems (Gökalp & Martinez, 2022).

2.5.1 *Legacy systems in national department*

National departments are making strategic decisions of moving towards more modern, efficient, and interoperable digital solutions (Irani et al., 2023). This transformation is driven by the need to enhance public services, improve transparency, and facilitate better data integration across various government platforms. Legacy systems are mission-critical and support the core business processes of the institution and they are developed using monolithic architectures and are often deployed on-premises (Hasan et al., 2023).

As business rules changes over time, these systems have undergone numerous modifications and expansions in functionality. This has increased their

complexity, making them integral to the organisation's daily operations but difficult to maintain and upgrade (Hasan et al., 2023). In another study, Baker et al. (2022) states that legacy systems often contain valuable data that has accumulated over many years, making them a vital resource for historical information and records which are crucial for decision-making and operational continuity. Furthermore, the findings emphasise the importance of a strategic and inclusive approach to modernising legacy systems within the national department, with a strong focus on enhancing service delivery to citizens and meeting the demands of digital transformation.

There is a growing need to modernise technologies in national departments because some of their systems operate in isolation from other newer systems within the organisation. This results in data silos where information is trapped within one system and does not easily transfer to others, complicating data management and analytics in the organisation (Hafseld et al., 2022).

These studies by Bakar et al., (2022), Hafseld et al. (2022) and Hasan et al. (2023) discuss in depth the transition to digital transformation in the national department as a strategic move to replace outdated legacy systems with modern, efficient technologies that improve service delivery and inter-agency operations.

2.5.2 *Proposition 2 (P2)*

National departments can navigate and overcome the challenges posed by legacy systems through strategic initiatives that prioritise alignment of organisational will and fosters digital maturity.

2.6 To evaluate strategies used by national departments.

As the concept of digital transformation within national departments is widely being researched, it is essential to delineate the critical concepts that inform the success of this concept.

To achieve a successful digital transformation in national departments, a deep understanding of the systems and business processes to be transformed, the policies they serve, and the broader public administration setting they operate within is deemed essential (Irani et al., 2023). It is empirical for organisations to develop a comprehensive plan that outlines the sequence of actions required to achieve the change, complete with timelines and responsibilities. This roadmap will act as a guiding document that coordinates all change activities and ensures consistency with the strategic vision. Simultaneously, a benefits register is maintained to track the advantages realised from the initiative, ensuring that all changes contribute positively to the organisation's objectives. (Ba et al., 2024).

The emphasis on stakeholder involvement, clear scope definition, and phased implementation reflects a deep understanding of the complexities involved in digital transformation projects. Such an approach not only addresses the technical aspects of integrating new technologies but also considers the human and organisational factors that are critical for the success of such initiatives (Ba et al., 2024).

2.6.1 *Digital transformation strategies*

As national departments embark on digital transformation journeys, they face numerous challenges and constraints (Bakar et al., 2022; Danaeefard et al., 2024; Irani et al., 2023). Vial (2021) underlines that a successful digital transformation strategy in national departments should not merely focus on technology adoption but rather on a holistic re-envisioning of organisational structures, processes, and services to enhance agility and responsiveness. The study further suggests that organisations should invest in digital transformation strategies as the act as a fully mediates the relationship between IT infrastructure and enterprise digital transformation. This means that the effectiveness of investments in promoting digital transformation relies significantly on having a robust digital transformation strategy (Vial, 2021).

Digital transformation in national departments is significantly shaped by the strategic deployment of IT infrastructure which acts as a catalyst for broader organisational digital innovation initiatives (Zhang et al., 2023b). The study further highlights the crucial role of digital transformation strategies as mediators between IT infrastructure investments and the overall digital transformation outcomes within the organisation. These strategies enable national departments to leverages on digital transformation to overcome the challenges imposed by legacy systems, thereby enhancing operational efficiencies and achieving greater transparency and responsiveness in government operations (Zhang et al., 2023b).

Successful implementation of digital transformation in national departments requires digital organisational resilience, collaborative clearly formulated strategy execution (Fleron et al., 2022). The research further highlights how Denmark's success was not just about implementing technology but about creating a cohesive strategic approach across various levels of government. Employing efforts to study at how historical insights into the past initiatives, both successful and unsuccessful implementation of digital transformation informed the development of future strategies. This coordination was vital to overcome previous failures, which often stemmed from a lack of collaboration strategies and coherent direction (Fleron et al., 2022).

Elsafty and Yehia (2023) emphasises on digital infrastructure strategies that states, national department should have the required physical infrastructure to support digital initiatives. This includes having reliable high-speed data networks, and secure servers to facilitate the effective deployment of digital services and operations.

2.6.2 *Proposition 3 (P3)*

Employing comprehensive strategies that include stakeholder involvement, clear scope definition, phased implementation, robust IT infrastructure, and

organisational resilience, organisations can overcome digital transformation hindrances.

2.7 ANALYTICAL FRAMEWORK

2.7.1 *Theoretical Framework*

Technology organization environment framework was utilised to analyse the literature concerning challenges posed by legacy systems during digital transformation. The framework comprises of technological, organisational, and environmental dimensions offered a robust foundation for understanding the multifaceted nature of the challenges.

Legacy systems, as identified in the study, are deeply integrated into the operational frameworks of national departments, yet their outdated architecture impedes modernisation efforts. The TOE framework allows for an analysis of these systems' limitations, such as their lack of interoperability and high maintenance costs, aligning with broader findings on the role of technology in organisational change (Tornatzky & Fleischer, 1990). The study further explored how technological readiness, including the adoption of cloud computing and AI, is critical for overcoming these barriers.

The TOE framework highlights the role of multi-level technological integration in improving organizational effectiveness, particularly in environments driven by technological advancements. This perspective aligned with the evolving nature of digital transformation in the digital era, where emerging technologies shape business processes and decision-making (Gong et al., 2024).

2.7.2 *Conceptual Framework*

The conceptual framework for this study is designed to integrate the challenges posed by legacy systems, the strategies employed by national departments to overcome these challenges, and the overall impact on digital transformation

initiatives. Legacy systems have been identified as a major barrier to digital transformation in national departments. These systems are often deeply embedded in an organization's operational processes, making them difficult to replace or modernise (Danaeefard et al., 2024). The primary challenges include limited interoperability, high maintenance costs, and difficulty in integrating with modern digital technologies

This study extended the TOE framework by incorporating an additional dimension to identify and understand the strategies national departments employ in navigating digital transformation. The conceptual framework provided a structured approach for evaluating digital transformation by considering four key dimensions.

- Technological context – Examining both existing and new technologies, compatibility issues, and the constraints that legacy systems impose.
- Organizational context – Assessing internal factors such as human resources, organizational structure, and leadership readiness that influence the adoption of digital solutions.
- Environmental context – Analysing external factors, including regulatory requirements, supplier dependencies, and industry-specific constraints.
- Strategies context – Investigated the strategies implemented to overcome challenges posed by legacy systems to facilitate digital transformation efforts.

By using this framework, the study explored how national departments navigated digital transformation within a regulated environment while managing the constraints of legacy systems. The conceptual framework visually represented the relationship between these challenges and the strategic responses that enable successful digital modernization

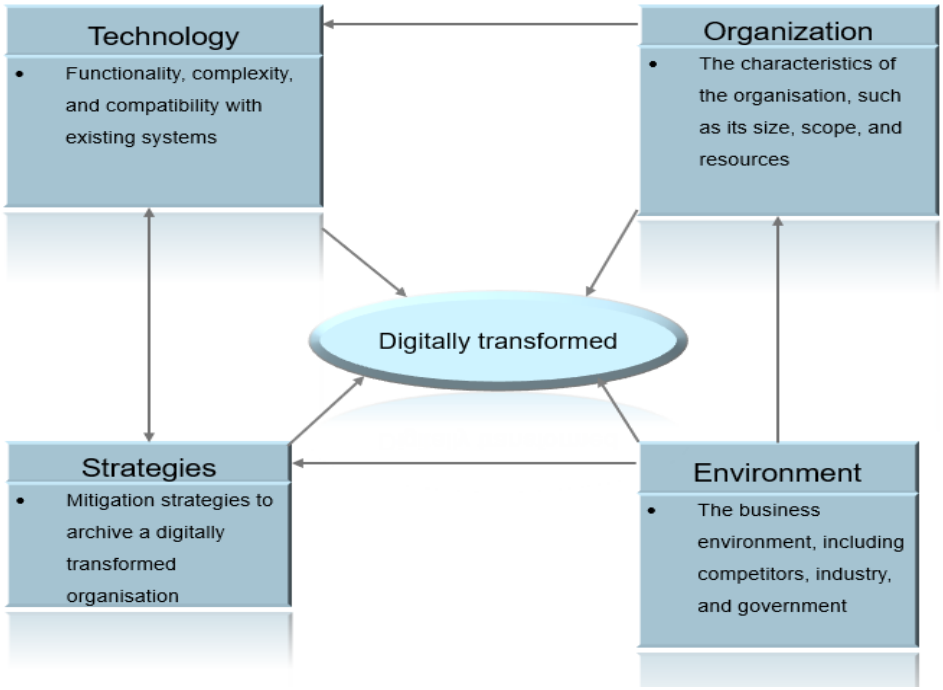


Figure 1: Extended TOE conceptual framework (Ramonyai 2024)

It integrates the challenges presented by legacy systems, strategies employed by national departments to overcome these challenges, and the overall impact on digital transformation initiatives.

2.8 Conclusion of Literature Review

The literature review has provided a comprehensive understanding that there are challenges associated with digital transformation in national departments, particularly in the context of legacy systems. The presence of legacy systems in national departments poses significant hurdles that must be navigated to achieve successful digital transformation.

The primary challenges identified in the literature include the inflexibility of legacy systems in integrating with other systems which complicate their integration with modern technologies, and high maintenance costs of legacy systems, Legacy systems are often deeply embedded in core business processes, making them mission-critical yet difficult to replace or upgrade. This integration challenge is

further exacerbated by issues related to interoperability, where outdated systems struggle to communicate effectively with newer, more advanced systems. The literature highlights that overcoming these barriers requires a strategic approach that balances technical upgrades with organisational change management.

Some literature emphasis the importance of achieving digital maturity within national departments to effectively manage the transition from legacy systems to modern digital infrastructures.

The study has adopted the TOE framework which outlined a structured approach that will provide an overview of the processes followed by these institutions that leads them to overcoming the challenges imposed by legacy systems.

2.8.1 *Proposed research questions*

- What are the factors influencing digital transformation and the management of legacy systems in national departments?
- What is the extent of impact legacy system presents on digital transformation?
- How do national departments in Gauteng navigate and overcome the challenges imposed by legacy systems?

CHAPTER 3. RESEARCH METHODOLOGY

3.1 Research Paradigm

In this section, the chosen research paradigm for the study is discussed, detailing its ontology, epistemology, and axiology. The study adopted an interpretivist paradigm to explore how national departments in South Africa navigate the challenges imposed by legacy systems during digital transformation.

Ontology

Ontology refers to the nature of reality and what is known about it (Turyahikayo, 2021). Within the interpretivist paradigm, the ontological stance is that reality is socially constructed and subjective. This perspective posits that the understanding of the world is shaped by individuals' experiences, social interactions, and context (Turyahikayo, 2021). For this study, the ontology recognised that the challenges and strategies related to legacy systems in digital transformation are not universally fixed but are perceived differently by various stakeholders within national departments. This approach allowed the research to capture the multiplicity of realities and the nuanced ways in which different institutions and individuals experience and interpret the phenomenon of digital transformation amidst legacy system constraints.

Epistemology

Epistemology concerns the nature and scope of knowledge and how it can be acquired (Phoenix et al., 2013). This study sought to understand the subjective meanings and interpretations that national department officials ascribe to their experiences with legacy systems and digital transformation. Knowledge is thus seen as contextual and constructed through the lived experiences and insights of the participants (Turyahikayo, 2021). Semi-structured interviews were employed to gather rich, in-depth data that reflect these subjective perspectives.

Axiology

Axiology deals with the role of values in research. Within the interpretivist paradigm, it is acknowledged that research cannot be value-free, as the researcher's beliefs, values, and experiences inevitably influence the research process (Phoenix et al., 2013). In this study, the values of the researcher are explicitly recognised and reflected upon throughout the research process. The axiology of this study emphasised the importance of ethical considerations, such as obtaining informed consent, ensuring participant confidentiality, and being sensitive to the context and experiences of the participants (Turyahikayo, 2021).

Justification for the Interpretivist Paradigm

The interpretivist paradigm was particularly well-suited for this study because it allowed for an in-depth exploration of complex and context-dependent phenomena (Turyahikayo, 2021). The challenges imposed by legacy systems on digital transformation efforts within national departments were multifaceted and embedded within specific organisational, social, and technological contexts. An interpretivist approach enabled the study to delve into these complexities and understand the subjective experiences and meanings that national department officials attach to their digital transformation journeys.

By adopting an interpretivist paradigm, the study acknowledged that the realities faced by national departments in South Africa are diverse and influenced by various factors, including institutional culture, political dynamics, and technological environments.

3.2 Research approach

The research approach adopted for this study was qualitative. Qualitative research focuses on exploring phenomena in their natural settings, seeking to understand the meanings and interpretations of individuals experiencing the phenomena (Köhler et al., 2022). This approach was inherently flexible, allowing

for a deep and detailed exploration of the research topic. The qualitative approach involved semi-structured interviews and qualitative study analysis to capture the experiences and perspectives of national department officials dealing with legacy systems during digital transformation.

The research aimed to explore how national departments navigated the challenges imposed by legacy systems. This required an in-depth understanding of the experiences of participants, which was best achieved through qualitative methods that allowed detailed and nuanced data collection. The study focused on the South African national departments, specifically in the Gauteng province. Qualitative research was well-suited to capture the unique contextual factors influencing digital transformation efforts, including institutional culture, political dynamics, and technological environments (Köhler et al., 2022).

Assumptions of the Qualitative Approach

The qualitative approach was based on three assumptions that align with the objectives and context of this study:

- Acknowledging that national department officials may have different perspectives and experiences regarding the challenges and strategies related to legacy systems. This assumption was appropriate as it allowed for the exploration of diverse viewpoints and the construction of a comprehensive understanding of the research problem.

- South African national department necessitates an exploration of the specific contextual factors that influence digital transformation efforts. By embracing this assumption, the research was able to provide insights that are deeply rooted in the real-world context of the participants.

- This approach aligned with the aim of the study that aimed to uncover the underlying factors and strategies associated with navigating legacy system challenges. Inductive analysis allows the study to build theories

and frameworks based on the data collected, ensuring that the findings are grounded in participants' experiences.

The qualitative research approach was well-suited for this study and to address the research questions. Its focus on exploring complex, context dependent, descriptive data, and allowing for flexibility and adaptability in data collection aligned with the aim of the study to understand the challenges and strategies related to legacy systems in digital transformation within South African national departments (Köhler et al., 2022).

3.3 Research design

The research design focused on national departments in the Gauteng province of South Africa, examining how these institutions navigated the challenges imposed by legacy systems during digital transformation.

National departments operate within specific socio-political, economic, and technological contexts, and the qualitative study design enabled a detailed examination of these contextual factors and their influence on the digital transformation process.

The qualitative study was based on different national departments with different portfolios having head offices in Gauteng. This study collected data about challenges imposed by legacy systems in digital transformation from five national departments by conducting online interviews.

3.4 Data collection methods

The primary data collection method used in this study was semi-structured interviews. These interviews were conducted with key informants from selected national departments in the Gauteng province. The participants included senior officials, IT managers, and other relevant personnel involved in digital transformation initiatives.

The semi-structured interviews involved a set of predefined questions, allowing for flexibility to explore emerging themes and insights during the conversation. By engaging directly with individuals who had firsthand experience with legacy systems and digital transformation, the study captured detailed narratives and insights that were critical for addressing the research questions.

Procedure for Data Collection

The data collection process followed a structured approach to ensure systematic, ethical, and efficient data gathering. The steps included:

- National departments within the Gauteng province were identified by contacting Chief Information Officers (CIO) or digital transformation leadership officials based on their roles using LinkedIn.
- A direct message was sent to potential participants introducing the research study, its purpose, and the importance of their participation. The voluntary nature of participation, confidentiality of responses, and data usage were explained.
- Contact details were shared with participants who confirmed participation in the study.
- Interviews were scheduled on Microsoft teams based on the availability of participants.
- An interview guide was followed by all the participants with open ended questions. At the start of each interview, the purpose of the study and confidentiality measures were shared. The interviews were conducted following the semi-structured interview guide, allowing participants to elaborate on their responses and probe deeper into areas of interest.
- The meetings were recorded and transcribed word by word and loaded into Atlas ti.

The semi-structured interviews provided numerous benefits, including in-depth data, flexibility, and the ability to handle complex issues. This method was particularly useful in obtaining detailed and qualitative insights directly from

respondents and provided up-to-date information, which was valuable in the fast-changing field of digital transformation (Mazhar, 2021).

3.5 Population and sample

This section describes and justifies the population and sampling methods used to gather data for this study. Given the focus on national departments in the Gauteng province of South Africa, the study involved one population to ensure comprehensive data collection and triangulation.

3.5.1 *Population*

The primary population comprised national department executives involved in digital transformation initiatives within selected institutions in the Gauteng province. This included CIOs, divisional heads, IT senior managers, project managers, and other key personnel who had direct experience with legacy systems and digital transformation projects.

3.5.2 *Sample and sampling method*

A purposive sampling technique was employed to select participants who possessed the necessary knowledge and experience to provide relevant insights into the research problem. This non-probability sampling method ensured that the selected participants were best positioned to contribute valuable information to the study (Stratton, 2024).

Purposive sampling was appropriate for this qualitative study because it allowed the researcher to intentionally select individuals who had specific expertise and experience with the challenges and strategies related to legacy systems. This method ensured that the data collected was rich, relevant, and directly addressed the research questions (Stratton, 2024).

Eight participants ranging from IT Manager to CIO were selected and interviewed as shown in the table 3.1

Table 1 : Participants information

No	Interviewee	Position
1	Respondent 1	Head of Enterprise Information Systems
2	Respondent 2	Software Engineer Manager
3	Respondent 3	Quality Assurance Senior Manager
4	Respondent 4	Enterprise Information Systems Senior Manager
5	Respondent 5	Software Applications Support Manager
6	Respondent 6	Knowledge Management Senior Manager.
7	Respondent 7	Head of information Security
8	Respondent 8	Chief Deputy Commissioner /CIO

3.6 The research instrument

The semi-structured interview guide consisted of open-ended questions that allowed participants to provide detailed responses and share their experiences, insights, and perspectives. The guide was structured to address the key research questions and themes identified in the literature review and theoretical framework.

The research instrument comprised the following themes to extrapolate the relevant information from the participants:

The structure addressed the themes below:

- Challenges Posed by Legacy Systems
- Impact of Digital Transformation
- Strategies used for Navigating Challenges

3.7 Procedure for data collection

This section describes the detailed procedure for data collection using the semi-structured interview guide. The procedure was designed to ensure systematic, ethical, and efficient data gathering, facilitating the replication of the study by future researchers.

Semi-structured interviews were conducted with selected officials from national departments within the Gauteng province. The interview guide was designed to elicit detailed responses about their experiences, challenges, and strategies regarding digital transformation. The interviews were recorded, transcribed, and analysed using thematic analysis to identify key themes and patterns. A total of 8 interviews were conducted with executives, IT managers and process owners.

3.8 Data analysis strategies and interpretation

This section details the data analysis strategies and interpretation methods that were employed in this study. Thematic analysis was the primary method used to analyse the data collected from semi-structured interviews. This approach was selected for its ability to identify, analyse, and report patterns or themes within qualitative data, providing a rich and detailed understanding of the research problem (Lochmiller, 2021).

Steps in Thematic Analysis

1. **Familiarisation with Data**

   All interview recordings were transcribed verbatim, and the transcripts were read multiple times to highlight key points and make notes on initial impressions and ideas.

2. **Generating Initial Codes**

   Qualitative data analysis software Atlas ti was used to systematically code the data. Labels were assigned to specific segments of the text that appeared relevant to the research questions.

3. **Searching for Themes**

   Codes were collated into potential themes, and related codes were grouped into broader themes.

4. **Reviewing Themes**

   The themes were reviewed to ensure they accurately captured the coded data. Adjustments or merging of themes were made as necessary to provide a coherent and comprehensive representation of the data.

5. **Defining and Naming Themes**

   Clear definitions were developed for each theme, and themes were named in a way that succinctly conveyed their essence.

6. **Producing the Report**

   The analysis section of the research report was written, presenting the themes and supporting them with relevant data extracts. The findings were discussed in relation to the existing literature and theoretical framework.

Thematic analysis was chosen for this study because it was well-suited to the qualitative nature of the research and the exploratory aims of the study. It allowed for a detailed examination of the experiences and perspectives of national department officials regarding legacy systems and digital transformation (Lochmiller, 2021).

3.9 Quality Assurance

In qualitative research, ensuring the rigor and trustworthiness of the study was paramount. The study adhered to the principles of transferability, dependability, credibility, and confirmability, which are the qualitative equivalents of external validity, reliability, internal validity, and objectivity, respectively (Kakar et al., 2023).

3.9.1 *Transferability*

The study provided comprehensive and detailed descriptions of the research context, participants, and findings. This included background information on the national departments in Gauteng, the specific challenges and strategies related to legacy systems, and the contextual factors influencing digital transformation.

3.9.2 *Credibility*

To ensure the credibility of the data presented, all participant statements in the report had been transcribed verbatim. The statements are directly copied from the original audio written sources without any modification, ensuring that their exact words and expressions are preserved.

3.9.3 *Dependability*

An audit trail was maintained throughout the research process, documenting all steps taken, decisions made, and changes in the research design. Any discrepancies were discussed and resolved, ensuring consistency in the coding and theme development.

3.10 Ethical considerations

Ensuring ethical conduct throughout the research process is paramount to maintaining the integrity of the study and the well-being of the participants. This section outlines the specific steps and measures taken to address ethical considerations in the study, in alignment with the principles of respect for persons, beneficence, and justice.

- Participants were asked to sign an informed consent form before the interview began. For virtual interviews, verbal consent was obtained and recorded at the start of the session.
- Identities of participants were protected by assigning unique codes to each participant. All data, including audio recordings, transcripts, and documents, were stored in password-protected files on a secure server (MS-OneDrive).
- Participants were informed that they could withdraw from the study at any time without any negative consequences.
- An ethics application, including the detailed ethics form, was submitted to the Wits Business School (WBS) Ethics Committee for review and approval before commencing data collection. Approval was sought from the Post-Graduate Committee (PGC) before the ethics application was submitted and approved.
- Participants were informed about the purpose of the study, how their data would be used, and the overall research process.

3.11 Proposed schedule and timelines

This section outlines the planned timelines for the research project, detailing each stage from initial preparation through to final submission. The timeline ensured that all phases of the study are completed systematically and within the stipulated deadlines.

Research timeline

- Initial preparation (May 2024 - August 2024)

Conducted a comprehensive review of existing literature to refine research questions and objectives. Secondly, finalised and submitted the research proposal to the PGC for approval. Lastly prepared and submitted the ethics application to the business school ethics committee.

- Participant recruitment (September 2024 – October 2024)

Identified national departments in the Gauteng province and potential participants and sent invitation letters and consent forms to potential participants.

- Data collection (October 2024 – November 2024)

Carried out semi-structured interviews with participants, ensuring ethical guidelines are followed and transcribe interview recordings verbatim for analysis.

- Data analysis and drafting findings (December 2024 – January 2025)

Conducted initial coding of interview transcripts and documents and write up preliminary findings and share with participants for member checking.

- Writing and revising the thesis (February 2025)

Write the initial draft of the thesis, including methodology, findings, and discussion and submitted the draft to the supervisor for review and feedback.

- Final submission (February 2025)

Proofread the final draft for errors and consistency and submit the final thesis to the university for evaluation.

Table 2: Consistency table: research questions, propositions, data collection and data analysis

RQ #		State Research Question or Objective	Prop/hyp #	State Proposition or Hypothesis	Data collection detail	Data analysis method
1		What are the factors influencing digital transformation and the management of legacy systems in national departments?	1	Legacy systems present challenges to digital transformation by resisting modifications and complicating integration with modern systems.	Online Interview	Thematic analysis
2		What is the extent of impact legacy system presents on digital transformation?	2	National departments can navigate and overcome the challenges posed by legacy systems through strategic initiatives that prioritise	Online Interview	Thematic analysis

RQ #		State Research Question or Objective	Prop/hyp #	State Proposition or Hypothesis	Data collection detail	Data analysis method
				alignment of organisational will and fosters digital maturity.		
3		How do national departments in Gauteng navigate and overcome the challenges imposed by legacy systems?	3	Employing comprehensive strategies that include stakeholder involvement, clear scope definition, phased implementation, robust IT infrastructure, and organisational resilience, organisations can overcome digital transformation hindrances.	Online Interview	Thematic analysis

CHAPTER 4. PRESENTATION OF RESULTS

4.1 Introduction

This chapter presents the findings derived from the qualitative study investigating the challenges posed by legacy systems on digital transformation within Gauteng national departments. A qualitative research methodology was employed, utilising semi-structured interviews with eight participants to gain deep insights into this phenomenon. These interviews formed the basis for a thematic analysis, revealing twenty-one codes packed into six categories that were systematically refined into five overarching themes.

The presentation of results followed a structured approach, starting with the demographic profile of the respondents to provide context for the findings. Then a methodology was used to extract and refine the themes using tools such as Atlas ti for coding and analysis. Following this, the themes were presented based on their relevance to the research questions identified in Chapter 2, each supported by illustrative quotes and examples from the interview data.

4.1.1 Demographic profile of respondents

The study included eight respondents from various national departments in Gauteng, South Africa, all of whom hold senior positions in IT and digital transformation. These individuals were selected based on their expertise and direct involvement in managing legacy systems and digital transformation initiatives within their respective departments.

The participants covered a wide range of IT functions, including software engineering, quality assurance, enterprise systems, information security, and knowledge management. Additionally, the CIO and Heads of IT divisions, played a pivotal role in shaping digital transformation strategies.

Each respondent had first-hand experience dealing with legacy systems, their challenges, and the transition to modern digital technologies. This diverse representation ensured a comprehensive perspective on the impact of legacy systems on digital transformation and how national departments are addressing these challenges. Summary table of the respondents:

Respondents Summary table as shown in Table 1 in chapter 3.

No	Interviewee	Position
1	Respondent 1	Head of Enterprise Information Systems
2	Respondent 2	Software Engineer Manager
3	Respondent 3	Quality Assurance Senior Manager
4	Respondent 4	Enterprise Information Systems Senior Manager
5	Respondent 5	Software Applications Support Manager
6	Respondent 6	Knowledge Management Senior Manager.
7	Respondent 7	Head of information Security
8	Respondent 8	Chief Deputy Commissioner /CIO

4.1.2 Identified Thematic Themes

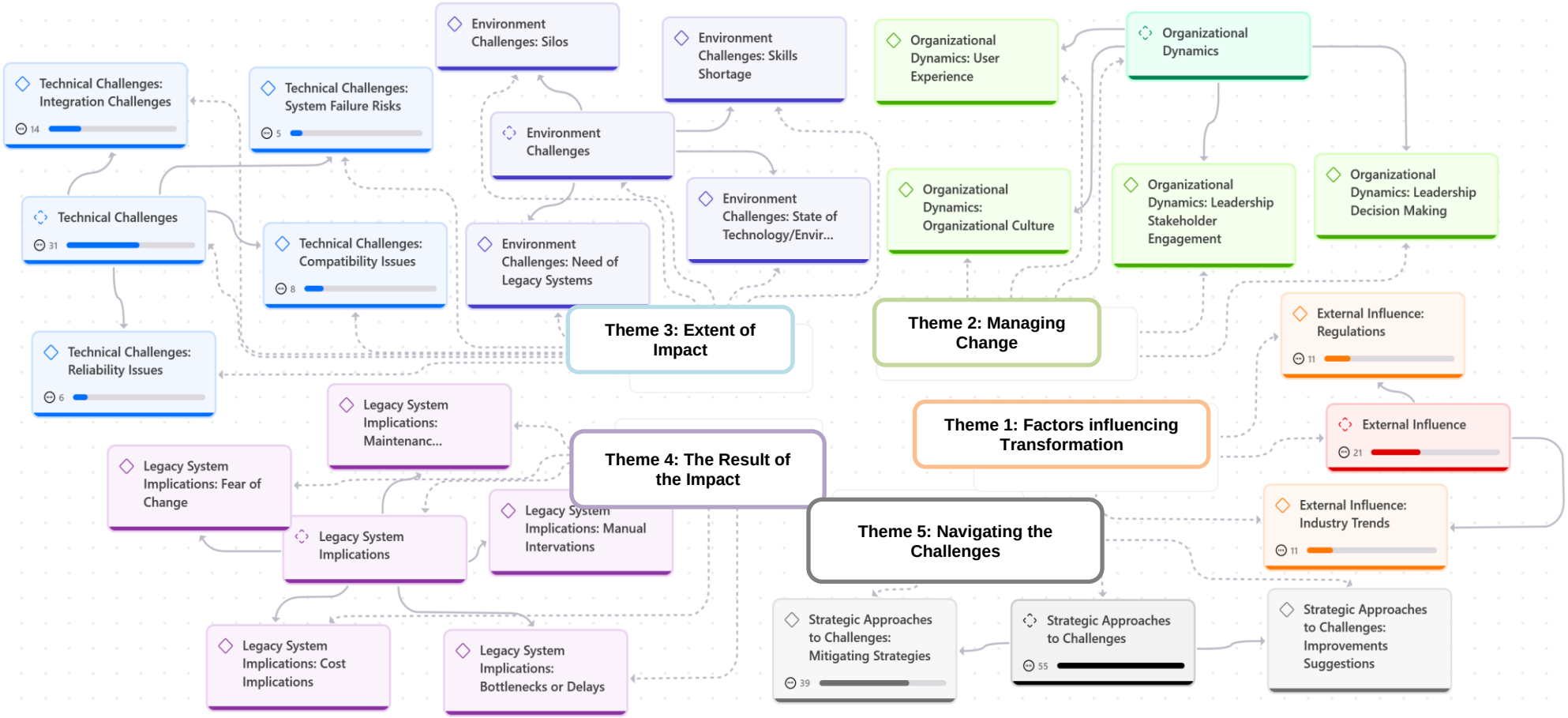


Figure 2: Thematic Analysis Network Diagram

4.2 What are the factors influencing digital transformation and the management of legacy systems in national departments?

4.2.1 Factors influencing transformation

The factors influencing transformation theme was derived to present the key drivers impacting digital transformation within national departments findings. This theme highlighted the role of government regulations, industry trends, leadership decisions, and organisational culture in shaping digital initiatives. It explored how national policies, such as the NDP 2030, provide strategic direction for digital adoption, while emerging technologies like AI, cloud computing, and automation drive innovation.

a. ***Regulations***

Participants highlighted the importance of adhering to regulations like national frameworks and policies as a key driver for adopting digital technologies and solutions. Participant 1 noted that regulatory requirements, particularly those outlined in the National Development Plan (NDP) 2030, serve as a directive for all government departments to transform their processes and achieve paperless operations.

> *"I think it would be you know important that I need to just give you context that we are directed by, you know, the national programs as a public sector. There are strategies, there are frameworks that direct us. So I would say that digital strategy is an initiative from the SA governments towards transforming, reforming and digitalizing government services. So there is a national integrated ICT policy, white paper and a national E government strategy that forms an ICT program of government that is part of the NDP 2030 or National Development Plan 2030, that says that by 2030, all government departments must be paperless or Government department must be able to share or exchange information." Participant 1*

Similarly, Participant 8 elaborated on the need for regulatory alignment to foster collaboration across departments, particularly for data sharing and interoperability.

"In our context, we have been directed to adopt technology, to improve members management and facilitate communication between members and their families within our systems and also secondly to be able to exchange data between our three sister departments." Respondent 8

The influence of regulations extends beyond merely adopting digital technologies. Respondent 3 highlighted the proactive role of leadership in aligning digital transformation initiatives with national strategies. Additionally, participant 2 emphasised how specific acts such as the Protection of Personal Information Act (POPIA), shape the way systems are designed and implemented to ensure compliance.

"Yeah, it is easy for us, even for our leadership, to drive the organisational change through communication and inspiring the employees and also providing the clear vision and also because of the mandate of the government. Because like I mentioned our organisation reports directly to the Parliament and you will remember that even in Parliament, the President and the Ministers, they are also part of pushing the new technologies and 4IR." Respondent 3

"But the mandate that we have to make our environment scalable has assisted in opening people minds and work towards transforming our organisation." Participant 7

"So now we have to cater also for the POPI Act as well to make sure we are not violating that." Responded 2

b. ***Industry Trends***

The adoption of digital technologies in South African national departments is heavily influenced by prevailing industry trends. Participants highlighted the critical role of these trends in driving innovation, shaping strategic priorities, and aligning departmental goals with global advancements in digital transformation.

One major trend identified was the move toward cloud computing. Quotes from Participant 1 described this shift as part of a broader government directive.

“On cloud computing, there is a DPSA directive for cloud computing that all government department should go cloud, the integrated financial management system, would be a cloud based ERP.” Respondent 1

Similarly, Participant 2 emphasised the importance of cloud computing for achieving future compatibility and enhancing system efficiency.

“So we are not going to integrate fully with the legacy systems because it's going to close the channels for us to actually start using cloud computing, start integrating with AI as well.” Responded 2

Further quotes on automation and data driven decision making was another recurring theme. Where both Participant 5 and Participant 8 illustrated how automation and data is shaping operational processes.

“Yeah. And I'm also going to use some of the buzzwords, right. We’re talking about automation, we’re talking data-driven decision making, we’re talking making decision based on data.” Respondent 5

“for example, we're also trying to build new technologies to come up with solutions where we are using cloud technology to start things and stuff like that.” Respondent 6

Participant 7 and Participant 8 also noted the increasing influence of AI as a transformative force. Participant 7 described its impact on organisational innovation and Participant 8 highlighted the potential for AI-powered systems to revolutionise departmental integration.

“But we are always monitoring them as we trying everything in our power to board a new tool to replace them and we move to cloud.” Respondent 7

“Now we've got AI that is happening. You've got all of those terms that people are talking about, now people have an open mind to innovate and make sure that we are competitive to the world of innovation.” Responded 7

“Yeah, I think what we're doing there in addition to using AI, is making sure that we get real time data. Integrating with all the major institutions to be able to provide efficiency in our monitoring.” Respondent 8

4.2.2 Managing Change

The managing change theme outlined how national departments navigate the challenges associated with digital transformation. This theme presented organisational culture, leadership decision-making, and stakeholder engagement findings shape the adoption of digital technologies.

a. *Organisational culture*

Organisational culture emerged as a critical factor influencing the success of digital transformation initiatives within South African national departments. Participants frequently identified cultural resistance, generational differences, and rooted work habits as significant barriers to change. However, they also emphasised the role of proactive change management and strategic leadership in fostering a culture conducive to transformation.

Several participants highlighted how long-standing practices and resistance to change hindered the adoption of digital technologies.

“The only challenge actually is I think, is culture. You know, there are people working in this organisation for over 40 years, so the people are used to this culture.” Respondent 1

This resistance often manifested as a reliance on manual processes, as noted by Participant 2

“You find that even though we are introducing the registration process that we have, there is still people who are still reliant on manual registration and then there will be data that will be in the system and there will be data that will be missing and the other data will be in the documentation that they've created.” Respondent 2

“Users always go back and use their old way of work and don't want to move into the new system that we have shown them, but we do conduct trainings for them and they get out of the training happy” Respondent 4

Participant 7 further elaborated on this reluctance

“Firstly, I would say people, people, they so reluctant to change. I'm telling you the people who are using those legacy systems are much comfortable and reluctant in moving to the new environments because they believe these systems have been working for years and they've been tested and there's nothing wrong with it.” Respondent 7

Participants also noted generational differences in attitudes toward digital transformation. Younger employees were generally more open to adopting new technologies, while older employees were more resistant.

“So for younger stuff to adopt the new technologies will be easy compared to the older stuff because they've been using that system for a very long time.” Respondent 3

“You know, people in your 50s, people in your 40, so that becomes a challenge because culturally, they've been doing things this way and we are saying no more, this is how you must do it now. So that's the challenge that I can highlight and very close to my heart in that culture shift is definitely needed.” Respondent 5

Another aspect of cultural resistance quoted by Participant 6 was fear of job displacement.

“So we introduced a system where we have one front end for registration and feeds into multiple applications. That’s where people think they will lose their jobs because this now seems to be a one man's job, not ten people.” Respondent 6

Despite these challenges, participants underscored the importance of strategic change management in addressing cultural barriers. Participant 6 shared how early engagement and communication helped mitigate resistance. While Participant 3 emphasised on preparing people’s minds when change is taking place in an organisation.

“But what helps with adoption to new technology is change management where when you still doing your requirements you keep on showing them that this is how the new system is going to look like.” Respondent 6

“OK, so you know change is noisy, especially for when it comes to using systems. So people do not feel comfortable with change, you know, because they are used to be doing something for a very long time so now when you have to introduce a new system, you have to wait much into preparing people's mind.” Respondent 3

Participant 5 emphasised the need for consistent communication.

“You know the need for a culture shift in most of our team members and most of the employees that's the biggest thing because generally what we then saying is this is how you're doing work, you're not going to do it like this anymore. So that's somewhat, putting people in an uncomfortable space because they have mastered how they do their work and now it becomes something else and they need to now also learn buttons and click mouses.” Respondent 5

Participant 8 has elaborated on how their department needs to have innovative culture in order to stay afloat despite legacy systems making their life difficult.

“They just make our life a nightmare that’s it. But when it comes to innovation, the nature of our department actually depends on us being innovative.” Respondent 8

Then Participant 3 mentioned about the culture that they must comply with regulatory requirements.

“So in our organisation we check must comply when audited. It has to be up to standard because of the type of the department that we are in” Respondent 3

b. ***Leadership Decision Making***

Participants highlighted the critical role of leaders in shaping strategies, making decisive interventions, and ensuring alignment with broader organisational goals. While strong leadership can accelerate transformation efforts, a lack of vision or support from leaders can stall progress.

Participants emphasised that leaders are responsible for driving digital transformation by setting clear priorities and aligning resources to meet strategic objectives. Participant 3 underscored this point.

“OK, since you know, since we are a government department. Yeah, it is easy for us, even for our leadership, to drive the organisational change through communication and inspiring the employees and also providing the clear vision and also because of the mandate of the government.” Respondent 3

Similarly, Participant 6 noted that leadership involvement is essential for managing external stakeholders and securing resources.

“So the management buy in I crucial, talking from the same voice that we are talking from is very crucial for us to be able to transform and even when things go wrong, they are able to explain it to other their parliament to say this is what is going wrong and this is our plan to fix it. Respondent 6

Decisive leadership in budget allocation was identified as a significant enabler for digital transformation. Participant 4 pointed out.

“They should open up the budget because you spend for quality and not for something which will break in the near future. So they should provide the budget. And assist in cutting the red tape for procuring new applications or new systems. Because leadership needs to make the decision to say override this process right now and get those solutions in place.” Respondent 4

There are disparities in the level of engagement by leaders in technology-related decisions. Participant 1 quoted about a lack of understanding of technological priorities which affects buy in.

“Currently projects comes from us and we tell our leaders that this is a way we need to do things. The leaders do not actually recognise the significance of emerging technologies. Because they are relying on us that we explain the environment to them. But when we are not getting a buy in, it's a very serious problem.” Respondent 1

“The directorates should actually be coming from our CIOs and whatsoever telling the business that guys, these are the new trends, this is how we're going to enable business processes currently, but we are currently the ones doing that and we must also try to convince them” Respondent 1

However, participants 7 emphasised the importance of building trust with leadership to enable and champion digital initiatives as they rely heavily on subject matter teams for direction.

“Your leadership must trust you, because if they don't trust you, then it's going to be very hard for them to listen to what you. So you must be clear to them in that level, then they will start trusting you say. You don't want to go there and talk about the jargon and slag and all of that. You need to be a person that can speak clearly with details so that you can get a buy in from the. Make them aware of what you are bringing to them so that you win their blessing. You must win their trust so that you can win their blessing if they put the pen down black and white, then you are a very good representative.” Respondent 7

Despite these challenges, there are efforts to address gaps through leadership renewal. Participant 8 shared

“Prior minister, he has been getting younger people into leadership positions. And hence the things are starting to come a little bit easier. So in terms of decision making, you can hear when we're sitting in executive meetings, the conversations that we are having ambitious people.” Respondent 8

Additionally on the positive side, Participant 5 highlighted an example of proactive leadership.

“So definitely I would say the role of leadership played a very vital role in making sure that this program is a success. I mean, there was another application where. The decision came to from leadership to say no in actual fact, we're not renewing the license of this application. We're not going to renew it and they must quickly go and use the new system.” Respondent 5

c. *Leadership Stakeholder Engagement*

Stakeholder engagement, led by senior leadership, emerged as a pivotal factor in ensuring the successful adoption of digital technologies in South African national departments. Few participants underscored the importance of active leadership role in engaging both internal and external stakeholders to create alignment and build trust.

Participants highlighted that effective engagement begins with leadership demonstrating commitment to digital transformation initiatives. As Participant 4 noted

"Leadership should be the first to show the users to lead by example and show the users and their subordinates that we need to move into the new system." Respondent 4

This sentiment was echoed by Participant 5, who emphasised the motivational role of leadership

"And this is saying that things are better when they come from the top. So I think having the leadership buy in was the most effective thing or the most positive thing to have happened to this program because we had them sending out ways of encouragement in terms of using the new systems." Respondent 5

The ability of leadership to bring together diverse stakeholders within and outside the department was identified as a crucial factor for success. Participant 6 explained

"So the support of leadership is very crucial, and because these are the people that talks to other stakeholders at a higher level." Respondent 6

4.3 What is the extent of impact legacy system presents on digital transformation?

4.3.1 Extent of Impact

The extent of impact theme outlined the influence of legacy systems on digital transformation within national departments. This theme presents findings on outdated technologies, system dependencies, and interoperability challenges affect the efficiency and adaptability of digital initiatives

a. ***Need of Legacy Systems***

Despite being labeled as outdated and often cited as barriers to digital transformation, legacy systems remain critical to the operations of South African national departments. Participants emphasised that these systems, though challenging to modernise, are deeply embedded in the core functions of their organisations and continue to provide essential services that cannot be easily replaced.

Legacy systems underpin many mission-critical processes within national departments, ensuring the continuity of essential functions. Participant 1 and participant 3 highlighted.

"When we talk about legacy systems, they are very, very, very critical obviously, so we have the current department's corporate core systems like you know the HR system, the financial system, the supply chain management system" Respondent 1

"OK. So talking about legacy systems we know that we are referring to those old tools that Organisation used to use or some organisation still using so these legacy systems have a significant impact." Respondent 3

Similarly, Participant 4 elaborated on the importance of a legacy ERP system for financial management with participant 8 noted a similar reliance on legacy systems for critical functions.

"So one legacy system is ERP system that we are using for finances purposes where we do payments. Which it's not on the cloud, it's hosted in our data centers. It holds our most important process of billing, and if it were to fail today, people will not get paid." Respondent 4

"I think there's a lot of departments that still have legacy systems and we are not exempted from that. We also have our inhouse systems as I have already said, and they play a vital role in making sure that our employees are paid in time." Respondent 8

Participants emphasised the reliability of legacy systems in handling long-standing operations and the centrality of these systems in managing historical data. Participant 6 remarked

"These systems are still very important because that's where our data is sitting." Respondent 6

While acknowledging their importance, participants also identified barriers to replacing legacy systems. Participants highlighted the challenge of phasing out such systems.

"OK. That's a good question. So with the legacy systems, it's gonna take long to face them out. They've been here and the people I already used to the legacy systems. Some of the core processes of our department, they are embedded in our infrastructure." Respondent 2

"Every organisation values their system, especially legacy systems even though they are old. I don't know if it is because they like to work the way they used to" Respondent 7

"Legacy systems, they don't have space in my life. I'm joking. There is certain applications that I would say of legacy nature. Quite unfortunate that to even move away from that it's a bit of a problematic one, but there is plans in replace them." Respondent 5

b. *Compatibility Challenges*

Legacy systems, despite their critical role in core operations, often struggle to communicate effectively with newer technologies, leading to inefficiencies, integration barriers, and delays in digital transformation initiatives.

Participants consistently highlighted how legacy systems are often unable to communicate seamlessly with modern technologies due to outdated architectures.

“And then the other thing it also affect Interoperability because you find that It doesn't read very well with the newer softwares you know because it was built for the old operating system.” Respondent 3

“So we encountered challenge that there is no communication between them.” Respondent 2

“So you can't just connect and, say, move the files that are here or the data that's sitting here and put it on that particular storage. So yeah, it has been a challenge and it has just been time consuming in actual fact.” Respondent 5

The challenge of ensuring smooth data exchange between legacy and modern systems was frequently mentioned. Participant 7 elaborated on the difficulties of managing mismatched data formats often resort to temporary fixes.

“So yes there are many challenges with making these systems work together, issues of compatibility and data records not matching.” Respondent 6

“The issue of compatibility, the records not matching and misaligned, so it also goes back to having a third party system that will assist with integration, remodeling API upon API to enable the integration between legacy systems and new technologies.” Respondent 7

“When you need to connect to an old database to retrieve information and the system you have still has to talk to SQL Server 2000 or 2005 in 2024, then obviously you are going to have a problem, you know.” Respondent 8

c. *Integration Challenges*

Integration challenges are one of the most significant barriers faced by South African national departments in their digital transformation journey. These challenges stem from the inherent complexity of aligning legacy systems with modern technologies, creating inefficiencies and slowing the pace of transformation.

Participants highlighted those legacy systems, with their outdated architectures, often cannot interface seamlessly with modern systems.

“So only to realise that we cannot align and we cannot integrate because our system is still a very old system.” Respondent 1

“You know, when it comes to any company or any organisation including us, because you find that as we navigate to this new technologies, some of the legacy systems that we have cannot be integrated very well with the new technology.” Respondent 3

Participant 3 elaborated on the difficulties that frequently forces departments to resort to manual processes, increasing inefficiencies.

“OK, so one of the issues that we have especially when we look into. Testing you find that one of the legacy system that we have cannot interact directly with SQL database where we are storing our data and that's a problem because now you have to get data and then you have to use Excel spreadsheet.” Respondent 3

This inability to integrate creates silos, where systems function independently, limiting the flow of information and collaboration between departments.

“So that has been my experience, it's not easy to integrate with the current technologies.” Respondent 2

“So end-points becomes an issue when you have to integrate, data integrity and database structural issues.” Respondent 6

“The fact that we are unable to integrate with other systems is a nightmare.” Respondent 8

Furthermore, participants highlighted the issues during digital transformation initiatives that integration challenges also stifle efforts to implement automation and innovative solutions.

“There was even an initiative to try automate the process of leave system. But the experience that we got there was that precisely the legacy system, we cannot integrate it.” Respondent 5

“Yes, so currently our SharePoint is not integrating with our ERP system and our SharePoint is just sitting on its own.” Respondent 4

d. ***Reliability Issues***

Participants described the frustration caused by system unreliability. One of the most quoted reliability issues was the frequent downtime of legacy systems, which disrupts critical operations. Participant 2 criticised legacy systems for their inability to manage the growing volumes of data required in modern operations.

“We are definitely working with these old systems however, you know there's this issue of being offline and is just our frustration in the department.” Respondent 1

“The analysis that we've done, is that it's not able to handle the amount of data that we are trying to get back” Respondent 2

“That there will be delays in some other processes because they sometimes take time to come up.” Respondent 4

e. ***Silos***

Participants identified silos created by isolated systems that operate independently, hinder data sharing, process efficiency, and organisational collaboration. They consistently highlighted how the lack of integration across systems and processes results in inefficiencies, delays, and missed opportunities for innovation.

“And then those legacy systems unfortunately, they are operating in silos.” Respondent 1

“The challenge is that those systems are sitting in silos. So you would work on ERP and then go to SharePoint, download the documents and put them back into your ERP which is a problem to us.” Respondent 4

“Yeah, I wouldn't say so, because as much as their functions are wide, it is known by the department that it's being managed specifically in a silos way in the moment.” Respondent 5

“So you'll find that you have a three systems for registration process and stuff like that. If you miss one system, it creates problems of processes. Sometimes you don't know where the problem the issue is, because now you need to check on three or four systems.” Respondent 6

f. ***Skills Shortage***

A shortage of skilled personnel to manage legacy systems, participants highlighted as a challenge where the loss of technical expertise creates operational inefficiencies and stalls modernisation efforts.

This exodus of talent leaves departments struggling to maintain critical systems and resolve technical issues, leading to increased reliance on external vendors or consultants, which can be costly and time-consuming.

“We have lost our specialist, I mean those people with skills, skills about these old legacy systems. They've left the department, especially the mainframe guys that leave to go to the bank, I mean we cannot compete with the bank.” Respondent 1

“Another one is the people who have more knowledge on the system as well. They are leaving the companies right? And then, because now there was a human dependency, they leave with the knowledge.” Respondent 2

“Another challenge that we have is running out of your internal stuff to operate that system you know, as you run out of those people, maybe they leave the organisation,

you find that now you don't have new people who are skilled to work on the older legacy systems." Respondent 3

"I mean, when I started on this role, there is this mainframe application that has been and could only be managed by a particular old man." Respondent 5

"You know, sometimes when you have a legacy system and no one understands something like we know that there's this process that runs, maybe the job that runs at night, we know that it runs. But when we have changes no one really knows how to go and manipulate it or to update it" Respondent 6

"Because if nobody else is supporting them in South Africa, imagine how much money are you going to pay to bring this specialist" Respondent 7

g. ***State of Technology***

The responses from participants regarding the state of technology reveal that there are challenges in adapting legacy systems to modern digital transformation efforts. Despite being crucial to their day-to-day operations, where the national departments are in terms of technology presents substantial barriers due to their outdated nature, siloed architecture, lack of integration capabilities, and security vulnerabilities.

Participants shared key findings about pervasive reliance on aging infrastructure of these systems that limits their ability to integrate with newer technologies and are running core processes of the business.

"It's just that unfortunately, when coming to integration of systems that is not part of our vocabulary yet. These are the corporate systems and unfortunately this system that I'm referring to, they've been in operation for over 22 years." Respondent 1

"They've been here and the people I already used to the legacy systems. Some of the core processes of our department, they are embedded in our infrastructure." Respondent 2

Furthermore, participant 5 shared that some legacy systems are not only outdated in terms of their functionality but also in their user interfaces.

“Very old in nature, you know, when you work on it it's almost like command prompt or DOS function that you use.” Respondent 5

Participant 4 shared another critical issue about the siloed nature of the systems, where different tools and platforms cannot easily communicate or share data.

“The challenge is that those systems are sitting in silos. So you would work on ERP and then go to SharePoint, download the documents and put them back into your ERP.” Respondent 4

“Like I referenced that we have some processes that are still manual paper based and some processes that are on the system.” Respondent 6

One of the most significant concerns regarding the state of technology is the lack of security features in many legacy systems as shared by participants.

“As I’ve already mentioned, these systems have no security patching, leaving us always finding a way to make sure they do not fail.” Respondent 7

4.3.2 The Result of the Impact

This section presents findings under result of the impact theme that outlines the consequences of legacy systems on digital transformation within national departments.

a. *Bottlenecks or Delays*

Bottlenecks are a recurring issue spoken about by the participants as they arise from inefficiencies in processes and legacy system constraints slowing the pace of modernisation and impacting service delivery. Participants consistently pointed out how these delays hinder productivity, disrupt workflows, and escalate costs.

One of the primary causes of delays highlighted by participants was the frequent downtime of legacy systems, which directly impacted critical processes. Respondent 1 shared the following about the consequences of downtime

“For example, the lock system to do reconciliation, they are experiencing very serious problems because the system sometimes it will be off, then it means that we cannot process payments remember the government, the focus areas are the service providers that they must be paid within 30 days. Government 30 days is not part of our vocabulary because of these systems.” Respondent 1

Participants also emphasised the challenges in integrating legacy systems with newer technologies, which often leads to significant delays in processing and project timelines. Similarly, Respondent 7 described the need for third-party systems to help bridge this gap

“So we have to somehow keep on going into the code to understand the business rules.” Respondent 2

“But the experience that we got there was that precisely the legacy system, we cannot integrate it. And yeah, that then put a huge blocker in that process.” Respondent 4

“So it also goes back to having a third party system that will assist with integration, remodeling API upon API will enable the integration between legacy systems and new technologies. This only impacts the timelines not but does not stop the transformation process.” Respondent 7

Another contributing factor to delays is the dependency on individual employees for critical tasks. Respondent 2 illustrated this issue

“So that is the current issues that we have, that there will be a lot of work that is stuck if for example, one official was running with the registration and then went on leave, there is a lot of work that will be piling up on.” Respondent 2

“It's just a step back, but it's a needed step just to make sure that we, we've taken every aspect into consideration.” Respondent 2

Participant 3 pointed to inefficiencies in both reporting and payment processes, which were made worse by limitations of legacy systems.

“So that's the impact that we have because another thing, they delay even our products that we want to produce because, now the legacy system is holding whatever that we want to produce.” Respondent 3

“So one of the challenges that we have with the legacy systems it does not produce you know, more efficient reporting tools that we need. And as a result that means that there is a gap when it comes to reporting another thing when it comes to payments.” Respondent 3

The delays caused by legacy systems often have significant effects on project timelines. Respondents reflected on a project that suffered from such setbacks and these extended timelines reflect the cascading delays that result from working with outdated systems and processes.

“So then, because of that, you now begin to run out of support of your legacy systems, so we had have encountered that situation and it was a project that was supposed to have to have been completed in less than two months, it took about six months.” Respondent 3

“So that creates a lot of inefficiencies because if the person is not there, a call needs to be logged to get someone access to it and the check who is available so that they can allocate the work.” Respondent 6

“So in terms of the bottleneck, yes, there are bottlenecks because each and every organisation improves their processes, so if no one touches these systems in terms of enhancements and they are not maintained, it forces a manual way of processing.” Respondent 7

Participants also echoed that this long road to modernisation underscores the difficulties organisations face when trying to transition from legacy systems to more advanced, efficient technologies.

“It's not that easy to achieve a modernised environment and the delays are way more than six months some could be years, but we hopefully will be able to overcome.” Respondent 8

“It's challenging always and costly and delays the process. Because now people spend a little bit more time on those to babysit.” Respondent 8

In addition to system failures, participants highlighted the time and cost involved in working around system limitations. Participants shared how such workarounds are labour-intensive and costly, further contributing to delays in achieving operational goals.

“Some instances we go physically to the actual server and take the disc out completely and unplug it on the new server and copy data because some of these things cannot wait and with the network was just simply not happening so.” Respondent 8

“So really some processes stay on pending for a while.” Respondent 7

b. ***Cost Implications***

The outdated nature of these systems not only results in direct costs for maintenance and support but also creates additional expenses when trying to integrate them with newer technologies or address compatibility issues. Participants shared various perspectives on how these costs impact their organisations and the broader digital transformation efforts.

One of the most significant cost implications mentioned was the expense of maintaining legacy systems and participants also shared specific examples of the additional costs incurred when migrating or transferring data between legacy systems and new platforms. Respondent 5 described a situation.

“And again, because they are old and the cost will always be there and it's going to be huge.” Respondent 7

“I drove myself in my car to go to that department to get the hard drive of data to bring it on our environment and then put that data somewhere where the migration tool can be able to pick up.” Respondent 5

“It's challenging always and costly and delays the process. Because now people spend a little bit more time on those to babysit.” Respondent 7

The challenge of integrating outdated systems with newer technologies is further compounded by the need to find or develop specialised solutions. Respondent 2 elaborated on how compatibility issues contribute to the costs.

“It's very difficult because compatibility issues, so it's not flexible in that regard. So that has been my experience, it's not easy to integrate with the current technologies so and it becomes very costly because now some of the packages you find that they are phased out, they are not supported anymore.” Respondent 2

The need to hire specialists from abroad can significantly increase costs, making it harder for organisations to manage their budgets effectively. Respondent 7 also discussed the added expense of bringing in external expertise for systems that are no longer supported locally.

“One of the impacts of the legacy system that is negative is the cost, because if nobody else is supporting them in South Africa, imagine how much money are you going to pay to bring this specialist or this engineer to come and fix.” Respondent 7

In addition to maintenance costs, integrating legacy systems with modern technologies was described as both costly and challenging.

“So if the legacy system is unable to integrate with, then you will need to introduce other tools like your web services or other integration tools that we can implement so that will be able to integrate with that legacy system.” Respondent 4

“The fact that we are unable to integrate with other systems is a nightmare. We need to create a program on top of a program to enable us to get information from these systems.” Respondent 8

c. ***Fear of change***

Resistance to change is a common challenge when introducing new technologies or systems, particularly within organisations that have long relied on legacy systems. The fear of change, often rooted in unfamiliarity and discomfort with new processes, was a recurring theme in the responses shared by participants.

Participants emphasised how long-standing employees familiarised with legacy systems contributes to their reluctance to adopt new technologies.

“Firstly, I would say people, people, they so reluctant to change. I'm telling you the people who are using those legacy systems are much comfortable and reluctant in moving to the new environments.” Respondent 7

“And then a lot of people will not take in change easier. You find that even though we are introducing the registration process that we have, there is still people who are still reliant on manual registration.” Respondent 2

The discomfort with adopting new systems was further explored by several participants. Respondent 3 described how noisy change becomes in an organisation.

“OK, so you know change is noisy, especially for when it comes to using systems. So people do not feel comfortable with change, you know, because they are used to be doing something for a very long time.” Respondent 3

Fear was identified as a natural response to change, particularly when employees feel uncertain about how new systems will impact their work

“There is a lot of change, but you must remember that with change comes fear.” Respondent 6

“We had a couple of resistance in terms of people not willing to adopt new technologies but luckily, those that do not accept new technologies when you then look into the data, it tells you that they will be going on retirement in soon.” Respondent 8

“So in most cases when we change a system, the users will resist the change.” Respondent 4

d. *Maintenance Challenges*

The maintenance of legacy systems presents significant challenges for organisations, particularly as these systems age and become less compatible with modern technologies. Participants highlighted various issues, including

security risks, difficulties in upgrading, and the increasing costs of maintaining outdated systems

A critical concern when maintaining legacy systems is the risk to data security. Respondent 3 discussed how outdated systems create vulnerabilities, particularly during upgrades or patches

“During that process, some of the data is being lost and then security is being paused there because you cannot upgrade and close. You know those. Vulnerabilities and audit findings because of the old and outdated systems.” Respondent 3

Participants further explained that as legacy systems are phased out and no longer supported, integrating them with modern software becomes increasingly complex and expensive, creating additional hurdles for organisations seeking to modernise. These missed updates can lead to system inefficiencies, security vulnerabilities, and compatibility issues, further complicating the maintenance process.

“So that has been my experience, it's not easy to integrate with the current technologies so and it becomes very costly because now some of the packages you find that they are phased out, they are not supported anymore.” Respondent 2

“So there's always updates that no one knows about, missed updates that go back to years.” Respondent 6

“And another negative part is the updates and patches and it keeps breaking. Like I said, because they are not maintained they still have the old versions that are not supported.” Respondent 7

“Though we have roadmap to enhance them, they are still very much critical. The only challenge is that you can't upgrade them. There's no security patches around all of them.” Respondent 8

e. ***Manual Interventions***

As participants highlighted, many processes require manual workarounds due to system limitations, which increases operational inefficiencies, risks of errors, and

delays in critical workflows. Below are key insights shared by participants on the impact of manual interventions.

A common source of manual interventions arises when new systems fail to integrate smoothly with existing legacy systems, forcing employees to rely on spreadsheets and manual data comparisons. Respondent 3 explained

“Yes, we have encountered that when we moved our Payment calculator or payment system to one of the new systems it could not integrate very well, and then because of that, we had to use manual way of spreadsheets and doing the lookup, in order to compare the columns you know.” Respondent 3

In some cases, respondent 4 shared workflows must be manually triggered within the system to keep processes moving.

“Another thing is that sometimes you need to push the workflow manually or go into the system and push the workflow manually.” Respondent 4

“And effectively what it meant is we could never apply for leave in that organisation on a system because it needs to go on pasal, meaning we must do a manual form.” Respondent 5

Participants also noted that when legacy systems are not maintained or enhanced, the need for manual workarounds becomes even more and more of strategies.

“If no one touches these system in terms of enhancements and they are not maintained, it forces a manual way of processing some of the workflows.” Respondent 7

“Because now people spend a little bit more time on those to babysit. Literally, we are babysitting some of the systems.” Respondent 8

4.4 How do national departments in Gauteng navigate and overcome the challenges imposed by legacy systems?

4.4.1 Navigating the Challenges

This section presents findings on how departments employ strategic planning, phased system upgrades, stakeholder collaboration, and leadership-driven change management to overcome these barriers.

a. ***Improvements Suggestions***

Participants provided several valuable suggestions for improving the digital transformation process within organisations. These suggestions focus on enhancing communication, ensuring proper planning, investing in training, and addressing external procurement challenges.

One of the key suggestions was the establishment of a clear blueprint or enterprise architecture that defines business processes and application development. Respondent 1 emphasised the need for a structured approach.

"You remember we spoke about the enterprise architecture, yeah, we are saying that let us have this blueprint that would define processes, business processes that would outline what applications we want to build." Respondent 1

Participants emphasised the importance of thorough analysis before committing to solutions, ensuring that the selected tools and processes are the right fit for the needs of the organisation. By assessing the current state of infrastructure, organisations can make more informed decisions about what changes are necessary and how best to implement them without disrupting operations.

"So what I would suggest is stay more in the environment space, understand what infrastructure we currently have before the transformation process can start" Respondent 2

“So with the leadership, we need to just provide room for the team to do the analysis before committing into anything and making sure that all the quality solutions are also thought of in that process.” Respondent 1

“Do some research, you need to assess the current environment. Make sure you know what have right now? Where do you want to go.” Respondent 7

“Make sure that there is the right solution for that specific problem and educating everybody through documentation, through training, making sure you have the right resources as well for that problem that will be resolving.” Respondent 2

When it comes to promoting adoption of new technologies, respondent 3 highlighted organisations can benefit from appointing “digital transformation champions” who actively research and evaluate technologies that align with the strategic goals of the organisation.

“Yes, one of the best way is for them to have digital transformation champions. You know, these are the forums or the groups that they will setup, to look into or to research of new technologies for their organisation that will fit their strategies.” Respondent 3

Participants stressed the importance of involving users early in the process to ensure their needs are considered and to prevent resistance later.

“We need to improve in the communications. That we need to involve the users before we even go and get the new technologies.” Respondent 4

“What I can say is. Having open communication with business leaders and also users a important.” Respondent 6

Some participants suggested that organisations should not force integrations with legacy systems if they are not suitable.

“Hey, there must not even integrate with. I'm kidding. Yeah, like I said, we from the onset, we are never interested in even integrating them because like I mentioned running parallel and getting rid of the old” Respondent 5

Training and upskilling employees was consistently cited as a key area for improvement. Proper training ensures that staff members are capable of using new systems effectively, reducing the resistance that often accompanies change.

“Companies must invest in training their staff. So training is very important, not only awareness training, but on the job training that is functional training. People must study upskilling people should key.” Respondent 7

Respondent 8 addressed external challenges related to government procurement processes, particularly the involvement of State Information Technology Agency (SITA) in IT services. Furthermore, respondent 8 highlighted the importance of fostering interdepartmental collaboration.

“So the biggest area of improvement is government marriage to SITA. You know when we procure IT services we need to go through SITA, right and we are obliged to do it.” Respondent 8

“So areas of improvement are those of interdependent and collaborations, I cannot mention stress out the issue of SITA. If you are to write something, write about these people.” Respondent 8

b. ***Mitigating Strategies***

Participants shared a variety of strategies for mitigating the challenges associated with digital transformation, particularly those arising from legacy systems, manual processes, and resistance to change. These strategies focus on phased implementation, change management, and leveraging both old and new technologies to ensure a smooth transition. Below are the key mitigating strategies shared by the participants.

One of the most significant challenges highlighted was the reluctance of employees to adopt new technologies, particularly among older workers. Respondent 1 emphasised the importance of targeted training and a robust change management strategy.

“So we must make sure that we provide computer literacy training especially to the elderly people. Make sure that you have a clear change management strategy because there is a very serious problem people being comfortable with their manual processes and are unwilling to transform.” Respondent 1

Starting with essential functionalities and gradually expanding helps minimise disruption and ensures that the organisation can adapt to new systems step by step.

“So that has been our way of doing things, understanding as fast and then starting small, like implementing the main functionalities first.” Respondent 2

“Those that we can integrate, we do so, but those that have compatibility issues, we just continue using the legacy systems and bearing with the hardships that we have with that system. But while pushing for new functionality, new work coming through to use new technologies.” Respondent 2

In situations where new technologies cannot be immediately integrated, some participants mentioned using manual processes as a temporary workaround. Another strategy mentioned was working with vendors to implement specific modules that can integrate with existing systems, offering a partial solution while phasing out legacy systems.

“So one of the strategies you know like I mentioned it's the hard way you know of doing manually and doing manually.” Respondent 3

“But then another thing that we are doing, we use vendors so purchase maybe a specific module, just for our stuff to feel the part of it. And while we so we face out the legacy system bit by bit and then we'll just say for now let us take this only this part maybe HR and then we're going to take maybe with submission of timesheet and payment system and then we leave the other parts.” Respondent 3

“we find ways to link them together, we sometimes find another systems to be the middle man between the two.” Respondent 4

Participants mentioned running legacy and new systems in parallel as a way to transition without losing functionality and suggested building new systems to take over the functions previously provided by old technologies.

“the strategy had always just been to run the applications in parallel. And get to a place where users and data is moved onto a new system and then slowly on the other hand, switch off and decommission the old system that has just been the strategy also helped.” Respondent 5

“From my experience, the better way to do it is to continue running the legacy system as your main system right, and then the new system that you have implemented, you start running it as a pre production data.” Respondent 6

“So what happens is that on the one hand we are creating a more transformed solution and building a solution from scratch to take over certain functions that have been provided by a number of these legacy systems. And we move through in phase.” Respondent 5

Successful adoption of new technologies requires ongoing communication, training regular updates, demonstrations, and training sessions can help mitigate resistance and ensure a smoother transition.

“But what helps with adoption to new technology is change management where when you still doing your requirements you keep on showing them that this is how the new system is going to look like.” Respondent 6

Respondent 7 mentioned the importance of having frameworks of ensuring that measures are in place throughout the transformation process to protect sensitive data and ensure compliance.

“We've got a framework, information security management framework that we are using and that this framework is actually linked to the ISO 27,001 for information security management system.” Respondent 7

“Other processes that we have internally as an organisation and again we've got information security management policy that we are actually following, making sure that

whatever it is that is happening in an organisation were guided by the policy so that we will know exactly what is it that we need to do." Respondent 7

"The regions were doing their own things away from the head office which ended up leading to the whole department not being aligned. So eliminating silos regions played a huge role in our department." Respondent 8

4.5 Summary of the Results

The results of this study offer an in-depth understanding of how South African national departments, particularly in Gauteng, manage the challenges posed by legacy systems during their digital transformation journeys. Drawing from semi-structured interviews with key participants, several recurring themes emerged that provide insights into the difficulties faced, the strategies employed, and the broader impact of these challenges on digital transformation initiatives.

The findings of this study underscore the complexity of digital transformation within the context of legacy systems in South African national departments. While these systems are vital to daily operations, they hinder the adoption of modern technologies and limit the potential for digital innovation. To successfully navigate this transition, national departments must address cultural resistance, ensure leadership alignment, and implement strategic, phased approaches to system integration. By leveraging industry trends, such as cloud computing and automation, and adhering to regulatory frameworks, national departments can gradually modernise their IT infrastructure and enhance service delivery. The successful digital transformation of these departments will require continuous adaptation, leadership commitment, and a clear vision that aligns with broader governmental goals.

Figure 3 highlights how one of national departments navigates around the challenges imposed by legacy systems based on their responses.

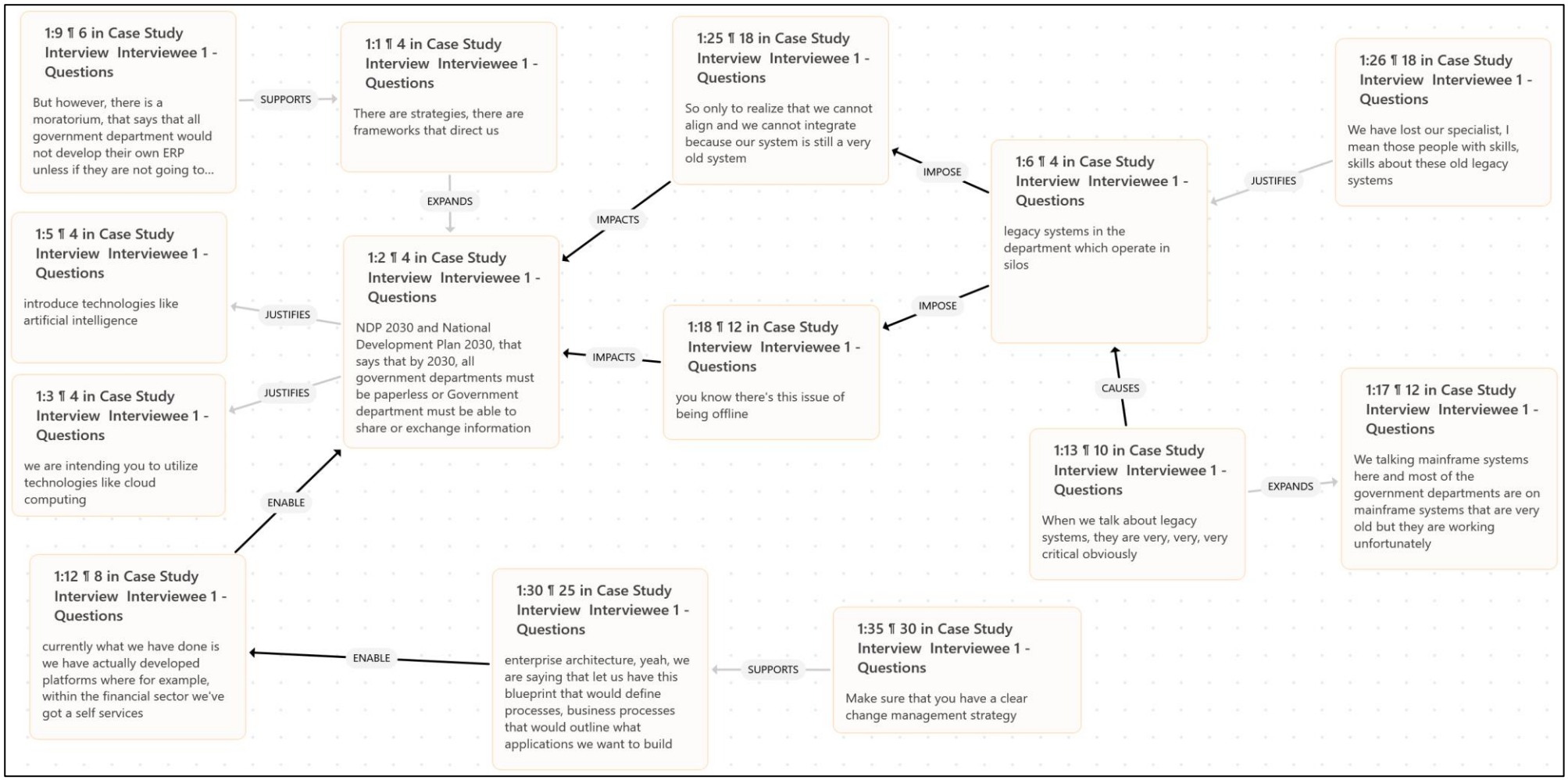


Figure 3: Network diagram of findings for respondent 1

CHAPTER 5. DISCUSSION OF THE RESULTS OR FINDINGS

5.1 Introduction

This chapter discusses the findings from Chapter 4 in relation to the theoretical framework and literature reviewed in Chapter 2. The goal is to evaluate the extent to which the findings align with or diverge from existing literature and to interpret the results using the TOE framework. The discussion is structured around the thematic areas identified in Chapter 4: factors influencing digital transformation, the extent of legacy system impacts, managing change, leadership dynamics, and strategies to navigate challenges.

5.2 What are the factors influencing digital transformation and the management of legacy systems in national departments?

This section aims to identify the factors that influence the need for and rise of digital transformation in South African national departments. The findings revealed that regulatory frameworks and industry trends significantly influence digital transformation efforts. Participants highlighted the importance of adhering to national and sector-specific regulations, such as the NDP 2030 and the POPIA, which provide strategic mandates and guidelines for adopting digital technologies. Additionally, emerging technologies like cloud computing, AI, and data-driven decision-making were identified as key drivers shaping digital strategies.

5.2.1 Factors influencing Transformation Theme

The findings revealed that regulatory frameworks significantly influence digital transformation in national departments. Participants highlighted the importance of adhering to national and sector-specific regulations, such as the NDP 2030 and the POPIA. These regulations provide strategic mandates and guidelines for adopting digital technologies, ensuring compliance and fostering collaboration across departments.

a. ***Regulations***

The findings revealed that regulatory frameworks significantly influence digital transformation in national departments. Participants highlighted the importance of adhering to national and sector-specific regulations, such as the NDP 2030 and the POPIA. These regulations provide strategic mandates and guidelines for adopting digital technologies, ensuring compliance and fostering collaboration across departments.

The NDP 2030 was identified as a critical driver, requiring government departments to achieve paperless operations and facilitate interoperability by 2030. Participant accounts emphasised that these mandates act as both a guide and a pressure point, compelling departments to align their digital transformation initiatives with broader national goals. This aligns with Manda (2022), who emphasised that governance and regulatory policies are pivotal in driving technological advancements.

Similarly, POPIA was highlighted as a key regulatory consideration, particularly concerning the design and implementation of systems to protect personal data. This reflects findings identified by Irani et al. (2023) on the growing importance of compliance in digital initiatives. The dual role of regulations as enablers and constraints, reflecting experiences of the regulatory mandates by participants on driving transformation while posing compliance challenges (Tsai et al., 2022).

The findings also revealed that regulatory alignment extends beyond compliance, influencing strategic priorities and fostering a culture of accountability. For instance, directives from the Department of Public Service and Administration (DPSA) on cloud computing adoption were seen as instrumental in shaping IT strategies.

b. *Industry Trends*

The results of this study show that industry trends play a pivotal role in influencing digital transformation in national departments. Emerging technologies such as cloud computing, AI, and data driven decision making in shaping digital strategies. The emphasises of adopting these technologies is essential to enhance operational efficiency, streamline processes, and align with global advancements.

The adoption of cloud computing and automation will directly address the limitations of legacy systems, enabling departments to modernise and future-proof their infrastructure. By embracing these trends, departments align their operations with global best practices, improving competitiveness and innovation capacity. Additionally cloud computing was particularly noted as a transformative trend and a directive from the DPSA mandating the transition to cloud-based solutions, it is a cornerstone of modern digital ecosystems (Tsai et al., 2022).

Furthermore, the importance of automation is noted as a significant factor in improving efficiency and reducing manual interventions. Mahula et al. (2022) emphasised automation as a critical enabler of digital transformation. The adoption of these trends directly addresses the limitations of legacy systems, enabling departments to modernise and future-proof their infrastructure.

However, participants acknowledged challenges in integrating these technologies due to legacy system limitations, which restrict the full realisation of their potential.

5.2.2 Managing Change Theme

This section explores the role of organisational culture, leadership decision-making, and stakeholder engagement in managing change during digital transformation. Participants identified cultural resistance, deeply rooted work habits, and generational differences as major barriers to adopting new technologies. However, they also emphasised the role of proactive change management and strategic leadership in fostering a culture conducive to transformation.

a. *Organisational culture*

The findings reveal that organisational culture is a critical factor influencing the success or failure of digital transformation initiatives within the national departments. Participants identified cultural resistance, deeply rooted work habits, and generational differences as major barriers to adopting new technologies. This resistance often stems from a fear of job displacement and a lack of trust in new technologies.

Generational dynamics in adopting new technologies, aligning with the observed openness among younger employees compared to the resistance of older staff (Hong et al., 2022; Rinta-Kahila et al., 2023). Elsafty and Yehia (2023) highlighted the role of leadership in navigating cultural resistance, consistent with what the participants suggestions for strategic communication and engagement.

Several reports verifies that long standing practices and reliance on legacy systems create an environment resistant to change, delaying transformation efforts. Organisational leadership was highlighted as a key enabler in shaping a culture conducive to transformation. By fostering an environment that values innovation and adaptability, leaders can mitigate resistance and encourage collaboration. This reflects findings by Zhang et al. (2023), who argued that cultural transformation is as critical as technological upgrades in achieving digital maturity.

b. *Leadership Decision Making*

Leadership decision making emerged as a critical factor in driving and managing change during digital transformation. Participants highlighted that leaders play a pivotal role in setting priorities, aligning resources, and making decisive interventions to address challenges posed by legacy systems. While others noting that some leaders lack a clear understanding of technological priorities, affecting their ability to fully support digital initiatives.

Several participants pointed out that effective leadership requires a clear vision and the ability to communicate it across all levels of the organisation. Leaders who actively promote digital transformation by articulating its benefits and aligning it with the strategic goals organisation were seen as instrumental in overcoming resistance. Decisive action in budget approval and resource allocation significantly impacts transformation efforts (Zhang et al., 2023a).

A lack of decisive interventions delays modernisation, prolonging reliance on outdated systems when leaders delay in setting the tone for organisational culture by influencing employee attitudes toward transformation and innovation (Manda, 2022). Inclusive decision making play a significant role particularly in mitigating resistance to change (Gökalp & Martinez, 2022).

c. *Leadership Stakeholder Engagement*

Stakeholder engagement was identified as a vital component of leadership in managing change during digital transformation. Leaders must lead by example, showing active involvement and support for digital transformation initiatives. Participants emphasised that leaders who actively engage with internal and external stakeholders foster alignment, trust, and collaboration, which are critical for overcoming resistance to change.

Leaders who demonstrate commitment and encourage amongst their teams foster a culture of trust, reducing resistance to change and promoting alignment with transformation goals. Involvement at higher levels ensures that external

stakeholders, such as regulatory bodies or vendors, are engaged effectively, aligning their contributions with departmental objectives.

The leadership must consistently play a role of motivating teams and fostering trust during digital transformation (Elsafty & Yehia, 2023). Additionally, Manda (2022) highlighted the importance of stakeholder alignment in public sector transformation, mirroring the need for leadership to bridge internal and external interests. Encouragement and communication from leadership motivate users and teams to adopt new systems.

5.3 What is the extent of impact legacy system presents on digital transformation?

This question aimed to explore the degree to which legacy systems influence the progress and implementation of digital transformation initiatives within national departments. The findings shed light on the pervasive influence of legacy systems across various operational dimensions. Twelve categories were identified with two themes from the data collected.

The following sections looks after the categories identified under extent of impact and the results of the impact themes. The findings are then linked with the literature from chapter 2

5.3.1 Extent of Impact Theme

The findings revealed seven key categories of challenges associated with legacy systems, highlighting their extensive impact on digital transformation initiatives. These categories, derived from participant responses, illustrate the multifaceted nature of the obstacles posed by legacy systems and their influence on operations within national departments.

The seven categories emerging from the findings demonstrate the depth of the issues faced. These include architectural rigidity, security vulnerabilities,

scalability limitations, operational inefficiencies, siloed data systems, dependency on external vendors, and outdated user interfaces. Each category represents a unique dimension of impact, collectively illustrating the pervasive nature of the challenges that impact digital transformation efforts.

a. *Need of Legacy Systems*

Despite their limitations, legacy systems were noted as indispensable for the continuity of critical operations. Participants emphasised that many core processes, such as payroll management, financial reporting, and compliance tracking, depend on these systems, making their outright replacement impractical in the short term. The literature also confirmed this view asserting that legacy systems often serve as the backbone of essential organisational functions (Venâncio et al., 2023; Irani et al., 2023; Velimeneti, 2016).

The findings also highlighted the role of legacy systems in ensuring stability and reducing the risks associated with abrupt technological changes. Participants indicated that legacy systems, though outdated, are often perceived as reliable and well-understood by long-serving employees, which reduces operational disruptions. This aligns with Bakar et al. (2022), who noted that organisations must balance the need for modernisation with the operational dependencies on existing systems.

Moreover, participants pointed out that transitioning away from legacy systems requires substantial financial and human resources. The cost of system upgrades, coupled with the need for extensive training to familiarise staff with new technologies, poses a significant barrier. This reflects findings by Mahula et al. (2022), who emphasised that resource constraints often delay the replacement of legacy systems.

As a result, the necessity of legacy systems is often set against with their limitations, underscoring the need for phased modernisation strategies. Participants advocated for hybrid approaches, where legacy systems are incrementally integrated with modern technologies to improve functionality and

compatibility without disrupting critical operations. These strategies echo the incremental upgrade frameworks proposed identified from the literature (Bakar et al., 2022).

b. *Compatibility Challenges*

The findings highlight the persistent challenges associated with lack of compatibility of legacy systems and modern digital technologies. Participants reported that outdated architectures often prevent seamless integration with cloud-based platforms, data analytics tools, and advanced software applications. Furthermore, legacy systems fail to integrate seamlessly with newer software due to data formats not matching and outdated operating systems, often requiring third-party tools or Application Programming Interfaces (API) to bridge gaps. Another finding is that managing compatibility requires significant time and effort, as manual fixes and temporary solutions are frequently employed.

The findings reveal that compatibility challenges significantly delay and complicate digital transformation initiatives. Legacy systems were designed for environments and use cases that differ immensely from the requirements of modern technologies.

The findings align closely the literature reviewed that compatibility issues are a hallmark of legacy systems, which often lack the interoperability required to integrate seamlessly with modern technologies (Irani et al., 2023). The outdated architectures create barriers to data exchange and require significant efforts to enable integration to the modern technologies (Tsai et al., 2022).

The compatibility challenges directly impact the research problem, as organisations face extended timelines due to the additional effort required to ensure interoperability and need for third party integration tools and ongoing maintenance drives up operational costs.

c. *Integration Challenges*

The study found that integration challenges play a significant barrier to digital transformation initiatives. These challenges were attributed to differences in data formats, communication protocols, and system architectures, which often require extensive customisation and development efforts. They described integrating legacy systems with modern platforms as a highly challenging process, similar to building a bridge between two different worlds, thus leading other participants saying they are no longer even trying to integrate them. These systems created in isolation, limiting information flow and reducing collaboration between departments.

The inability of legacy systems to integrate with modern technologies leads to fragmented operations, reducing organisational efficiency and collaboration. Departments are unable to leverage advanced technologies such as automation due to integration roadblocks.

Literature identified that one of strong aspect that poses a significant barrier to digital transformation is integration of legacy systems to modern technologies (Bitsch et al., 2023; Rinta-Kahila et al., 2023). This perspective highlights the technical complexity and significant resource demands involved in such integration efforts, particularly in organisations with fragmented IT ecosystems (Irani et al., 2023).

The inability to integrate legacy systems delays the adoption of modern technologies and prolongs the digital transformation initiatives. Because of their nature of isolated structure, limits departmental collaboration and impact the ability to deliver efficient service to the public.

d. *Reliability Issues*

Reliability challenges associated with legacy systems were highlighted as a concern by the participants. Legacy systems often experience periods of being offline, disrupting critical operations and causing frustration. Furthermore, the outdated infrastructure of legacy systems struggles to manage the growing data

demands of modern operations and leads to inefficiencies, as delays in bringing systems online slow down operational workflows.

Such reliability issues disrupt critical operations, creating bottlenecks in workflows and increasing operational risks (Venâncio et al., 2023). Venâncio et al., (2023) further discussed how system unreliability leads to increased operational costs and negatively impacts user confidence, reflecting frustrations of participants. Outdated systems are not equipped to handle modern data demands, which creates bottlenecks in data processing and decision making (Cao & Iansiti, 2022).

Frequent system downtime interrupts essential services, which can have cascading effects on productivity and service delivery. Time and resources are often redirected toward troubleshooting and maintaining these unreliable systems, diverting focus from strategic transformation efforts.

e. ***Silos***

The findings revealed that most legacy systems have a silos structure within the national departments, where they operate independently, limiting cross-functional data sharing. Participants highlighted the inefficiency of manually transferring data between systems, such as ERP and SharePoint and registrations take place in multiple systems.

This increases the time and effort required to complete tasks as the lack of integration creates challenges in identifying and addressing issues within processes, as problems can span multiple systems without clear visibility. such as transferring data manually or managing multiple systems for a single process (Hafseld et al., 2022).

The literature identified analysis of legacy system complexity, which highlights that these systems often operate as closed ecosystems, limiting their ability to interconnect with modern digital platforms (Venâncio et al., 2023). that silos restrict visibility and innovation, a challenge echoed in accounts by participants

of operational blind spots and difficulties pinpointing process issues (Cao & Iansiti, 2022; Tsai et al., 2022).

f. *State of Technology*

The findings illustrate critical challenges related to the state of technology in national departments particularly regarding legacy systems. Legacy systems, while essential to daily operations, are characterised by outdated architecture, limited integration capabilities, and security vulnerabilities. Participants highlighted that these systems, despite being necessary, hinder progress toward modern digital solutions.

The outdated nature of legacy systems prevents departments from aligning with modern digital transformation goals. Their obsolescence obstruct organisational adaptability and innovation (Bakar et al., 2022). Participants reported that these systems often operate independently, preventing effective communication and data sharing across platforms. Such inefficiencies highlight the fragmented structure of these systems, reflecting on the argument made by Zhang et al. (2023) that silos undermine organisational integration and collaboration.

Maintaining aging infrastructure and addressing security vulnerabilities require significant resources, diverting funds from modernisation efforts and their inability to integrate limits innovation and reduces the potential for improved service delivery.

g. *Skills Shortage*

The findings highlighted a critical shortage of skills required to maintain and support legacy systems, which emerged as a significant impact to digital transformation. Participants emphasised that these outdated systems require specialised expertise, which is increasingly scarce due to the retirement of experienced personnel and the lack of new entrants being trained in legacy technologies.

Dependence on a small number of individuals for legacy system management leaves departments vulnerable to disruptions when those individuals leave. These findings suggest that the skills shortage is not just a staffing issue but a fundamental issue that affects achieving sustainable digital transformation because of not having the right individuals that knows the whereabouts of legacy systems.

This aligns with the observations of Mahula et al. (2022), who noted that legacy systems often depend on knowledge that is not transferable to newer platforms, exacerbating the skills gap. The dependence on a shrinking pool of legacy system experts, noting that this creates operational bottlenecks and increases reliance on external vendors (Irani et al., 2023).

5.3.2 The Result of the Impact Theme

This section discusses the consequences of legacy systems on digital transformation, including bottlenecks, cost implications, fear of change, maintenance challenges, and manual interventions.

a. ***Bottlenecks or Delays***

The findings revealed that bottlenecks and delays are significant challenges in digital transformation within national departments, primarily arising from legacy system constraints. Frequent outages disrupt critical processes, such as reconciliations and payments, with government departments struggling to meet deadlines like the 30 day payment rule. There is an over reliance on specific employees for key tasks creates workflow bottlenecks when they are unavailable. Legacy systems frequently slow down decision making processes and reduce operational efficiency (Mahula et al., 2022).

One major source of bottlenecks was the reliance on manual interventions to reconcile incompatible systems. The outdated systems often required extensive human effort to perform tasks such as data migration, reporting, and integration

with modern platforms. This not only delaying critical operations but also increased the likelihood of errors. Such inefficiencies having to manually intervene are a direct consequence of legacy system inflexibility (Venâncio et al., 2023).

Another contributing factor to delays was the inability of legacy systems to handle increased data volumes and complex workflows. Participants pointed out that systems designed decades ago lack the capacity to support the demands of contemporary operations. Bakar et al. (2022) argued that outdated infrastructure often becomes a bottleneck as organisations attempt to scale their operations.

Overall, the findings underscore the pervasive impact of bottlenecks and delays on organisational efficiency and highlight the critical need for modernisation strategies to address these challenges effectively. These implications underscore the urgency of addressing bottlenecks to create a more efficient, responsive, and modern public service infrastructure.

b. *Cost Implications*

There is a significant cost implication associated with legacy systems in national departments, particularly in the context of maintaining and supporting legacy systems. Maintaining outdated systems incurs ongoing expenses, which are often high due to their age and the need for specialised expertise. Legacy systems require constant maintenance due to their outdated architecture and lack of local support, straining departmental budgets.

Furthermore, data migration from legacy systems to modern platforms is labour intensive, requiring additional resources and tools. National departments face difficulties in allocating sufficient funds for modernisation due to the high cost of maintaining existing systems (Tsai et al., 2022). These manual interventions and extended timelines for migration and integration contribute to significant hidden costs in terms of lost productivity and delayed modernisation.

These findings illustrate the pressing financial challenges associated with legacy systems, emphasising their pervasive impact on strategic resource allocation and overall organisational effectiveness. the financial strain caused by the lack of local expertise, pushes the national departments to experiences of hiring costly external specialists (Venâncio et al., 2023).

c. *Fear of change*

The fear of change poses a significant barrier to digital transformation. Employees often hesitate to adopt new technologies due to concerns about job security, the complexity of new systems, and potential disruptions to established workflows. Resistance among employees slows the rollout and integration of new technologies, extending project timelines and this leads to continued reliance on manual processes and legacy systems that hampers productivity and undermines modernisation efforts. Gökalp and Martinez, (2022) described this fear of change as a common psychological barrier in technology adoption.

Managing the resistance of older employees while leveraging the openness of younger staff requires targeted change management strategies. A well structured change management will assist in addressing resistance and fostering adaptability to new technologies thus influencing adoption of digital transformation in national department (Manda, 2022).

Another dimension of fear highlighted in the findings was related to a lack of confidence in using new systems. Participants pointed out that employees often avoid engaging with new tools due to apprehension about making mistakes or appearing incompetent. The same findings were identified in the literature where Zhang et al. (2023), who emphasised the role of self-efficacy in determining willingness to embrace technological change in employees.

Fear and uncertainty can lower employee morale, reducing overall engagement with transformation initiatives in the national department. Consistent messaging about the goals and implications of digital transformation initiatives has been identified as a contributing positive factor in the adoption of new technologies.

d. *Maintenance Challenges*

Maintenance of legacy systems has been pointed out as a significant barrier during digital transformation These systems are often outdated and complex, requiring specialised skills and extensive resources to keep them operational. These systems lack security patches and updates, creating vulnerabilities that expose data and operations to risks. Furthermore, the scarcity of skilled personnel familiar with legacy technologies intensifies this issue.

Missed updates of these unsupported systems create challenges in meeting regulatory audit requirements and results in high maintenance costs and security risks which later affects the integration the new technologies (Mahula et al., 2022). As legacy systems are no longer supported by vendors, vulnerabilities and frequent breakdown continue to impede on digital transformation by directing resources to baby sit these systems (Bakar et al., 2022).

Additionally, there is always a situation, where even minor or major system updates require external assistance, thus leading to delays and increased expenses. This dependency reflects the literature by Venâncio et al. (2023), who noted that vendor lock-in is a common issue with legacy systems.

Overall, the findings emphasises that maintenance challenges not only strain financial and human resources but also impede progress toward digital transformation goals. These challenges highlight the urgent need for strategic planning to address the operational limitations posed by legacy systems.

e. *Manual Interventions*

The findings revealed that manual interventions remain a critical challenge in the context of legacy systems, particularly concerning the need to reconcile incompatible systems and processes. Participants described scenarios where manual workarounds were necessary to bridge gaps between legacy systems and newer platforms. These interventions often involve extracting, transforming, and loading data manually, which increases the risk of errors and delays.

National departments workforce is burdened with additional tasks, such as babysitting these outdated systems, reducing overall productivity. Additionally, these manual interventions impact the scalability and efficiency of operations thus leading to the lack of seamless integration between systems often results in duplicated efforts, where multiple teams are required to perform redundant tasks.

Employees tasked with repetitive manual processes may feel frustrated and undervalued, reducing engagement and morale. This need for manual interventions reflects deeper integration and system compatibility issues, delaying digital transformation efforts in the national departments. These inefficiencies were cited in the literature as a major barrier to achieving the streamlined workflows necessary for effective digital transformation (Van Der Hoogen et al., 2024).

Generally, the persistence of manual interventions highlights the need for robust integration solutions and the modernisation of legacy systems to eliminate inefficiencies and enhance operational effectiveness.

5.4 How do national departments in Gauteng navigate and overcome the challenges imposed by legacy systems?

This section explores the strategies employed by national departments to navigate and overcome the challenges posed by legacy systems during digital transformation. The findings revealed that targeted training, phased implementation, and strategic integration are key strategies for mitigating these challenges.

5.4.1 Navigating the Challenges Theme

There were several improvement suggestions for navigating the challenges posed by legacy systems and ensuring successful digital transformation. One key recommendation was the establishment of enterprise architecture, a blueprint designed to define business processes and guide application development.

a. *Improvements Suggestions*

There were several improvement suggestions for navigating the challenges posed by legacy systems and ensuring successful digital transformation. One key recommendation was the establishment of enterprise architecture, a blueprint designed to define business processes and guide application development. This structured approach ensures alignment between transformation efforts and organisational priorities. Another suggestion emphasised conducting a detailed assessment of the current infrastructure before implementing changes, this will lead the departments to minimise risks, avoid disruptions, and ensure that the chosen technologies align with their needs.

Digital transformation champions were identified as essential for promoting innovation. These champions would research and evaluate technologies aligned with organisational strategies, helping to build a culture of innovation and ensuring alignment with long term goals. Participants also stressed the importance of early user involvement to reduce resistance and address user needs effectively. Engaging employees during the planning stages can foster a sense of ownership and ensure smoother adoption of new systems. Similarly, targeted training and upskilling programs were cited as vital for equipping staff with the skills needed to use new technologies effectively, thereby reducing resistance and enhancing adoption rates.

Strategic integration decisions were another area of focus. There is a need to address procurement challenges, particularly with the SITA, was also highlighted. Streamlining procurement processes can help accelerate IT service acquisition and ensure timely execution of transformation projects. Lastly, fostering interdepartmental collaboration was seen as crucial for aligning efforts and resources, promoting unified and efficient transformation initiatives.

These recommendations reflect the need for a structured, inclusive, and strategic approach to digital transformation. Strategic planning, such as enterprise architecture, ensures that transformation efforts are goal-oriented, while user-

centric approaches like training and early engagement reduce resistance and enhance competence (Vial, 2021). Thorough analysis and informed decision-making mitigate the risks of implementing unsuitable technologies, while collaboration and streamlined procurement improve efficiency and resource allocation (Irani et al., 2023). These strategies collectively address both technical and organisational dimensions of transformation, paving the way for sustainable progress.

Establishing a clear enterprise architecture enhances alignment between technologies and business processes, while user involvement and training foster higher adoption rates (Rinta-Kahila et al., 2023). Improved efficiency is achieved through thorough planning and strategic integration, reducing redundancies and streamlining workflows. Collaboration across departments will strengthens shared resource utilisation, and addressing procurement inefficiencies ensures timely execution of initiatives (Manda, 2022). Additionally, appointing digital transformation champions and focusing on upskilling build internal capacity for sustained innovation, securing long-term sustainability.

Moreover, the findings pointed to the need for fostering a culture of collaboration and innovation. Encouraging cross-departmental communication and involving stakeholders in decision-making processes were identified as effective strategies for breaking down silos and addressing cultural resistance. Participants noted that clear communication about the benefits and goals of digital transformation initiatives could mitigate fear and build trust among employees.

These improvement suggestions underscore the multifaceted nature of the challenges associated with digital transformation and the need for a comprehensive, collaborative approach to overcome them.

b. *Mitigating Strategies*

A range of strategies were identified to mitigate the challenges imposed by legacy systems associated with digital transformation in the national departments. The findings revealed that these strategies are pivotal in minimising the challenges

and address key barriers identified in the findings, particularly the limitations of legacy systems, resistance to change, and resource constraints.

A targeted training and structured change management, which emphasised providing computer literacy training for older employees and equipping all staff with the necessary skills to adopt new systems. This approach focuses on building employee confidence and creating an organisational culture more receptive to technological advancements.

Another key strategy was phased implementation, where new systems are introduced gradually, beginning with essential functionalities before expanding their scope. Incremental upgrades to legacy systems, prioritising critical functionalities, allow for smoother transitions while minimising operational disruptions (Bakar et al., 2022; Rinta-Kahila et al., 2023). This step by step approach minimises disruption and allows organisations to adapt incrementally, addressing any challenges that arise without compromising critical operations (Venâncio et al., 2023). Furthermore, building new systems from scratch to replace legacy systems entirely, especially when integration is impractical or inefficient it will be pivotal in national departments and will ensure they mitigate the challenges. Running parallel will be a practical way to transition from legacy systems to new technologies (Rinta-Kahila et al., 2023).

The proposed mitigating strategies have significant implications for digital transformation efforts. Reduced disruption is achieved through phased implementation and parallel operations, ensuring that critical functions remain uninterrupted during transitions. Improved adoption is facilitated by training, communication, and ongoing demonstrations, which build employee confidence and enhance technology adoption rates.

CHAPTER 6. CONCLUSIONS & RECOMMENDATIONS

6.1 Introduction

The digital transformation of national departments is an essential initiative aimed at improving service delivery, operational efficiency, and governance in the public sector. However, one of the most significant challenges impacting this transformation is the presence of legacy systems. These systems, while historically valuable, often impede modernisation efforts due to their outdated architecture, lack of interoperability, and high maintenance costs.

This chapter synthesizes the key findings of the study, focusing on how national departments in Gauteng navigate the challenges imposed by legacy systems during their digital transformation journey. The discussion will explore the factors influencing digital transformation, the extent to which legacy systems impacts modernisation efforts, and the strategies employed by national departments to overcome these obstacles. Additionally, the chapter will present recommendations derived from the findings and propose areas for further research.

Understanding these challenges and the approaches used to mitigate them is critical for shaping future policies and strategies. By examining studies and insights from national departments, this study aims to contribute to the broader discourse on public sector digital transformation, particularly within the South African context.

The findings of this study align with previous research in some areas but also reveal new insights that differentiate it from existing literature. Prior studies have primarily focused on the technical barriers to digital transformation, such as interoperability issues and high costs of upgrading legacy systems (Danaeefard et al., 2024; Hasan et al., 2023; Irani et al., 2023; Tsai et al., 2022; Venâncio et al., 2023). While this study confirms the significance of these challenges, it also

highlights the critical role of bureaucratic inertia, leadership hesitancy, and resistance to change, organisational and cultural resistance, which has been underexplored in prior research. Additionally, while earlier research positioned government policies as a strong driver of digital transformation (Manda, 2022), this study finds that inconsistent enforcement and slow policy execution often hinder progress. Another notable distinction is the role of leadership where previous studies acknowledged leadership as a factor, this study emphasizes its centrality in bridging the gap between policy directives and real-world implementation.

6.2 What are the factors influencing digital transformation and the management of legacy systems in national departments?

Digital transformation in national departments is shaped by multiple factors, including regulatory frameworks, technological advancements, and organisational culture. This section provides an answer to the first research question based on the findings from the study, it is evident that while digital transformation is a priority for national departments, several barriers impact its full implementation.

One of the primary drivers of digital transformation is the regulatory and policy landscape. Government directives, such as the NDP 2030 and the POPIA, establish clear guidelines for digital modernisation. These policies are designed to promote interoperability, improve service delivery, and enhance efficiency in government operations. However, while these policies serve as enablers, they also present challenges due to slow implementation, lack of coordination across departments, and bureaucratic inertia. Many departments struggle to align their digital transformation initiatives with policy mandates, resulting in fragmented efforts and delays.

Technological advancements, particularly cloud computing, artificial intelligence, and big data analytics, also play a crucial role in driving digital transformation.

Cloud adoption, in particular, has been emphasized as a solution to modernize government IT infrastructure. However, integrating these modern technologies with legacy systems remains a significant challenge. Many departments continue to rely on outdated IT infrastructure, making it difficult to fully transition to digital solutions. The study found that while departments recognize the benefits of modern technology, a lack of investment in scalable infrastructure and skills development has slowed down adoption. Furthermore, compatibility issues between legacy and modern systems create inefficiencies, forcing departments to rely on manual workarounds that reduce productivity.

Beyond regulatory and technological factors, organisational culture and leadership emerged as critical influences on digital transformation. Cultural resistance to change was identified as one of the biggest obstacles, with employees particularly those who have worked in government for many years reluctant to adopt new systems. This resistance is further exacerbated by generational differences, as older employees tend to prefer traditional manual processes, while younger staff are more open to digital solutions. Leadership commitment plays a pivotal role in overcoming these cultural barriers. Departments with proactive leadership that actively drives digital initiatives tend to experience more successful transformation efforts. Leaders who engage stakeholders, communicate a clear vision, and invest in change management strategies are better positioned to navigate the challenges posed by legacy systems. On the contrary, departments where leadership fails to prioritize digital transformation struggle with low adoption rates and fragmented implementation.

Ultimately, this study demonstrates that digital transformation in national departments is not solely a technological shift but a complex process influenced by policies, leadership, infrastructure, and organisational culture. While legacy systems remain a significant challenge, addressing cultural resistance, ensuring policy enforcement, and fostering strong leadership are equally critical in overcoming barriers to transformation. This nuanced understanding of digital transformation in the public sector provides valuable insights for policymakers and department leaders seeking to accelerate digital modernisation efforts.

6.3 What is the extent of impact legacy system presents on digital transformation?

Legacy systems have a profound impact on digital transformation in national departments, influencing the efficiency, scalability, and interoperability of digital initiatives. In answering the questions, the findings from this study indicate that while legacy systems remain essential for core government functions, they pose significant challenges that hinder modernisation efforts. These challenges include system incompatibility, data silos, high maintenance costs, security vulnerabilities, and organisational inefficiencies.

One of the most significant impacts of legacy systems on digital transformation is their incompatibility with modern technologies. Many legacy systems were designed decades ago using outdated programming languages, rigid architectures, and proprietary formats that do not support seamless integration with newer digital solutions. The study found that national departments often struggle to connect legacy systems with cloud platforms, artificial intelligence tools, and other emerging technologies. This lack of interoperability forces departments to maintain manual workarounds, which slows down service delivery and reduces operational efficiency. Several participants highlighted how legacy systems limit automation efforts, making it difficult to implement digital workflows that could streamline government operations.

Another major impact of legacy systems is their contribution to data fragmentation and inefficiencies. Because many of these systems were developed in silos, they do not facilitate data sharing across departments, leading to duplication, inconsistency, and delays in decision-making. The study found that national departments often face challenges in consolidating and analysing data, which affects their ability to provide accurate and timely public services. Participants described instances where critical information was stored in outdated databases that required complex manual extraction processes, further hampering digital transformation efforts. This fragmentation also impacts citizen services, as

departments are unable to provide integrated digital solutions that require seamless access to shared data across government entities.

The high cost of maintaining legacy systems was another key finding in this study. Unlike modern cloud-based systems that offer cost-effective scalability, legacy systems require substantial financial resources to operate and maintain. The study revealed that national departments allocate a large portion of their IT budgets to maintaining outdated infrastructure, leaving limited funds available for investing in digital transformation initiatives. Additionally, the scarcity of skilled personnel with expertise in older technologies increases operational risks, as departments struggle to find professionals capable of maintaining and upgrading these systems. Some participants expressed concerns that their departments were "locked in" to legacy technologies due to expensive vendor contracts and dependencies on proprietary software, making it difficult to transition to more agile digital solutions.

Security vulnerabilities were also identified as a critical impact of legacy systems on digital transformation. Outdated software and unsupported operating systems expose national departments to cybersecurity threats, including data breaches, system failures, and compliance risks. The study found that while departments recognize the need to modernize their IT security, their reliance on legacy systems creates gaps that cannot be easily addressed without a complete overhaul of existing infrastructure. Several participants noted that legacy systems often fail to meet modern security standards, making them an attractive target for cyber threats. Additionally, the inability to integrate advanced security features, such as encryption and multi-factor authentication, further exacerbates the risks associated with these systems.

Despite these challenges, the study found that legacy systems still play a critical role in government operations. Many national departments rely on them for mission-critical functions such as financial management, human resource administration, and citizen records management. Participants highlighted that replacing these systems is not always a viable option due to the complexity, cost,

and potential service disruptions associated with system migration. As a result, some departments adopt a hybrid approach, maintaining essential legacy functions while gradually integrating modern digital solutions. However, this approach requires careful planning and investment to ensure a smooth transition without compromising service delivery.

The impact of legacy systems on digital transformation is extensive, affecting technological integration, data management, financial resources, security, and institutional efficiency. While these systems remain critical to government operations, their limitations present substantial obstacles to modernisation efforts. The study suggests that addressing these challenges requires a multifaceted approach that includes policy enforcement, investment in scalable infrastructure, proactive leadership, and workforce adaptation strategies. By implementing these measures, national departments can navigate the complexities of legacy system management and accelerate their digital transformation journey.

6.4 How do national departments in Gauteng navigate and overcome the challenges imposed by legacy systems?

Overcoming the challenges posed by legacy systems requires a combination of strategic planning, technological innovation, leadership engagement, and change management and this section answers this research question. The findings from this study reveal that national departments employ various approaches, including phased modernisation, hybrid system integration, strategic leadership interventions, and targeted capacity building to mitigate the constraints of legacy systems while advancing their digital transformation agendas.

One of the most effective strategies identified in this study is the phased modernisation of legacy systems. Instead of attempting to replace outdated systems entirely an approach that is often costly, disruptive, and technically challenging many national departments opt for a gradual transformation. This involves upgrading components of legacy systems in stages, ensuring that critical

functions remain operational while new digital solutions are integrated. Some departments begin by migrating non-critical functions to cloud-based platforms while maintaining core legacy applications. This incremental approach minimizes service disruptions, allows for better resource allocation, and enables a smoother transition to modern digital infrastructure.

Additionally, some departments adopt a parallel system deployment strategy, where new technologies are developed and run alongside existing legacy systems. This approach minimizes operational disruptions, as it allows users to gradually adapt to the new system while still having access to the familiar legacy infrastructure. By providing hands-on experience with both systems, employees can transition more smoothly, reducing resistance to change and ensuring that critical processes are not interrupted. Furthermore, this phased transition enables departments to identify and address integration challenges in real-time, refine system functionalities based on user feedback, and mitigate the risks associated with a sudden system overhaul.

Another strategy adopted by national departments is hybrid system integration, which involves creating interfaces that allow legacy systems to interact with modern technologies. Many departments struggle with interoperability issues due to the rigid and outdated architectures of their legacy systems. To address this, IT teams develop APIs and middleware solutions that enable data exchange between legacy and modern platforms. While this does not eliminate legacy systems entirely, it significantly improves operational efficiency by allowing departments to leverage new digital tools without completely overhauling their existing IT infrastructure.

Strategic leadership and policy alignment also play a crucial role in overcoming legacy system challenges. The study found that digital transformation efforts are more successful in departments where leadership actively supports modernisation initiatives. Proactive leaders drive transformation by securing funding, aligning IT strategies with government policies, and fostering a culture that embraces change. Some departments have established digital

transformation task forces led by senior executives to oversee modernisation projects and ensure alignment with national policies such as the NDP 2030. Strong leadership ensures that digital transformation is not merely an IT-driven initiative but a strategic priority embedded within the broader institutional framework.

Workforce adaptation and change management have also emerged as key factors in overcoming legacy system challenges. The study found that resistance to change among employees is one of the biggest barriers to modernisation. Many staff members, particularly those who have been using legacy systems for years, are hesitant to adopt new technologies due to familiarity with existing processes and fear of job displacement. To address this, departments invest in continuous training programs to enhance digital literacy and upskill employees. Some departments have also implemented change management strategies, including early stakeholder engagement, hands-on training sessions, and incentives for digital adoption, to encourage a smoother transition from legacy systems to modern solutions.

National departments navigate the challenges of legacy systems through phased modernisation, hybrid integration, strong leadership engagement, workforce adaptation, and financial optimisation. These strategies enable departments to maintain critical operations while gradually transitioning to a more agile, interoperable, and digitally driven environment. This study underscores the importance of a multi-dimensional approach to overcoming legacy system constraints one that integrates technical, organisational, and strategic solutions to ensure a sustainable and scalable digital transformation.

6.5 Recommendations

The findings of this study have highlighted that national departments in Gauteng face significant barriers in their digital transformation journey due to the continued reliance on legacy systems. However, departments have also employed various

strategies to navigate these challenges, such as hybrid integration, phased modernisation, and strategic leadership interventions. To build on these strategies and ensure long-term success, this section provides specific recommendations that directly address the realities identified in this study.

6.5.1 *Establish a targeted legacy system modernisation plan with defined priorities*

Instead of attempting full-scale legacy system replacements which have been shown to be expensive and disruptive, departments should adopt a targeted modernisation approach. This means conducting department-wide system audits to identify which legacy applications are most critical, which can be phased out, and which require integration with new technologies. The study found that financial systems, Human Resources (HR) platforms, and citizen service databases remain heavily reliant on legacy infrastructure. Thus, modernisation plans should prioritize integrating cloud-based solutions for financial processing and HR management while implementing data migration strategies for citizen service records to improve interoperability and accessibility.

6.5.2 *Develop custom APIs and middleware for bridging legacy and modern systems*

A key finding of this study is that many national departments struggle with data silos because legacy systems do not communicate with newer digital platforms. To address this, departments should focus on developing and implementing APIs and middleware solutions tailored to their specific systems. These solutions should be designed to enable real-time data exchange between old and new platforms, reducing reliance on manual data transfers and redundant administrative processes.

6.5.3 *Strengthen leadership's role in digital transformation*

The study found that departments with engaged, and digitally literate leaders demonstrated greater success in overcoming legacy system challenges. However, in many cases, leaders lack technical knowledge and rely on IT teams to drive transformation efforts. To address this, national departments should implement mandatory executive-level digital transformation training for Directors-General, CIOs, and senior managers. This training should focus on understanding legacy system limitations, identifying digital opportunities, and aligning modernisation with organisational objectives. Furthermore, departments should establish a Digital Transformation Steering Committee at the executive level, ensuring that modernisation efforts receive high-level oversight, budget prioritisation, and cross-departmental collaboration as per one of the national departments is currently implementing.

6.5.4 *Expand digital skills development to reduce resistance to change*

One of the most consistent barriers identified in this study was employee resistance to adopting new digital solutions, particularly among long-tenured staff accustomed to legacy systems. Departments must implement structured change management programs that go beyond traditional IT training. This includes:

- Customized learning tracks for different job roles
- Hands-on training with real-world use cases, such as how digitized procurement processes can improve efficiency and reduce delays caused by legacy financial systems.
- Internal digital adoption incentives, such as recognition programs for employees who transition successfully to digital platforms.
- Establishment of digital champions in each department, where selected employees receive advanced training and serve as on-site support to assist colleagues with technology adoption.

6.5.5 *Reduce dependence on legacy system through gradual decommissioning*

The study found that national departments spend their resources on maintaining outdated systems rather than investing in new solutions. To address this issue, departments should implement a legacy system cost-reduction strategy, which includes:

- Assessing the true operational cost of maintaining each legacy system and identifying redundant or overlapping systems.
- Implementing a progressive decommissioning strategy, where non-critical legacy applications are retired first while mission-critical applications receive parallel modernisation investments.
- Standardizing data formats across departments to facilitate easier integration between legacy and new systems.
- Mandating the use of government-approved middleware solutions that allow real-time communication between departmental databases.
- Creating a centralized government data repository that national departments can access securely to reduce duplicate data storage across different agencies.

6.6 Suggestions for further research

One of the most significant challenges identified in this study is employee resistance to digital transformation, particularly among long-serving government officials. Future research should assess the effectiveness of different change management approaches, including training programs, incentive structures, leadership engagement, and digital adoption campaigns. A deeper understanding of which strategies work best in a government context could help departments develop tailored interventions to accelerate digital adoption among employees.

Future research could be to investigate how AI can be used to modernise legacy systems, enhance interoperability between legacy and modern systems, particularly in areas such as data migration, predictive maintenance, and intelligent decision-making. This research could help national departments determine which legacy functions can be automated rather than replaced, reducing costs and improving efficiency.

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APPENDIX A (Participant Information Sheet)

Participant Information Sheet (PIS)

Dear Sir / Madam

My name is Reneilwe Ramonyai, I am a Masters student in Business Management Digital at the University of the Witwatersrand, Johannesburg. My supervisor is Dr Kiru Pillay. I am conducting a research study about challenges imposed by legacy systems. The study title is **Exploring challenges imposed by legacy system on digital transformation in Gauteng national departments**

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I am inviting you to take part in an interview. If you decide to take part, your participation in this research study will last about 2 hours. The interview activity will take place either online via zoom or teams at a specific time based on your availability.

With your permission, I would like to audio record the interview activity. This data will be stored in password locked computer for 1 year and deleted after 1 year. 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 name and role.

The interview 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. With your permission, other researchers may use the data collected from this research study, but your name and any personal information will not be used or passed on.

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. Your travel/data costs to attend the interview will be reimbursed to a maximum of R150.

The risks for this research study are no more than what happens in everyday cooperate wok life and would not be about your personal life. If it happens that the questions make you sad, I will stop the interview and continue another time.

This research study will be written up as a research report. The report will be available on the university library website. A summary of this report will be shared with 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:
Reneilwe Ramonyai, 2731977@students.wits.ac.za, 0794376278

Supervisor:
Kiru Pillay, kirubagaran.pillay@wits.ac.za, 0826027261

APPENDIX B (Consent Form)

Consent Form

Exploring challenges imposed by legacy system on digital transformation in Gauteng national departments

Reneilwe Ramonyai

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

I agree to the following:

(Please circle the relevant options below)

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

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

…… (signature)
…… (name of researcher/person seeking consent)
…… (date)

APPENDIX (C) Instrument - Interview Guide

INTERVIEW GUIDE QUESTIONS

RESEARCH TITLE: **Exploring challenges imposed by legacy system on digital transformation in Gauteng national departments**

Date	
Time	
Interviewee	
Interviewer	Reneilwe Ramonyai

Introduction

Q1 Please describe your role in your department/organisation?

Notes:

Section 1: Digital Transformation
1. Understanding Digital Transformation
How would you describe your understanding of digital transformation in the context of your department?
2. Perceived Importance
In what ways do you believe digital transformation is important for your department? Can you provide examples?
3. Current Digital Transformation Efforts
Can you describe the current digital transformation efforts within your department? What specific initiatives have been undertaken?
4. Impact of Digital Transformation
How has digital transformation affected your department's operations and service delivery? What changes have you noticed?
Section 2: Legacy Systems
5. Role of Legacy Systems
What role do legacy systems currently play in your department? How critical are they to your daily operations?
6. Experience with Legacy Systems
Can you describe your experience working with the legacy systems in your department? How do they impact your work?

7. Legacy Systems and Innovation
How do you think the presence of legacy systems affects the ability of your department to innovate or adopt new technologies?
8. Interoperability Issues
Have you encountered any challenges in making new technologies work with the existing legacy systems? Can you provide examples?
Section 3: Challenges Imposed by Legacy Systems
9. Challenges in Integration
What challenges have you experienced when trying to integrate new digital tools with legacy systems? How have these challenges impacted the digital transformation process?
10. Impact on Workflow
How do legacy systems affect the workflow within your department? Can you describe any specific instances where they have created bottlenecks or inefficiencies?
11. User Experience and Training
How does the use of legacy systems impact the user experience of new technologies? What training or support challenges have you faced?
12. System Failures and Reliability
Can you share any experiences where legacy systems have caused system failures or other reliability issues during digital transformation efforts?
Section 4: Strategies for Addressing Challenges
13. Current Mitigation Strategies
What strategies has your department implemented to overcome the challenges posed by legacy systems during digital transformation? How effective have these strategies been?
14. Leadership and Decision-Making
How do you perceive the role of leadership in addressing legacy system challenges? Can you provide examples of effective or ineffective leadership in this context?
15. Suggestions for Improvement
Based on your experience, what strategies or actions do you think could improve the integration of new digital technologies with legacy systems in your department?