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Digital transformation at third-party logistics providers: Challenges and best practices

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Background: Digital transformation (DT) is key for service providers in the logistics industry to achieve or retain a sustainable competitive advantage. However, for many third-party logistics (3PLs) in South Africa, implementing DT remains a challenge.

Objectives: To explore the challenges that hinder the implementation of DT and to present the best practices that are important for achieving success in DT among South African logistics service providers.

Method: This study was exploratory and descriptive. Data were collected through semi-structured interviews with a sample of 10 managers employed by South African 3PLs companies. Thematic analysis was used to analyse the data, which involved manually coding the findings, the organisation of these 'codes' into related areas to construct 'descriptive' themes and the development of 'analytical' themes.

Results: The challenges and best practices of DT implementation centre around leadership and strategic alignment, technological integration and innovation, data management and cybersecurity, and resource optimisation and cost management.

Conclusion: Substantial challenges and best practices associated with DT implementation in the logistics sector were identified.

Contribution: The significance of the study lies in examining DT through the lens of 3PLs providers in South Africa, a segment not conventionally associated with innovation. The outcomes contribute to academic research and industry practice. Firstly, the findings bridge a critical gap in the existing literature, providing insight into previously unexplored DT challenges and best practices. Secondly, this study provides valuable insights into key areas, offering practical guidance for industry practitioners.

Keywords: digital transformation; third-party logistics; challenges; best practices; South Africa.

Introduction

In recent years, the proliferation of digital technologies has drastically altered the competitive landscape of the logistics service industry, prompting incumbent service providers to embrace digital transformation (DT) (Castillo et al. 2018). Despite this, many third-party logistics (3PLs) in developing countries such as South Africa continue to struggle with advancing their digital technologies (Castillo et al. 2018; Mathauer & Hofmann 2019).

To maintain a sustainable competitive advantage and achieve growth, 3PLs in South Africa must enhance their value proposition for shippers and customers (Mathauer & Hofmann 2019). This necessitates an increase in operational efficiency through the resolution of industry-specific problems such as high fragmentation, low transparency, underutilised assets, costly manual processes and in many instances, outdated customer interfaces (Zhou et al. 2020). Additionally, 3PLs should strive to provide improved customer experience through the implementation of smarter, faster and more sustainable logistics (Liu et al. 2019; Philipp, Gerlitz & Moldabekova 2020). The utilisation of technology plays a vital role in differentiating logistics value and catalysing innovation, thus elevating efficiency and responsiveness (Yeow, Soh & Hansen 2018). As a result of logistics innovations, supply chain members can adapt to market changes, improve performance and increase agility (Noussan & Tagliapietra 2020). A significant proportion of logistics activities in South Africa are outsourced, thus placing a considerable burden on 3PLs to serve as architects for the further development of flows within Industry 4.0 and backbones for e-commerce growth (Philipp et al. 2020). In order to capitalise fully on the

opportunities presented by new technologies and to effect DT, 3PLs in South Africa must evolve their approaches, organisational cultures and operation strategies (Yeow et al. 2018).

Effective leadership and strategic alignment are crucial for driving DT initiatives within 3PLs. Leaders play a pivotal role in championing the adoption of digital technologies and ensuring alignment between technological investments and business objectives (Kane et al. 2018). By providing vision, direction and support, leaders can inspire organisational change and cultivate a culture of innovation and adaptability. Strategic alignment ensures that digital initiatives are in sync with the overall goals of the organisation, maximising the impact of technological investments (Pellathy et al. 2018). It involves aligning technology projects with business objectives, allocating resources strategically and fostering collaboration across departments to drive collective progress towards DT goals. Technological integration and innovation are essential for enhancing operational efficiency and staying competitive in the evolving logistics landscape. By leveraging innovative technologies such as artificial intelligence (AI), Internet of Things (IoT) and blockchain, 3PLs can streamline processes, optimise resource utilisation and provide value-added services to customers (Habich-Sobiegalla, Kostka & Anzinger 2018; Hamdy, Mostafa & Alawady 2020). Technological integration involves seamlessly incorporating digital solutions into existing workflows and systems, ensuring interoperability and scalability. Fostering innovation entails encouraging experimentation, risk-taking and continuous improvement in the use of technology to address evolving business challenges and customer needs.

Effective data management and cybersecurity measures are necessary to protect sensitive information and maintain the integrity of digital logistics networks. Implementing robust data governance frameworks, encryption technologies and regular security audits helps mitigate the risk of data breaches and cyber-attacks, fostering trust among customers and partners (Barreto, Amaral & Pereira 2017; Kayikci 2018). Data management involves collecting, storing and analysing data effectively to derive actionable insights and support informed decision-making. Cybersecurity measures aim to safeguard data from unauthorised access, ensuring confidentiality, integrity, and availability across digital platforms and systems. Managing resources and organisational costs efficiently is essential for the successful implementation of DT initiatives. Third-party logistics should adopt cost-effective solutions, explore financing options for technological investments and prioritise investments based on their potential for delivering tangible business value (Bhandari 2014; Choy et al. 2014). Moreover, optimising operational costs through automation and process improvement helps enhance competitiveness and profitability in the long run (Hofmann & Rüsch 2017). By aligning resource allocation with strategic objectives and continuously evaluating cost-saving opportunities, 3PLs can maximise the return on investment in DT efforts while ensuring sustainable growth and profitability.

Problem statement

In the rapidly evolving domain of logistics, DT stands as a pivotal force reshaping operations and competitive dynamics, particularly within the context of 3PLs. While existing literature extensively explores the impact of digital technologies on logistics operations at a global level, there remains a distinct gap in understanding the intricacies of DT challenges and best practices, especially within the unique landscape of South Africa (Yeow et al. 2018). This gap signifies a critical shortfall in our understanding of how South African 3PLs navigate the complexities of DT implementation, which is vital for leveraging digital technologies effectively. This study aims to bridge this knowledge gap by examining the specific challenges and best practices of DT implementation in the South African logistics sector. By focussing on this area, the research seeks to equip managers of South African 3PLs with the insights necessary to navigate digitalisation's challenges, harness its opportunities and enhance competitiveness in the digital age. The ultimate goal is to foster successful and sustainable DT within South Africa's 3PL industry, contributing to an enriched understanding of DT in emerging market contexts. This study is guided by two primary research questions aimed at unravelling the challenges and best practices of DT implementation, thereby facilitating informed decision-making and strategic action in the face of digital evolution. In light of the apparent lack of existing comprehensive studies delving into the unique dynamics, complexities and contextual factors at play in South African 3PLs concerning DT implementation, the following statement was formulated: *There is a lack of information and knowledge on the challenges and best practices of DT implementation among South African 3PLs that could adversely affect digitalisation efforts in this specific industry context.*

This study is set in the South African logistics industry, with a focus on the challenges and best practices that influence the implementation of DT. Understanding the challenges and best practices of DT is essential for managers in South African 3PLs. It empowers them to make informed decisions, mitigate risks, improve customer experiences and stay competitive in a rapidly evolving digital landscape. Ultimately, it can lead to the successful and sustainable digitisation of the 3PLs. The study will address the following two research questions: (1) *What are the challenges to DT among South African 3PLs?* and (2) *What are the best practices for the successful implementation of DT among South African 3PLs?*

Literature review

Digital transformation

The concept of DT, while increasingly prevalent in both scholarly and practical domains, remains a subject of varied interpretations and definitions, underscoring the multifaceted nature of the phenomenon (Morakanyane, Grace & O'Reilly 2017; Osmundsen, Iden & Bygstad 2018). Scholars diverge in their understanding of DT, with some viewing it through the lens of a strategy aimed at leveraging digital technologies for competitive advantage (Bharadwaj et al. 2013; Kane et al. 2017). On the one hand, it is a process that encompasses the integration of digital technology into all areas of a business, fundamentally changing how the business operates and delivers value to customers (Berman & Marshall 2014; Cichosz 2018; Hansen, Kraemmergaard & Mathiassen 2011; Hausberg et al. 2018; Morakanyane et al. 2017) and yet on the other hand, it is a business model that encapsulates the creation of new value networks and revenue streams through digital means (Henriette, Feki & Boughzala 2016).

In the vast landscape of DT, a consensus emerges among scholars regarding the pivotal role of new digital technologies in catalysing significant enhancements across various business operations. This agreement underscores a shared recognition that the integration of digital solutions can drive efficiency, innovation and competitiveness within industries, offering a tangible pathway to redefining business models and processes for the digital era (Fitzgerald et al. 2014; Kane et al. 2018). The exploration and implementation of these technologies, as illustrated in recent studies, reflect a broad spectrum of applications, from improving customer engagement to streamlining supply chain logistics, thereby emphasising the transformative potential of digital tools in reimagining traditional business practices.

Furthermore, it is critical to appreciate that the essence of DT extends beyond the mere adoption of individual technologies. It embodies a holistic transformation that leverages a synergistic blend of advanced information systems, computing power, sophisticated communication networks and extensive connectivity solutions (Bharadwaj et al. 2013). This comprehensive approach to transformation advocates for the integration of a diverse array of technologies, spanning both digital and non-digital realms, to create a cohesive ecosystem that enhances operational effectiveness and agility. Within this context, even traditional non-digital assets, such as delivery vans, forklifts and conveyor belts undergo a transformation, becoming interconnected components of a digitised operational network. By outfitting these assets with modern technological capabilities, such as Global Positioning System (GPS) tracking and IoT sensors, businesses can achieve unprecedented levels of transparency, efficiency and responsiveness in their operations (Mathauer & Hofmann 2019).

The role of human capital in harnessing and maximising the benefits of digital capabilities within DT processes cannot be overstated. Individuals within organisations play a pivotal role in leveraging these technologies, acting as the linchpin between advanced digital tools and their practical application in driving business success (Morakanyane et al. 2017). The expertise, creativity and adaptability of employees are essential in effectively integrating digital solutions into business operations, ensuring that technology serves as an enabler of innovation and value creation rather than as an end in itself. This human-centric perspective on DT highlights the importance of fostering a culture of continuous learning, collaboration and digital literacy across all levels of the organisation. Ultimately, the goal of DT is to generate substantial value for businesses, stakeholders and customers alike, a feat that can only be achieved through the harmonious interplay of technology, processes and people.

Digital technologies within logistics

The integration and strategic utilisation of digital technologies within logistics operations are rapidly becoming a cornerstone for businesses seeking to establish or maintain competitive edges in increasingly complex and volatile markets. This assertion, supported by the research of Bhandari (2014) and Choy et al. (2014), underscores the transformative impact of digital tools across the spectrum of logistics activities. From enhancing the precision of resource planning systems to revolutionising warehouse management with automation and data analytics, these technologies offer promising avenues for optimising efficiency and responsiveness. Furthermore, the deployment of intelligent transportation systems, equipped with real-time tracking and predictive analytics, enables logistics operators to significantly reduce transit times and improve delivery accuracy. These advancements collectively contribute to a more agile, transparent and efficient logistics operation, positioning businesses to better meet customer demands and navigate the challenges of global supply chains.

In parallel, the critical importance of information and data security within the digital landscape is gaining unprecedented attention. As logistics operations become increasingly digitised, the potential vulnerabilities associated with data breaches, cyber-attacks and unauthorised access have prompted a heightened focus on security measures. Researchers such as Barreto et al. (2017), Kayikci (2018) and Oleśków-Szłapka and Stachowiak (2018) emphasise the necessity of robust cybersecurity frameworks to safeguard sensitive information and maintain the integrity of digital logistics networks. The adoption of advanced encryption technologies, secure data storage solutions and comprehensive risk management strategies is essential for protecting against the evolving threats in the digital era. This focus on security not only ensures the protection of critical logistics data but also reinforces the trust of customers and partners in the digital infrastructure of logistics services.

Amid the broader landscape of DT within the logistics sector, there is a concerted effort among scholars and industry professionals to identify and leverage innovative technologies

that can accelerate the transition to digitised operations. This pursuit is reflective of a broader movement towards Industry 4.0, where the integration of enabling technologies – such as the IoT, AI and blockchain – plays a pivotal role in reshaping manufacturing and logistics. The research highlighted by Habich-Sobiegalla et al. (2018), along with Hamdy et al. (2020), points to the significant potential of these technologies to streamline logistics processes, enhance operational visibility and foster collaborative ecosystems across the supply chain. By focussing on the identification and application of such technologies, the logistics sector can not only expedite its DT journey but also unlock new levels of innovation, efficiency and service excellence. This ongoing exploration into the capabilities and applications of enabling technologies is vital for navigating the complexities of modern logistics and achieving sustainable competitive advantages in the digital age.

In the domain of DT and its application to logistics and transportation, the work of Harris, Wang and Wang (2015) plays a crucial role in highlighting the transformative power of enabling technologies. Specifically, the study illuminates how cloud computing, wireless or mobile communication technologies and the IoT serve as foundational pillars for enhancing multimodal transportation systems. These technologies facilitate the seamless integration of various modes of transport, enabling real-time data exchange, improved tracking and visibility of cargo, and more efficient routing and scheduling. By leveraging cloud computing, logistics companies can access scalable computing resources on-demand, enhancing their ability to manage large datasets and complex algorithms essential for optimising logistics operations. Similarly, mobile and wireless communications ensure constant connectivity and information flow between vehicles, logistics hubs and operators, thereby enhancing operational responsiveness and flexibility. The IoT, with its network of connected devices, offers unprecedented visibility into the location, condition and status of goods in transit, enabling a level of precision and control previously unattainable. Collectively, these technologies are recognised as critical to driving the DT of transportation and logistics, paving the way for more agile, transparent and efficient supply chains.

Further expanding on the theme of enabling technologies in the context of the fourth industrial revolution, the research conducted by Ardito et al. (2019) identifies key technologies that play a pivotal role in facilitating effective supply chain integration among firms. Among these, the industrial IoT stands out for its ability to enhance operational efficiency and collaboration across the supply chain by providing a platform for the exchange of real-time data between machinery, systems and actors. Cloud computing emerges as another essential technology, offering the flexibility and computational power necessary to process vast amounts of data, support advanced analytics and enable the development of sophisticated supply chain management solutions. Big data analytics, meanwhile, allows firms to derive actionable insights from complex datasets, improving decision-making, forecasting and risk management. Strange and Zucchella (2017) further explore the impact of these digital technologies, including robotics alongside IoT and big data analytics, on the reorganisation of activities within global value chains. They argue that the widespread adoption of these technologies not only enhances operational efficiency but also fosters innovation and competitiveness by enabling more integrated and responsive global supply chains. This body of research underscores the importance of embracing digital enabling technologies to navigate the complexities of today's global market dynamics and to capitalise on the opportunities presented by the digital era.

Challenges and best practices in the implementation of digital transformation

The journey towards DT presents both opportunities and challenges for organisations across various sectors, including 3PLs. Understanding these challenges is essential, but equally important is recognising and applying best practices that can pave the way for successful DT implementation. Drawing insights from the works of scholars such as Barreto et al. (2017), Hofmann and Rüsch (2017) and Liu et al. (2019), it becomes evident that overcoming obstacles in DT requires a holistic approach, blending strategic foresight with meticulous planning and execution. Therefore, in navigating the complex landscape of DT within the logistics sector, understanding the challenges and embracing best practices are paramount for successful implementation. This literature review delves into the multifaceted realm of challenges and corresponding best practices across four crucial themes: leadership and strategic alignment, technological integration and innovation, data management and cybersecurity, and resource and organisation cost management. By examining these themes, we can glean insights into the challenges organisations face and the best practices they can employ to navigate the DT journey effectively.

Leadership and strategic alignment

Implementing DT results in challenges for leadership and strategic alignment within organisations, such as resistance to change, a lack of visionary leadership and misalignment between IT and business objectives (Kane et al. 2018; Pellathy et al. 2018). Resistance to change can stem from fear of the unknown or a reluctance to deviate from established norms. Additionally, without clear direction from leadership, DT initiatives may lack momentum and strategic direction, leading to inefficiencies and wasted resources (Kane et al. 2018; Pellathy et al. 2018). To address these challenges, organisations should establish a clear vision and goals for DT initiatives, ensuring alignment with broader business objectives. Leadership should actively champion the adoption of digital tools and technologies, leading by example to inspire confidence and buy-in from employees (Kane et al. 2018). Fostering a culture of innovation and continuous learning is essential, where employees are encouraged to update their skills and explore new technologies. Collaboration between different departments

should be encouraged to ensure alignment between technological investments and business priorities (Pellathy et al. 2018).

Technological integration and innovation

Technological integration and innovation present challenges such as dealing with outdated systems and infrastructure, skill gaps within the organisation, and managing the complexity and scalability of digital solutions (Habich-Sobiegalla et al. 2018; Hamdy et al. 2020). Outdated systems may not be compatible with new digital solutions, requiring significant upgrades or replacements. Skill gaps can hinder the effective implementation and utilisation of emerging technologies, while managing the complexity and scalability of digital solutions can be daunting. To overcome these challenges, organisations should invest in updating or replacing outdated infrastructure to ensure compatibility with new digital solutions. Providing training and development opportunities can address skill gaps and empower employees to leverage emerging technologies effectively (Pellathy et al. 2018). Adopting agile methodologies can help manage the complexity and ensure the scalability of digital initiatives, allowing for iterative improvements and flexibility in response to evolving business needs (Yeow et al. 2018). This could also include leveraging innovative technologies such as AI, IoT and blockchain to streamline processes and optimise resource utilisation (Yeow et al. 2018).

Data management and cybersecurity

Effective data management and cybersecurity are paramount in the DT journey, in order to ensure data privacy, protect against cyber threats, and manage the increasing volume and complexity of data (Barreto et al. 2017; Kayikci 2018). Data privacy regulations and compliance requirements add complexity to data management efforts, while the evolving nature of cyber threats poses a constant challenge to cybersecurity measures. Organisations should prioritise compliance with data protection regulations and establish robust cybersecurity frameworks to safeguard sensitive information (Hofmann & Rüsch 2017; Witkowski 2017). Implementing encryption technologies, regular security audits and employee training on data protection can help mitigate the risk of data breaches. Additionally, strategic partnerships with technology providers can offer access to the latest cybersecurity innovations and solutions (Witkowski 2017).

Resource and organisation cost management

Managing resources and organisational costs effectively is crucial for successful DT, with challenges including the significant initial investments required for technology, ongoing costs such as software licensing and maintenance, and the need to prioritise investments based on business value (Bhandari 2014; Choy et al. 2014). Smaller organisations may struggle with the financial constraints associated with DT, while ongoing costs such as software licensing and cybersecurity measures can add up over time. Organisations should adopt comprehensive budgeting and financial strategies to alleviate the burden of upfront costs, such as exploring leasing options for technology and seeking government grants or subsidies for digital innovation (Choy et al. 2014). Embracing cost-effective solutions such as open-source software and strategic partnerships with technology providers can help manage ongoing costs without compromising quality or security (Barreto et al. 2017; Kayikci 2018). Prioritising investments based on their potential for delivering tangible business value and optimising operational costs through automation and process improvements can ensure sustainable growth and profitability in the long run (Barreto et al. 2017; Kayikci 2018).

Theoretical framework

The Technology-Organisation-Environment (TOE) framework and the Diffusion of Innovations (DOI) theory serve as theoretical lenses through which this study examines the challenges and best practices of DT in the South African 3PLs sector. The TOE framework provides a comprehensive framework for understanding the interplay between technological factors, organisational characteristics and environmental influences on technology adoption and implementation within organisations (Bala & Venkatesh 2020; Hsiao & Chu 2019). In this study, the TOE framework helps elucidate how factors such as leadership, organisational culture and industry dynamics shape the DT process in logistics companies. Additionally, the DOI theory offers insights into the diffusion and adoption of innovations within social systems, emphasising the role of communication channels, social networks and perceived relative advantages in driving adoption (Rogers 2003; Van de Ven 2017). Applied to this study, the DOI theory helps explain how DT initiatives spread within the logistics industry and why certain best practices are more widely adopted than others. By incorporating these theoretical perspectives, the study gains a deeper understanding of the multifaceted challenges and dynamics inherent in DT efforts within the South African logistics context.

Research methodology

The research employed a qualitative methodology, involving the collection of data through semi-structured in-depth interviews. Qualitative research involves the depiction and examination of data derived from the personal experiences expressed by participants in their own words, with the underlying assumption that these subjective portrayals hold validity (Creswell et al. 2018; Hunter, McCallum & Howes 2019; Ryan 2018).

Research design

The research utilised a qualitative exploratory and descriptive research design, which was deemed suitable because the participants were well-equipped to offer insights into the challenges faced by South African 3PLs regarding the implementation of DT (Rah 2017).

Data collection methods

Empirical data were collected through semi-structured in-depth interviews using an interview guide. Participants were presented with open-ended questions to encourage them to express freely their thoughts and emotions on the subject under investigation. Semi-structured interviews allow the researcher to probe further into participants' responses (Andrade 2020; Creswell & Creswell 2018; Mojtaba & Sherrill 2019; Rahman 2017; Saunders, Lewis & Thornhill 2016).

Target population

This research study focusses on 3PLs affiliated with the South African Association of Freight Forwarders (SAAFF). This association was established in 1921 as the national body for local 3PLs. As a non-profit organisation, it plays a pivotal role in addressing challenges faced by freight forwarders across South Africa and in neighbouring countries, with regional chapters in Gauteng, KwaZulu-Natal, the Eastern Cape and the Western Cape. The association is instrumental in involving its members in international trade activities, that is, transportation management, documentation, customs clearing and other aspects of the global supply chain. It provides support to enhance the services offered by its members to their customers. With the management of over 80% of South Africa's international trade, SAAFF represents a significant industry voice, maintaining strong relations with the government and other logistics associations. As of 2023, SAAFF comprises 449 member companies categorised into forwarding and clearing, harbour carriers and warehousing, and the association is recognised by authorities for its contributions to trade facilitation in the region.

Sampling

This study employed a non-probability purposive sampling technique to select the study participants based on their skills and experience in implementing DT initiatives. Specific criteria for identifying case firms were established. Firstly, 3PLs that have either implemented or are in the process of implementing digital initiatives were chosen. Secondly, the focus was on South African 3PLs, which comprise the largest logistics market in Africa, recognised as the top preferred location for logistics activities in Africa in terms of their value proposition. Thirdly, large 3PLs, specifically those within the top 20 were targeted. These companies are global players with significant experience in digitalisation, and they could offer comprehensive insights into the challenges they encountered during DT and how they overcame them, as well as describe the critical best practices that enabled them to reach specific stages of DT. The rationale for limiting the sample size to 10 companies lies in the qualitative nature of the research, where data saturation is a critical consideration. As the study focussed on gaining deep insights into the challenges and best practices of DT within the South African logistics context, a smaller but information-rich sample size allowed for a thorough exploration of each case, ensuring data saturation and meaningful analysis of the identified themes and patterns. This approach aligns with qualitative research principles, emphasising the depth and richness of information over the sheer quantity of participants and thereby providing a robust and insightful exploration of the research topic.

Approval was granted by the CEO of SAAFF to gather data from its member companies. Following receipt of permission, emails were dispatched to the 3PLs to arrange interviews, with only 10 companies ultimately available to partake in the interviews. Table 1 provides the list of participants included in this study.

From each of these participating 3PLs, one senior management member with at least 12 years of experience in the logistics industry was selected to partake in the study. This criterion for selection was essential to gain in-depth and informed perspectives on the DT processes within the companies. The study conducted interviews with 10 experienced managers, one from each logistics company, thereby leveraging their extensive industry experience and insights. This approach not only enriched the data collected but also ensured a comprehensive understanding of the DT landscape in the logistics sector. Table 1 documents the list of these participants, highlighting the breadth and depth of expertise represented in the research.

Data analysis

In this research, thematic analysis was employed to analyse the qualitative data. Data were captured by means of handwritten notes and audio recordings, which were later transcribed. Thematic data analysis comprised several key steps. It began with the initial coding of primary study findings. Subsequently, these codes were grouped into related clusters to form 'descriptive' themes. Finally, 'analytical' themes were developed. This translation process, creating descriptive and analytical themes, was executed meticulously to ensure clear and transparent reporting. It involved the meticulous identification of themes, achieved by means of a thorough and iterative review of the data.

TABLE 1: List of participants included in this study.

Participants	Department	Gender	Position	Logistics industry experience (years)
Participant A	Distribution	Male	Logistics manager	14
Participant B	Warehouse operations	Male	Warehouse manager	23
Participant C	Transportation	Male	Transportation manager	12
Participant D	Inventory management	Female	Supply chain manager	12
Participant E	Distribution network management	Male	Distribution manager	30
Participant F	Shipping and receiving	Female	Warehouse manager	22
Participant G	Demand planning and inventory control	Male	Supply chain manager	20
Participant H	Overall operations oversight	Male	Operations manager	31
Participant I	Transportation	Male	Logistics manager	19
Participant J	Inventory management	Male	Logistics manager	13

Data quality

To ensure research quality, the trustworthiness criteria proposed by Lincoln and Guba (1985) were followed, as set out in this section.

Credibility

To ensure the research's credibility, established research methods were employed. Semi-structured interviews were chosen for data collection because of their ability to provide detailed information, as noted by Maxwell (2013). Recording of the interviews was undertaken to ensure the reliability and authenticity of the data. Furthermore, triangulation, member checking and an audit trail were used to ensure the credibility of the data. Methodological triangulation was employed by comparing interview data with relevant documentary evidence, such as company reports and industry publications, and cross-referencing findings across interviews. This approach helped validate the data through multiple sources and perspectives, enhancing the credibility of the findings. Furthermore, after initial data analysis, summaries or interpretations of interviews were sent back to the participants for their review and confirmation. This process, known as member checking, allows participants to verify the accuracy of the information and the interpretations, ensuring that the findings accurately reflect their views and experiences.

Transferability

In this research, the researcher promoted transferability by providing comprehensive explanations of all research processes, including data collection, research objectives and study findings, ultimately facilitating the replication of the study in similar conditions elsewhere.

Dependability

The researcher established dependability by thoroughly explaining the research design and conducting an audit trail to document the data collection process, demonstrating transparency in research decisions and activities.

Confirmability

Confirmability was ensured through the implementation of an audit trail, documenting the research process meticulously.

Results and discussion of the findings

Profile of the participants

In the 10 case 3PLs that constituted the study sample, the key individuals leading the organisation's DT efforts were identified. Initial contact with these potential participants was established via email or telephone, confirming their expertise and their interest in participating in the study. Of the 10 participants, two were females. All participants had been in the organisation for over 10 years.

Digital transformation implementation challenges and best practices

This section presents a comprehensive analysis of the challenges and best practices during the implementation of DT among the 10 3PLs in South Africa. Through the use of semi-structured in-depth interviews with managers (Participant A to Participant J), this section uncovers key challenges and actionable best practices, providing direct quotations to capture the nuanced perspectives of industry experts. The first-hand experiences and insights of 10 senior managers from South African 3PLs are explored, and the multifaceted challenges encountered during the journey towards DT in logistics operations are elucidated, together with suggested best practices. As mentioned previously, thematic data analysis was employed to examine the data. This analysis yielded a thematic map, which encapsulates the outcomes of the data analysis. Figure 1 illustrates the thematic map, showing the findings derived from the data analysis process.

Objective 1: Challenges in the implementation of digital transformation

This section presents an exploration of the challenges in the implementation of DT in logistics operations, as gleaned from semi-structured in-depth interviews with the participants. The challenges were divided into four main themes: leadership and strategic alignment, technological integration and innovation, data management and cybersecurity, and resource optimisation and cost management.

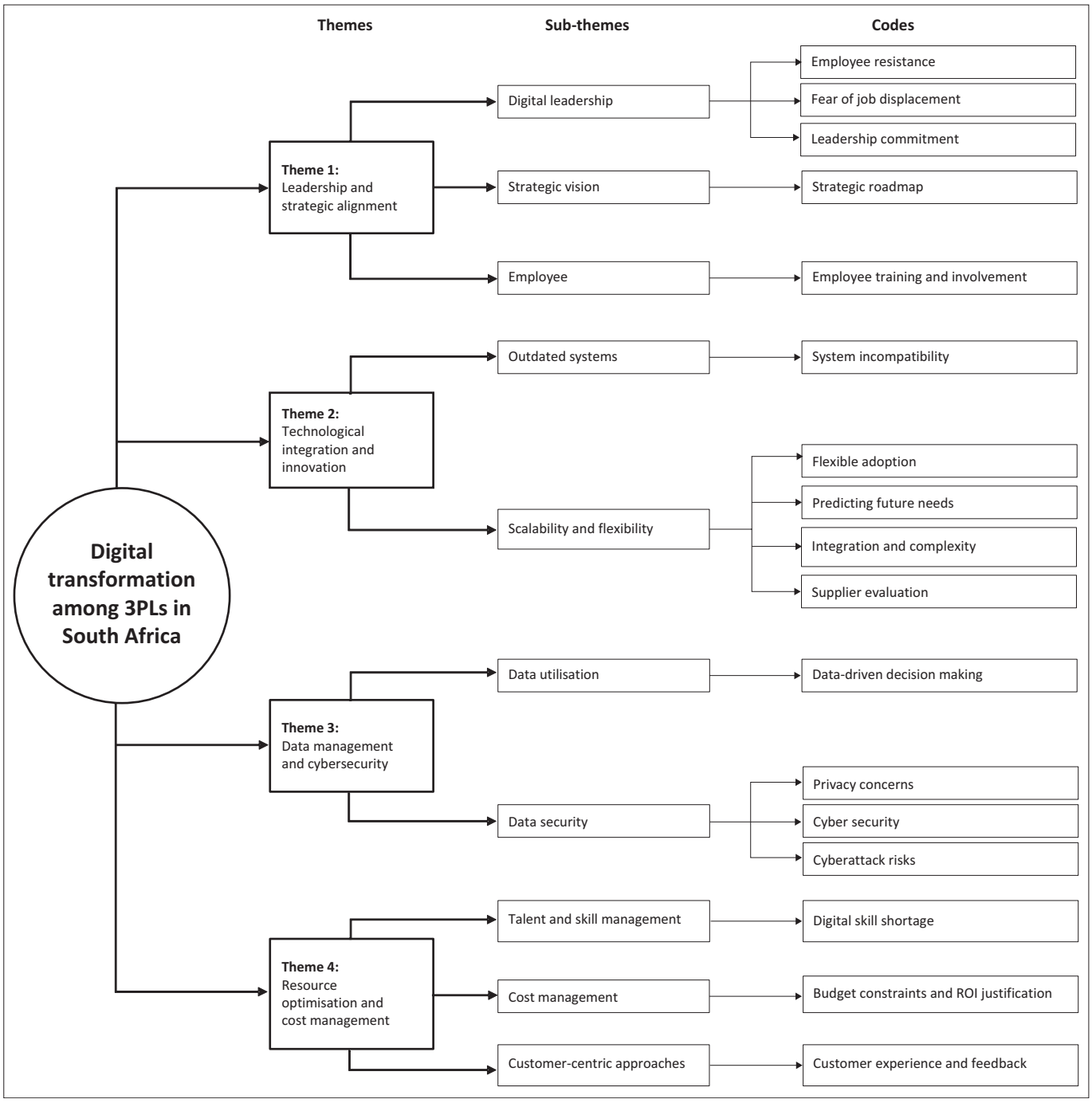
Theme 1: Leadership and strategic alignment

Digital leadership: Participants noted resistance from employees as one of the challenges facing the leadership among South African 3PLs:

> 'Changing established workflows and getting staff on board with new technologies is a monumental challenge.' (Participant B, Warehouse operations, M, Warehouse manager, 23)

> 'There's a fear of job displacement among our workforce, which hampers adoption.' (Participant D, Inventory management, F, Supply chain manager, 12)

In the realm of organisational change, the phenomenon of employee resistance has been acknowledged in the scholarly domain, as underscored by research by Toytari et al. (2017). Participant B's mention of resistance to changing established workflows aligns with the well-documented challenge of employee resistance in the face of DT (Vogelsang et al. 2019a). Furthermore, these challenges align with the Technology-Organisation-Environment (TOE) framework, which emphasises the role of organisational characteristics and leadership in technology adoption and implementation (Bala & Venkatesh 2020). The Diffusion of Innovations (DOI) theory further supports this perspective, suggesting that effective leadership and communication channels are crucial for driving the adoption of digital innovations (Rogers 2003).



3PLs, third-party logistics; ROI, return on investment.

FIGURE 1: Thematic analysis of the interviews.

Strategic vision: The strategic vision for DT among 3PLs varies, indicating a lack of uniform direction in the industry:

> 'We know we need to change, but there's no clear roadmap'. (Participant D, Inventory management, F, Supply chain manager, 12)

This mirrors the findings of Yeow et al. (2018), who emphasised that, without a clear strategic vision, companies struggle to align their DT efforts with their overall business goals. The TOE framework underscores the significance of organisational factors, such as strategic vision and goal alignment, in shaping technology adoption and implementation (Hsiao & Chu 2019).

Employee involvement: Employee resistance and the lack of training were identified as a challenge:

> 'Our staff is hesitant to embrace new technologies due to insufficient training.' (Participant B, Warehouse operations, M, Warehouse manager, 23)

This aligns with Oleśków-Szłapka and Stachowiak's (2018) observation that successful DT requires not just technological upgrades but also employee buy-in and effective training programmes. Challenges related to employee resistance and insufficient training align with the TOE framework's focus on organisational characteristics and human factors in

technology adoption (Bala & Venkatesh 2020). The DOI theory further emphasises the role of employee buy-in and effective communication channels in driving innovation adoption within organisations (Van de Ven 2017).

Theme 2: Technological integration and innovation

Outdated systems: Many participants noted the impediment posed by outdated systems:

> 'Our outdated systems are incompatible with modern digital tools, making integration a nightmare.' (Participant A, Distribution, M, Logistics manager, 14)

> 'We're held back by archaic infrastructure; it's challenging to adapt.' (Participant G, Demand planning and inventory control, M, Supply chain manager, 20)

This issue of grappling with outdated systems and their incompatibility with contemporary digital tools can be connected to the concept of the lack of digital leadership among 3PLs, as elucidated by Pellathy et al. (2018) and Vogelsang et al. (2019a). These scholars have highlighted the dearth of proactive digital leadership within the logistics industry, suggesting that it can exacerbate challenges associated with DT. Participant A's comment about outdated systems being incompatible with modern digital tools echoes the common issue of outdated system constraints in DT initiatives (Habich-Sobiegalla et al. 2018). Participant G's statement regarding challenges in adapting because of archaic infrastructure reflects the significance of infrastructure readiness as a factor in DT implementation (Bhandari 2014). Challenges related to outdated systems hindering technological integration resonate with the TOE framework's emphasis on technological factors influencing technology adoption (Bala & Venkatesh 2020).

Scalability and flexibility: The scalability of digital solutions posed difficulties:

> 'Scalability is crucial, but it's challenging to predict our future needs accurately.' (Participant I, Transportation, M, Logistics manager, 19)

Participant J highlighted integration issues, stating:

> 'Multiple digital tools need to seamlessly communicate; this is easier said than done.' (Participant J, Inventory management, M, Logistics manager, 13)

Participant I's recognition of the importance of scalability in DT implementation resonates with an emphasis in the literature on scalability as a critical aspect of digital solutions (Habich-Sobiegalla et al. 2018). The challenge of accurately predicting future scalability needs is consistent with the acknowledged complexities of scalability planning in DT initiatives, especially when dealing with evolving technologies (Bhandari 2014).

Participant J's highlighting of integration issues reflects the challenges outlined in the literature regarding the seamless integration of multiple digital tools. Integrating various technologies within a DT framework is recognised as a complex task, often requiring significant technical expertise and effort (Oleśków-Szłapka & Stachowiak 2018). The difficulty in achieving seamless communication among digital tools aligns with acknowledgement in the literature of integration challenges in the logistics sector (Barreto et al. 2017). The challenges associated with the scalability and integration of digital tools align with the TOE framework's consideration of technological factors and organisational characteristics in technology adoption (Hsiao & Chu 2019). The DOI theory also emphasises the role of perceived advantages and compatibility in driving the diffusion of innovations, highlighting the importance of addressing scalability issues to enhance adoption rates (Van de Ven 2017).

Choosing the right technology suppliers and forging partnerships was considered crucial but challenging:

> 'Identifying reliable supplies and establishing productive partnerships requires careful evaluation.' (Participant G, Demand planning and inventory control, M, Supply chain manager, 20)

> 'We must align with partners who share our vision for digital transformation.' (Participant F, Shipping and receiving, F, Warehouse manager, 22)

The participants' emphasis on careful evaluation of suppliers and alignment with partners resonates with the importance of strategic partnerships highlighted in the literature (Strange et al. 2017).

Theme 3: Data management and cybersecurity

Data utilisation: The findings revealed that the effective utilisation of data remains a challenge:

> 'We collect vast amounts of data but barely scratch the surface of using it effectively.' (Participant C, Transportation, M, Transportation manager, 12)

This reflects Witkowski's (2017) findings that many organisations fail to leverage data to its full potential, missing key insights that could drive decision-making. The challenge of effectively utilising data aligns with the TOE framework's consideration of organisational characteristics, such as data management practices, in technology adoption (Hsiao & Chu 2019). The DOI theory further emphasises the role of perceived advantages and compatibility in driving the adoption of data analytics solutions within organisations (Van de Ven 2017).

Data security: Data security and privacy concerns were prominently cited:

> 'The logistics industry handles sensitive data; ensuring its security and complying with regulations is demanding.' (Participant E, Distribution network management, M, Distribution manager, 30 and Participant C, Transportation, M, Transportation manager, 12)

The data security and privacy challenges highlighted by participants E and C align with the issue of information and

data security, a concern identified in the academic literature by scholars such as Ardito et al. (2019), Hofmann and Rüsch (2017) and Witkowski (2017). This challenge is recognised as one of the prominent obstacles encountered while executing DT initiatives within logistics.

Participants acknowledged the ever-present cybersecurity threats:

> 'As we become more digitally reliant, the risk of cyberattacks looms large.' (Participant C, Transportation, M, Transportation manager, 12)

> 'Protecting our digital assets is non-negotiable.' (Participant I, Transportation, M, Logistics manager, 19)

The concerns of Participants C and I about cybersecurity threats align with the recognition of cybersecurity risks in the digital era (Ardito et al. 2019). Concerns about data security and privacy resonate with the TOE framework's emphasis on environmental influences, such as regulatory requirements, on technology adoption (Bala & Venkatesh 2020). Additionally, the DOI theory suggests that perceived risks associated with new technologies can influence their adoption, highlighting the importance of addressing security concerns to promote adoption (Rogers 2003).

Theme 4: Resource optimisation and cost management

Talent and skill management: A lack of digital skills and talent shortages were acknowledged:

> 'Finding skilled professionals who understand logistics and digital technologies is a rare find.' (Participant C, Transportation, M, Transportation manager, 12)

> 'We need a workforce that's adept at leveraging digital tools effectively.' (Participant F, Shipping and receiving, F, Warehouse manager, 22)

This challenge is associated with competency traps, a concept previously identified in the academic literature by authors such as Hausberg et al. (2018) and Kane et al. (2018). Challenges related to talent shortages and skill gaps align with the TOE framework's consideration of human factors, such as organisational culture and workforce capabilities, in technology adoption (Hsiao & Chu 2019). The DOI theory also suggests that social networks and communication channels play a crucial role in driving the diffusion of new skills and knowledge within organisations (Van de Ven 2017).

Cost management: Cost constraints were cited by the participants:

> 'Implementing digital solutions requires substantial investments, which can strain our budgets.' (Participant A, Distribution, M, Logistics manager, 14)

> 'We need to justify costs while ensuring return on investment.' (Participant D, Inventory management, F, Supply chain manager, 12)

Several researchers in the domain of logistics, including Bhandari (2014), Choy et al. (2014), Barreto et al. (2017), Kayikci (2018), Oleśków-Szłapka and Stachowiak (2018), Habich-Sobiegalla et al. (2018), Osmundsen et al. (2018) and Hamdy et al. (2020), concur with the perspective expressed by Participant A regarding the significance of cost considerations in the implementation of DT within 3PLs. This alignment underscores the consensus within the scholarly community on the critical role that cost factors play in the context of DT initiatives among 3PLs. It highlights the need for careful attention to cost-related aspects as an integral component of successful DT endeavours in the sector. The challenge of managing costs associated with DT initiatives resonates with the TOE framework's focus on financial considerations and organisational characteristics influencing technology adoption (Bala & Venkatesh 2020). Additionally, the DOI theory suggests that perceived costs and benefits can influence the adoption of innovations, highlighting the importance of demonstrating the return on investment to justify expenditures (Rogers 2003).

Customer-centric approaches: It was found that 3PLs struggle to align DT with customer needs:

> 'Our digital initiatives don't always match what our customers want.' (Participant A, Distribution, M, Logistics manager, 14)

This is in line with the research by Pellathy et al. (2018) which suggests that customer-centric approaches are often sidelined in the rush to adopt new technologies.

In summary, the findings from this section have provided a comprehensive view of the myriad challenges faced during the implementation of DT in logistics operations. From outdated systems and employee resistance to data security and compliance complexities, these challenges are multi-dimensional. Understanding and addressing these challenges are essential steps in navigating the intricate landscape of DT within the South African logistics sector. Table 2 presents the summary of challenges in the implementation of DT gathered from the interviews and literature.

Objective 2: Best practices for digital transformation implementation

This section presents the exploration of best practices for the successful implementation of DT in logistics operations. The inclusion of best practices in this study is grounded in the objective to not only identify and understand the challenges faced by 3PL providers in South Africa during DT but also to offer actionable solutions and strategic directions that can lead to successful implementation. These best practices are identified from a combination of empirical data collected through interviews with participants, a review of existing literature, and an analysis of successful DT cases within and outside the logistics sector. By identifying these practices, the study aims to bridge the gap between theory and application, providing logistics companies with a practical roadmap to navigate the complexities of DT. The chosen best practices reflect a consensus among industry experts, align with theoretical frameworks on technology adoption and organisational change, and are tailored to the specific context and

TABLE 2: Challenges in the implementation of digital transformation.

Themes	Interviews	Literature
1. Leadership and strategic alignment	• Digital leadership • Strategic vision • Employee involvement	• Competency traps (Kane et al. 2018) • Mindset alteration (Toytari et al. 2017)
2. Technological integration and innovation	• Outdated systems • Scalability and flexibility	• Regular training and cross-functional collaboration (Vogelsang et al. 2019a)
3. Data management and cybersecurity	• Data utilisation • Data security	• Data privacy (Ardito et al. 2019) • Cybersecurity threats (Hamdy et al. 2020)
4. Resource optimisation and cost management	• Talent and skill management • Cost management • Customer-centric approaches	• Financial constraints for initial investment (Bhandari 2014; Choy et al. 2014) • Ongoing operational costs (Barreto et al. 2017; Habich-Sobiegalla et al. 2018; Hamdy et al. 2020; Kayikci 2018; Oleśków-Szłapka & Stachowiak 2018; Osmundsen et al. 2018)

Note: Please see the full reference list of the article, Mvubu, M. & Naude, M.J., 2024, 'Digital transformation at third-party logistics providers: Challenges and best practices', *Journal of Transport and Supply Chain Management* 18(0), a1023. https://doi.org/10.4102/jtscm.v18i0.1023, for more information.

challenges of the South African logistics sector. Thus, their inclusion is vital for offering a holistic view of how DT can be effectively managed and implemented, ensuring that the study delivers both theoretical insight and practical utility.

The best practices were divided into four main themes: leadership and strategic alignment, technological integration and innovation, data management and cybersecurity, and resource optimisation and cost management.

Theme 1: Leadership and strategic alignment

Digital leadership: Participants consistently emphasised the importance of the leadership commitment:

> 'Digital transformation must align with our strategic goals; top leadership buy-in is critical.' (Participant F, Shipping and receiving, F, Warehouse manager, 22)

> 'Leaders must set the tone and provide unwavering support.' (Participant B, Warehouse operations, M, Warehouse manager, 23)

The participants' emphasis on aligning DT with strategic goals and securing top leadership buy-in is consistent with recognition in the literature of the pivotal role of leadership in championing digital initiatives and fostering a culture of innovation (Pellathy et al. 2018). Reference to leaders setting the tone and providing unwavering support echoes the importance of leadership commitment in driving successful DT mentioned by Vogelsang et al. (2019a).

Leadership's role in driving and facilitating DT emerges as a pivotal factor. This research contributes to the broader discourse on digitalisation in logistics, shedding light on the intricacies and nuances of this transformative journey within the South African context. Participants C and J emphasise leadership's role, which aligns with the importance of digital leadership highlighted in the literature (Pellathy et al. 2018). Participants' mention of investing in training and setting a vision mirrors the scholarly view on the role of leaders in DT implementation (Vogelsang et al. 2019a). Furthermore, the emphasis on top leadership buy-in and setting the tone for DT aligns with the TOE framework's focus on organisational characteristics, such as leadership commitment and influencing technology adoption (Hsiao & Chu 2019). Additionally, the DOI theory suggests that leadership support and communication channels play a crucial role in driving the diffusion of innovations within organisations (Rogers 2003).

Strategic vision: Having a clear vision and a well-defined roadmap was deemed fundamental:

> 'We need a roadmap that outlines the stages of transformation and expected outcomes.' (Participant C, Transportation, M, Transportation manager, 12)

> 'A clear vision ensures everyone is moving in the same direction.' (Participant A, Distribution, M, Logistics manager, 14)

The participants' recognition of the need for a clear vision and a well-defined roadmap resonates with the literature, which emphasises the importance of having a strategic vision that guides the transformation journey (Pellathy et al. 2018). A clear vision ensures alignment across the organisation, which is a key aspect of successful DT (Hausberg et al. 2018). Having a clear vision and roadmap for DT reflects the TOE framework's consideration of organisational characteristics, such as strategic goals and planning, in technology adoption (Bala & Venkatesh 2020). Moreover, the DOI theory highlights the importance of perceived advantages and compatibility in driving the adoption of innovations, emphasising the role of strategic vision in facilitating adoption (Van de Ven 2017).

Employee engagement: Employee training and involvement were seen as pivotal:

> 'We actively involve our workforce in the transformation journey; their insights are invaluable.' (Participant F, Shipping and receiving, F, Warehouse manager, 22)

> 'Training programs equip our teams with the skills needed to harness digital tools effectively.' (Participant E, Distribution network management, M, Distribution manager, 30)

Participants' focus on engaging employees and investing in training aligns with the scholarly view that a workforce that is empowered, knowledgeable and collaborative is essential for DT success (Pellathy et al. 2018). Involving the workforce in the transformation journey and providing them with the skills needed to embrace digital tools mirror best practices identified in the literature (Vogelsang et al. 2019a). The focus on employee involvement and training aligns with the TOE framework's consideration of human factors, such as workforce capabilities and organisational culture, in technology adoption (Hsiao & Chu 2019). Additionally, the DOI theory suggests that social networks and communication channels play a crucial role in driving the diffusion of innovations, highlighting the importance of employee engagement in facilitating adoption (Rogers 2003).

Theme 2: Technological integration and innovation

Outdated systems: Addressing outdated systems was found to be crucial for DT's success:

> 'Upgrading our legacy systems was the first step towards effective digital transformation.' (Participant E, Distribution network management, M, Distribution manager, 30)

This resonates with the findings of Hamdy et al. (2020), who argued that replacing or updating outdated systems is fundamental to enabling more advanced digital capabilities. Addressing outdated systems aligns with the TOE framework's focus on technological factors influencing technology adoption (Bala & Venkatesh 2020). The DOI theory further suggests that perceived complexity and compatibility issues can impede the adoption of innovations, emphasising the need to address outdated systems to enhance adoption rates (Rogers 2003).

Scalability and flexibility: Being agile and flexible in adopting technology was considered essential:

> 'We stay flexible and adapt to emerging technologies as they fit our needs.' (Participant H, Overall operations oversight, M, Operations manager, 31)

> 'Agility helps us seize opportunities and stay ahead of the competition.' (Participant C, Transportation, M, Transportation manager, 12)

The participants' focus on agility in adopting technology aligns with the emphasis in the literature on flexibility and adaptability as key factors in DT implementation (Pellathy et al. 2018). Being able to seize opportunities and stay ahead of the competition through agile technology adoption is consistent with best practices (Vogelsang et al. 2019a). The emphasis on agility and flexibility in adopting technology resonates with the TOE framework's consideration of organisational characteristics, such as adaptability and flexibility, in technology adoption (Hsiao & Chu 2019). Moreover, the DOI theory highlights the importance of perceived advantages and compatibility in driving the adoption of innovations, suggesting that flexible adoption processes can enhance adoption rates (Van de Ven 2017).

Technological partnerships: Participants stressed the importance of collaborative partnerships:

> 'We collaborate with tech suppliers and other industry players to stay innovative.' (Participant I, Transportation, M, Logistics manager, 19)

> 'Partnerships can lead to co-creation and shared successes.' (Participant A, Distribution, M, Logistics manager, 14)

The participants' stress on collaborative partnerships reflects recognition in the literature of the importance of partnerships with tech suppliers and industry players in driving innovation and facilitating DT (Strange et al. 2017). The potential for co-creation and shared successes through partnerships aligns with best practices in collaborative DT efforts (Pellathy et al. 2018). The focus on collaborative partnerships aligns with the TOE framework's consideration of environmental influences, such as industry dynamics and collaboration networks, on technology adoption (Bala & Venkatesh 2020). Additionally, the DOI theory suggests that social networks and communication channels play a crucial role in driving the diffusion of innovations, highlighting the importance of partnerships in facilitating adoption (Rogers 2003).

Theme 3: Data management and cybersecurity

Data utilisation: Leveraging data for informed decision-making was highlighted:

> 'Data analytics is at the heart of our transformation; it guides our decisions.' (Participant I, Transportation, M, Logistics manager, 19)

> 'Real-time data empowers us to be proactive rather than reactive.' (Participant G, Demand planning and inventory control, M, Supply chain manager, 20)

Leveraging data for informed decision-making, as emphasised by participants, is in line with the recognition in the literature of data analytics as a crucial component of DT (Ardito et al. 2019). Real-time data empowering proactive decision-making aligns with the notion that data enable organisations to be agile and responsive (Pellathy et al. 2018). The emphasis on leveraging data for informed decision-making aligns with the TOE framework's consideration of organisational characteristics, such as data management practices, in technology adoption (Hsiao & Chu 2019). Moreover, the DOI theory highlights the role of perceived advantages and compatibility in driving the adoption of innovations, suggesting that effective data utilisation can enhance adoption rates (Van de Ven 2017).

Data security: Cybersecurity was a recurring theme:

> 'We invest in robust cybersecurity measures to protect our digital assets.' (Participant A, Distribution, M, Logistics manager, 14)

> 'A breach can be devastating; vigilance is non-negotiable.' (Participant H, Overall operations oversight, M, Operations manager, 31)

Participants' focus on robust cybersecurity measures aligns with the recognition in the literature of the importance of cybersecurity in the digital era, especially when handling sensitive data (Ardito et al. 2019). The acknowledgement that a breach can be devastating underscores the critical nature of cybersecurity measures in DT (Hamdy et al. 2020). The focus on robust cybersecurity measures reflects the TOE framework's consideration of environmental influences, such as regulatory requirements and security concerns, on technology adoption (Bala & Venkatesh 2020). Additionally, the DOI theory suggests that perceived risks associated with new technologies can influence their adoption, emphasising the importance of addressing security concerns to promote adoption (Rogers 2003).

Theme 4: Resource optimisation and cost management

Talent and skill management: It was stated that effective talent and skill management is key when implementing DT processes:

> 'We focused on building a team with the right digital skills.' (Participant G, Demand planning and inventory control, M, Supply chain manager, 20)

This aligns with Noussan and Tagliapietra's (2020) research, emphasising the importance of investing in talent capable of navigating and implementing DT processes. Effective talent and skill management aligns with the TOE framework's focus on human factors, such as workforce capabilities, influencing technology adoption (Hsiao & Chu 2019). Moreover, the DOI theory highlights the role of social networks and communication channels in driving the diffusion of innovations, suggesting that investing in talent can enhance adoption rates (Rogers 2003).

Cost management: The need for return on investment in DT was viewed as critical:

> 'We regularly assess our digital initiatives and recalibrate them as needed.' (Participant D, Inventory management, F, Supply chain manager, 12)

> 'ROI is important and we have to pivot when something isn't working.' (Participant B, Warehouse operations, M, Warehouse manager, 23)

The participants' emphasis on continuously assessing the viability of technology adoption to pivot is consistent with the view that flexibility and the ability to pivot when necessary are crucial for successful DT (Pellathy et al. 2018). Regular assessment and recalibration of digital initiatives mirror best practices in dynamic DT environments (Vogelsang et al. 2019a). The focus on assessing the viability of digital initiatives and recalibrating as needed reflects the TOE framework's consideration of financial factors and organisational characteristics in technology adoption (Bala & Venkatesh 2020). Additionally, the DOI theory suggests that perceived costs and benefits can influence the adoption of innovations, highlighting the importance of demonstrating the return on investment to justify expenditures (Van de Ven 2017).

Customer-centric approaches: Participants also noted the importance of a customer-centric approach:

> 'Our digital transformation aims to enhance the customer experience.' (Participant A, Distribution, M, Logistics manager, 14)

> 'Customer feedback informs our digital strategy.' (Participant E, Distribution network management, M, Distribution manager, 30)

The participants' emphasis on enhancing the customer experience and using customer feedback to inform digital strategy is consistent with the recognition in the literature of the need for a customer-centric approach in DT (Pellathy et al. 2018). Putting the customer at the centre of DT efforts is considered a best practice for achieving customer satisfaction and loyalty (Vogelsang et al. 2019a).

The emphasis on a customer-centric approach aligns with both the TOE framework and the DOI theory. From the perspective of the TOE framework, which considers organisational characteristics, environmental influences and technological factors in technology adoption, the customer-centric approach reflects the organisational aspect. Organisations recognise the importance of aligning their DT efforts with customer needs and preferences to remain competitive in the market. By prioritising customer experience and incorporating customer feedback into their digital strategy, companies are responding to environmental influences and adapting to changing market demands (Bala & Venkatesh 2020). This customer-centric orientation can enhance the organisation's ability to leverage technology effectively and drive successful DT initiatives. Moreover, from the DOI theory standpoint, the emphasis on a customer-centric approach highlights the role of communication channels, social networks and perceived relative advantages in driving the diffusion of innovations. By actively engaging with customers and incorporating their feedback into the digital strategy, organisations are leveraging communication channels and social networks to promote the adoption of digital innovations. Additionally, by focussing on enhancing the customer experience, companies are highlighting the perceived advantages of their digital initiatives, which can further stimulate adoption among customers and other stakeholders (Rogers 2003; Van de Ven 2017). This customer-centric approach not only enhances customer satisfaction and loyalty but also accelerates the diffusion of digital innovations within the organisation and the broader market.

Table 3 illustrates a summary of best practices associated with the implementation of DT among 3PLs in South Africa.

In summary, to respond to challenges in the implementation of DT, South African 3PLs have adopted various best practices. These include aligning DT with strategic goals, garnering leadership support and developing clear transformation roadmaps. Engaging the workforce through training and skill development, maintaining agility in technology adoption and fostering collaboration with vendors and peers are key strategies. Regular assessment of digital initiatives, robust cybersecurity measures and prioritising customer experiences further enhance competitiveness in the ever-evolving digital landscape.

Conclusion

In conclusion, this study has systematically identified and analysed the multifaceted challenges and best practices associated with DT implementation within South African 3PLs. These were categorised into four critical themes: leadership and strategic alignment, technological integration and innovation, data management and cybersecurity, and resource optimisation and cost management. Key challenges highlighted include the necessity for enhanced digital leadership and strategic vision, addressing the limitations of outdated systems, ensuring scalability and flexibility, improving data utilisation and security, and focussing on talent and skill management, cost management and adopting customer-centric approaches. Conversely, the identified best practices emphasise the importance of fostering digital

TABLE 3: Best practices for digital transformation implementation.

Themes	Interviews	Literature
1. Leadership and strategic alignment	• Digital leadership • Employee involvement	• Fostering a culture of innovation and continuous learning (Kane et al. 2018; Pellathy et al. 2018) • Leadership and empowerment (Pellathy et al. 2018)
2. Technological integration and innovation	• Outdated systems • Scalability and flexibility • Technological partnerships	• Regular training and Cross-functional collaboration (Vogelsang et al. 2019a)
3. Data management and cybersecurity	• Data utilisation • Data security	• Prioritising data privacy and security (Hofmann & Rüsch 2017; Witkowski 2017)
4. Resource optimisation and cost management	• Talent and skill management • Cost management • Customer-centric approaches	• Comprehensive budgeting (Bhandari 2014) • Financial strategies (Choy et al. 2014) • Cost-effective digital solutions (Barreto et al. 2017; Kayikci 2018)

Note: Please see the full reference list of the article, Mvubu, M. & Naude, M.J., 2024, 'Digital transformation at third-party logistics providers: Challenges and best practices', *Journal of Transport and Supply Chain Management* 18(0), a1023. https://doi.org/10.4102/jtscm.v18i0.1023, for more information.

leadership, strategic vision, employee engagement, technological partnerships, effective data utilisation and security measures, alongside emphasising talent and skill management, cost efficiency and customer-centricity. The findings of the challenges and best practices in DT within the South African 3PL sector closely align with the existing literature, the TOE framework and the DOI theory. The findings underscore the importance of effective leadership, strategic alignment and customer-centric approaches in navigating the complexities of DT and driving successful adoption within organisations. Furthermore, the findings underscore the complexity of DT implementation and offer valuable insights for managers in South African 3PLs to navigate the digital landscape effectively. By addressing these challenges and adopting these best practices, South African 3PLs can enhance their competitive edge and achieve sustainable DT, thereby contributing significantly to the broader discourse on digitalisation within emerging markets.

The study's originality stems from its examination of DT within the context of 3PLs, a sector traditionally not synonymous with innovation. The research sheds light on the distinct challenges and best practices that emerge within 3PLs in South Africa. This unique perspective enriches the current body of literature on DT, offering valuable insights into the intricate dynamics of the South African 3PL industry. Moreover, the findings equip 3PLs in South Africa and beyond with actionable knowledge and tools necessary to navigate and thrive in the ever-evolving digital landscape, thus contributing significantly to both academic research and practical industry applications.

Recommendations

Based on the research findings and analysis presented in this study, actionable recommendations can be proposed to guide South African 3PLs in effectively navigating DT implementation. Firstly, developing digital leadership capabilities is paramount, necessitating investment in leadership development programmes focussed on enhancing digital literacy, strategic vision, and change management skills among executives and managers. Secondly, prioritising strategic alignment and vision entails clearly articulating the organisation's DT strategy, ensuring alignment with overall business objectives, and adapting it in response to technological and industry changes. Thirdly, modernising technological infrastructure is crucial, urging investment in updating outdated systems and exploring partnerships for innovative solutions. Fourthly, enhancing data management and cybersecurity practices involves implementing robust protocols and cybersecurity measures to protect sensitive information effectively. Fifthly, optimising resource allocation and cost management requires a comprehensive analysis of resource utilisation and the adoption of cost management strategies. Additionally, focussing on talent development and customer-centricity necessitates prioritising talent development initiatives and adopting a customer-centric approach to service delivery. Lastly, continuously monitoring and evaluating progress through regular assessments and reviews is essential for identifying improvement areas and adjusting strategies accordingly. By implementing these recommendations, South African 3PLs can effectively address challenges, capitalise on best practices and drive successful DT, enhancing competitiveness in the evolving logistics landscape.

Limitations and future research

The empirical research was conducted on a sample of 10 3PLs, thereby excluding the participation of other 3PLs. Consequently, the DT challenges and best practices identified in this research may not apply to all 3PLs in South Africa. The study involved senior management, omitting the perspectives of general staff members who are directly involved in the day-to-day activities. Incorporating their viewpoints would have offered valuable insights into the challenges in the implementation of DT.

Subsequent research endeavours may explore potential distinctions in challenges and best practices associated with DT among small 3PLs in South Africa. Scholars might consider employing quantitative techniques to assess the significance of each best practice while evaluating various influencing factors such as company size and digital readiness, as well as other variables such as ownership structure or the range of services offered.

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Authors' contributions

M.M. significantly contributed to this article's inception through conceptualisation, methodology design, formal

analysis, investigative efforts, original draft composition, visualisation, project administration and data curation. M.M.'s involvement spanned various critical aspects of the research process. M.J.N. provided invaluable supervision and mentorship, overseeing the project's administrative facets, contributing to methodology refinement, validating findings and meticulously reviewing and editing the manuscript. M.J.N.'s guidance ensured the scholarly rigour and coherence of the research, enriching its quality and impact. Together, M.M. and M.J.N. synergistically propelled the study forward, manifesting a collaborative effort of expertise and dedication across its spectrum.

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Data availability

The data presented in this article were exclusively sourced from primary sources, specifically semi-structured interviews conducted for research purposes. None of the data used in this study were readily accessible in the public domain. We affirm that all information and insights presented herein stem directly from the original interviews and were treated with confidentiality and respect for participants' privacy. The data that support the findings of this study are available on request from the corresponding author, M.M.

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