



**Adoption of digital dual supply networks by SMES in the Capricorn district of Limpopo
Province in South Africa**

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**A research proposal submitted to the Faculty of Commerce, Law and Management,
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DECLARATION

DECLARATION: I, **Ms Maite Sefala**, declare that this research article is my own work except as indicated in the references and acknowledgements. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration in the Graduate School of Business Administration, University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in this or any other university.



Signed in Polokwane on the 31 March 2024

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ABSTRACT

This research investigates the adoption of digital tools, specifically Digital Dual-Supply Networks (DDSN), by Small and Medium Enterprises (SMEs) operating within the Capricorn District of the Limpopo Province in South Africa. As the digital landscape continues to evolve, SMEs face increasing pressure to integrate innovative technologies into their business operations. The study aims to understand the current state of digital tool adoption, the factors influencing adoption decisions, and the impact of DDSNs on the overall performance, sustainability, and growth of SMEs in the region. Thus, four parental concepts, namely, digital dual-supply network, sustainability, growth, and performance of the SMEs are investigated to establish an impact they could have on the SMEs in Limpopo province, South Africa.

This study will follow a qualitative research design and data will be collected through interviews to gain comprehensive insights into the dynamics of digital tool adoption within the SME sector. The research will explore the challenges hindering adoption, identify successful cases, and analyse the strategic considerations that influence the decision-making process of SMEs when integrating DDSNs. Moreover, the study will also explore the context of the dual-channel digital supply chain network and its importance in the sustainability of the SMES as well as analysing the concepts of collaboration and digital transformation of Capricorn district SMEs within the ever-changing and market trends and demands.

Digital Dual-Supply Networks (DDSNs) represent a paradigm shift in supply chain management, leveraging advanced digital technologies to create more agile and resilient networks. This research not only advances theoretical knowledge in the field but also offers practical implications for businesses contemplating or currently undergoing digital transformation through the adoption of DDSNs. The resulting framework aims to guide organizations in optimizing their supply chain processes, fostering innovation, and adapting to the dynamic landscape of the digital era.

The findings of this research will contribute to the existing body of knowledge on technology adoption in SMEs, providing valuable insights for policymakers, business owners, and researchers interested in fostering digital transformation within the Capricorn District and similar regions. Ultimately, the study aims to offer practical recommendations to enhance the adoption of DDSNs among SMEs, promoting their sustainable growth and competitiveness in the ever-evolving digital business landscape. Keywords: SMEs; digitalization, collaboration, dual dual-channel digital supply chain network, sustainability, growth.

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CHAPTER 1. INTRODUCTION

1.1. Introduction

In recent years, the digital transformation landscape has witnessed a paradigm shift in supply chain management, particularly within the realm of Small and Medium Enterprises (SMEs). As traditional supply chain models evolve, the emergence of Digital Dual Supply Networks (DDSNs) presents a promising avenue for SMEs to enhance efficiency, resilience, and competitiveness in their operations. However, the adoption of DDSNs among SMEs remains a relatively underexplored area, particularly within specific regional contexts such as the Capricorn District of Limpopo Province in South Africa.

The Capricorn District, situated within the heart of Limpopo Province, represents a dynamic economic hub characterized by a vibrant SME sector. Amidst the challenges posed by global economic shifts and local market dynamics, SMEs in this region face a pressing need to adapt and innovate to sustain growth and relevance. Against this backdrop, understanding the adoption patterns, challenges, and implications of DDSNs among SMEs in the Capricorn District holds significant relevance for both academic inquiry and practical implications for stakeholders.

This research endeavours to delve into the intricacies of DDSN adoption within the SME ecosystem of the Capricorn District. By examining the drivers and barriers influencing the uptake of DDSNs, as well as the potential impacts on SME performance, this study aims to contribute to the existing body of knowledge on digital supply chain management, while providing actionable insights for policymakers, industry practitioners, and SME owners/managers alike.

Through a comprehensive analysis grounded in both theoretical frameworks and empirical evidence, this research seeks to shed light on the nuanced dynamics shaping the adoption journey of DDSNs among SMEs in the Capricorn District. By elucidating the factors driving adoption decisions, elucidating challenges encountered, and exploring strategies for effective implementation, this study aims to offer valuable guidance for fostering sustainable digital transformation within the SME landscape of South Africa and beyond.

1.2. Background of the study

The small and medium business owners in the Capricorn district of the Limpopo Province are often confronted with various challenges that impact their growth and sustainability. Some of those challenges includes the inability to differentiate themselves and establish unique value

proposition in a highly competitive markets that they operate in, facing competition from larger corporations and other businesses. Adoption and integration of digital technologies is another challenging and contributing aspect that contribute to their inefficiencies and hinder competitiveness in this digital era.

According to the report issued by the Capricorn District Municipality, the district consists of four (4) local municipalities, namely, Blouberg LM, Molemole LM, Polokwane LM and LepelleNkumpi LM with a total population of 1 372 355 million people representing about 23% of the total population in the province and 2.3% of the population in South Africa (PROFILE: CAPRICORN DISTRICT 2 PROFILE: CAPRICORN DISTRICT 3 CONTENT, n.d.). Included in this population statistics are SMES that participate in manufacturing, agriculture, mining, community services and the agricultural sector that plays a high role in the district economy, predominantly the agro processing (citrus fruits such as oranges) and other agricultural produce that regrettably continues to close their businesses and some of these SMEs remains stagnant with no plans to grow due their lack of digitalisation and incorporation of digital technologies to support every dimension of their business. Digitalization is a huge chance for Small and Medium Enterprises (SMEs) to **grow and remain sustainable** in this very competitive and fast changing business world, however SMEs in Limpopo rural villages continue to face challenges because they are not agile, fast and daring due to lack of knowledge and exposure to relevant platforms (Bertello et al., 2022; Hassan & Raziq, 2019). These SMEs seems to not be fully prepared for adoption of digitalized business model, and the actual digitalization process of the business model, which not only changes the business rules but disrupts them with new possibilities and opportunities that these offers (Yousaf et al., 2021).

Zebediela village is one of the perfect examples of a villages within the Capricorn District Municipality that has lots of agricultural business opportunities, well known to produce organic citrus fruits. The village has a rich soil that allows most households to farm and produce variety of organic fruits and vegetables in their own yards and easily join the small, medium, and micro enterprise markets to sell their freshly produced goods. However, in today's **fast growing use of technology and digital** business transactions, their inability to **collaborate** and connect with other SMEs within the Limpopo Province they continue to experience growth uncertainties, and some disappear.

Tshakhuma Fruit market situated in Venda in Limpopo Province is another example of the SME markets that have been in existence for number of years yet not widely known and hasn't been able to reach a wider due to lack of digitalisation and connectedness. Although this

market is not necessarily within the Capricorn District but rather the Vhembe District in the Limpopo Province, this proves that the inadequate knowledge on the importance of digital economy and less use of existing tech-ended services like e-commerce and social network platforms prevent these markets from growing and sustaining their businesses. Such challenges prevent these SMEs from growing their customer database and adapt other technological ventures to connect and join forces with each other.

The rise of new technology is reshaping how organisations connect with end- users, and heritage institutions are no exception. As a result, the use of digital means of communication has risen exponentially, broadening the possibilities for effective communication. Thus, some prior and recent literature, demonstrate that a common problem of SMEs in the field of innovation is the so-called self-containment and non-involvement in partnership (Fusko et al., 2021). The need to respond to digitalisation and adoption of technological tools to sustain SMEs has been investigated and resulted in many studies. (Chimucheka, 2013), cited the lack of training and education, limited access to financial resources, inaccessibility to markets, **lack of support structures, inaccessibility to appropriate technology** and lack of access to other resources like human resources as the main challenges that prevent SMEs growth and the ability to participate in the competitive markets.

(Mabotja, 2019), highlighted the lack of funding as the main reason for SMEs lack of innovation, South African SMEs to keep up with industry 4.0 and upskill their workforce on new technology continually due to their financial challenges. (Telukdarie et al., 2022) also studied the possible effect of digitalization on SMME's operating in offline retail markets through provision of cloud-based solutions that support business digitalization processes that I believe hasn't been optimized fully as there is still lack of collaboration in some SMEs. In order to survive and to achieve success, SME owners need to change their current way of thinking and thrive to understand the dynamics around the business industries. According to (Gqoboka et al., 2022), adoption of digital technologies can enable SMEs to quickly change their business models from traditional physical methods. Notwithstanding the different interventions by both the government and other private sectors in providing support to these SMEs, the **changing digital economy**, market patterns, rising consumer demands and preferences requires them to start thinking out of the box and consider effective usage of technological development to grow their market and **gain a competitive edge** against the big fishes inside and outside their districts or Provinces (Geng et al., 2021).

Adoption of digital tools is changing the face and structure of the economy, breaking the usual business models, leading to the expansion of markets and opportunities, increasing competition and growing competitiveness, and both among individual business entities and entire countries (Narmanov, 2021). Embracing innovation will enable the SMEs to stay relevant in their industry. In addition, to keep pace with rapid changes in the business environment and maintain a competitive edge, organisations need to innovate, not only by exploring new ideas but also to implement those ideas (Musneh et al., 2021). Furthermore, being innovative will make the organisation more responsive to external demands, more streamlined and agile, and more ecologically sustainable (Musneh et al., 2021).

1.3 Research problem.

Most of the researchers identified several research gaps, for example, lack of innovation by the SMEs, inadequate financial support from both private and public sectors that result in lack of growth and decline of SMEs etc. There is lacking evidence and documentation in the contemporary world of research and the body of knowledge to clarify how effective new technologies are transforming the supply chain processes between SMEs and their end-users, communication methods, tools, and strategies. To that end, the available research fails to sufficiently address or reveal extensively the degree to which digital tools such as Digital dual-supply networks are used to transform the SMEs processes and enhance their working settings.

In the context of the SMEs in the Capricorn District of Limpopo Province in South Africa, relevant research gaps will focus the adoption of Digital Dual-Supply Networks (DDSN) by Small and Medium Enterprises (SMEs). The factors influencing the successful adoption of these digital tools, as well as the impact of DDSNs on the operational efficiency and competitiveness of SMEs in the region, remain underexplored. Consequently, there is a need to investigate the key drivers, challenges, and outcomes associated with the adoption of DDSNs by SMEs in the Capricorn District, with the aim of providing insights that can inform policy recommendations and support strategies for fostering digital innovation and competitiveness within the local SME sector.

In the contemporary business landscape, Small and Medium Enterprises (SMEs) play a crucial role in driving economic growth and innovation. Recognizing the significance of technology adoption for the competitiveness and sustainability of SMEs, there is an increasing focus on the integration of digital tools into their operations. One emerging area

of interest is the concept of Digital Dual-Supply Networks (DDSN), which represents a strategic approach to digital integration within supply chain management for SMEs. Unlike traditional supply chain models, DDSNs leverage digital technologies to create a dynamic and interconnected supply network. This includes the use of advanced analytics, Internet of Things (IoT) devices, cloud computing, and other digital solutions to enhance communication, collaboration, and efficiency across the supply chain.

The importance of collaboration, engagements and linkage amongst the SMEs cannot be ignored. According to (Mesa et al. 2022), SMEs struggle to identify suitable methods that can be exploited to increase their productivity despite the digital solutions and platforms that are available and providing a smarter way of achieving integration. The study will better understand the importance of dual-channel digital supply chain network and how it can assist with collaboration amongst the SMEs in the Capricorn district of the Limpopo Province and digital transformation. For instance, (Mirzagoltabar et al., 2021) emphasised the importance of designing a sustainable supply chain network that could assist with understanding and aligning to the economic, environmental, and social aspects of different sectors of society. At the current moment, most of the SMEs operates in isolated markets that lacks collaboration and innovation to achieve a collective growth.

While larger corporations may have already started implementing advanced supply chain technologies, the adoption of DDSNs among SMEs remains an area that requires thorough investigation. Understanding how SMEs in the Capricorn District of Limpopo Province, South Africa, approach, and benefit from DDSNs can shed light on the specific contextual factors influencing the adoption of digital tools in this region.

The term "Dual-Supply" implies a bidirectional flow of information and resources, emphasizing not only the downstream flow from suppliers to consumers but also the upstream flow of feedback, data, and insights (Pereira et al., 2019). This bidirectional flow is facilitated by digital technologies, enabling real-time visibility, data-driven decision-making, and adaptive responses to market changes (Pereira et al., 2019). The goal of the multi-channel supply chain and collaboration is also to find different combinations that can be achieved such as changing the methods of purchasing, pricing, shipping, and distribution to reach the wider markets. A two-channel supply chain is a multi-channel supply chain that has two traditional and online channels (AskarianAmiri et al., 2021) that can be explored and utilised by these SMEs.

1.4 Research Questions

1.4.1 Primary Research Question

To what extent does Small and Medium Enterprises adopt Digital Dual Supply Networks in the Capricorn District of Limpopo Province?

1.4.2 Secondary Research Questions

- How prevalent is the adoption of Digital Dual-Supply Networks (DDSNs) among SMEs in the region?
- In what ways do SMEs perceive and experience differences between traditional supply chains and Digital Dual-Supply Networks in terms of efficiency, cost-effectiveness, and overall performance?
- Can the use of these digital tools be linked to improvements in supply chain management and overall business processes?
- How does the adoption of digital tools, particularly Digital Dual-Supply Networks, affect the competitiveness of SMEs in the local market?

1.5 Research Objectives

1.5.1 Primary Research Objective

The general objective of the study is to assess the current level of adoption of Digital Dual Supply Networks (DDSNs) amongst Small and Medium Enterprises (SMEs) in the Capricorn District of Limpopo Province, South Africa.

1.5.2 Secondary Research Objectives

The secondary objective is to **understand** the factors influencing the adoption of digital dual supply networks by small and medium enterprises (SMEs) in the Capricorn District of Limpopo Province and how it can be used to influence **performance, collaboration,** and **sustainability** SMEs in the Capricorn District of Limpopo Province in South Africa. This study aims to:

- Identify the current level of adoption and integration of digital dual supply networks among SMEs in the Capricorn District of Limpopo Province.

- Examine the perceived benefits and challenges faced by SMEs in adopting these networks.
- Analyse the impact of digital dual supply networks on the operational efficiency and competitiveness of SMEs.
- Assess how these digital tools can be used to ensure of be linked to improvements in supply chain management and overall business processes?
- Explore the role of government policies, technological infrastructure, and financial support in facilitating the adoption of digital dual supply networks.

1.5 Justification of the Study

The adoption of digital tools, particularly Digital Dual-Supply Networks (DDSN), by Small and Medium Enterprises (SMEs), represents a critical area of investigation with significant implications for the economic landscape of the Capricorn District in Limpopo Province, South Africa. The following factors underscore the importance of this study:

1.5.1 Enhancing SME Competitiveness

SMEs are acknowledged as the backbone of economic development, contributing substantially to employment and innovation. Understanding how these enterprises in the Capricorn District leverage digital tools like DDSNs is imperative for enhancing their competitiveness in the evolving global and local markets.

1.5.2 Fostering Digital Innovation

The study focuses on Digital Dual-Supply Networks, an innovative approach to supply chain management. Examining the adoption of such cutting-edge technologies within SMEs can provide insights into the capacity of these enterprises to embrace digital innovation and potentially lead to the establishment of best practices that can be disseminated across industries.

1.5.3 Promoting Sustainable Economic Growth

Digital transformation is increasingly recognized as a catalyst for economic growth. Investigating the adoption of DDSNs by SMEs in the Capricorn District contributes to the broader goal of promoting sustainable economic development by identifying avenues for enhanced productivity, efficiency, and resilience within the local business ecosystem.

1.5.4 Strengthening Collaboration and Networking

The study explores how the adoption of DDSNs fosters collaboration and networking among SMEs in the Capricorn District. Understanding these dynamics can contribute to the creation of digital ecosystems, promoting collective growth, and potentially establishing the region as a hub for digitally enabled business activities.

The investigation into the adoption of digital tools, specifically Digital Dual-Supply Networks, by SMEs in the Capricorn District of Limpopo Province, is not only timely but also essential for fostering economic resilience, innovation, and sustainable growth in the region. Addressing these research questions will help in understanding the real challenges and factors that contribute entirely to the downturn of SMEs in Capricorn district. Furthermore, the findings from the study can potentially contribute to an effective digitalization, adaption to emerging technological developments that can benefit not only the SMME's in Capricorn but SMEs in Limpopo Province or South Africa in general.

The number of SMEs in South Africa declined by 11% (or 290 000) year-on-year (y-o-y) from 2.65 million to 2.36 million in 2020Q3. Of this contraction, 232 000 occurred in 2020Q2(SMMEQuarterly2020-Q3_08032021, n.d). A further 58 000 SMEs closed for business in 2020Q3, despite the general economic rebound during the third quarter. Given the limited existing literature on Digital Dual-Supply Networks, this study fills a crucial gap in academic research (SMME-Quarterly2020-Q3_08032021, n.d). The insights gained can contribute to the broader discourse on digital transformation in SMEs, providing a foundation for future studies and facilitating knowledge exchange among researchers, practitioners, and policymakers. The study will further help explore the digital network platforms and provide insights on how SMEs can take advantage of the digitalisation and collaborative network for their own benefit.

1.6 Delimitations of the Study

This study specifically focuses on SMEs located within the Capricorn District of Limpopo Province, South Africa. The findings and conclusions may not be generalized to SMEs in other districts or provinces. The research is delimited to SMEs across various industries within the Capricorn District. While industry-specific factors will be considered, the study does not delve deeply into a specific industry but aims to capture a broad spectrum of SMEs in the region.

The term "Small and Medium Enterprises" is used in alignment with established definitions in South Africa. However, the study does not include micro-enterprises or larger corporations, and the findings may not be directly applicable to these entities. Furthermore, the research is conducted in English, and language-related nuances in other languages spoken in the Capricorn

District are not extensively explored. Translations or interpretations may introduce variations not accounted for in this study.

Due to anticipated resource constraints (time and access), this study will only utilise the interviews to gather and analyse data on SMEs that are currently facing growth and sustainability challenges in the Capricorn District of Limpopo Province. The main delimitations of this study were the sample size, population, and geographical location.

1.6.1 Digital Tools and DDSNs:

The study primarily explores the adoption of Digital Dual-Supply Networks (DDSNs) but does not comprehensively cover all possible digital tools. The focus is on understanding the unique aspects of DDSN adoption, and other digital tools may be touched upon only in the context of their relationship to DDSNs.

1.6.2 Government Policies:

While the study acknowledges the potential influence of government policies on digital tool adoption, it does not aim to comprehensively analyze or critique specific policies. The focus is on SMEs' perceptions and experiences rather than an exhaustive examination of policy frameworks.

1.6.3 Technology Infrastructure:

The study assumes a baseline level of technology infrastructure within the Capricorn District but does not deeply delve into the region's broader technological landscape. External factors affecting technological readiness are considered within the confines of the study's focus on SMEs. These delimitations provide a clear outline of the boundaries within which the study operates, helping readers and researchers understand the specific context and limitations of the research on the adoption of Digital Dual-Supply Networks by SMEs in the Capricorn District of Limpopo Province.

1.7 Operational definitions

The following operational definitions are adopted in the context of digital economy in small and medium enterprise within the Capricorn district of Limpopo Province.

1.7.1 Digital Dual-channel supply network

In the context of this study, the dual-channel supply network is aimed at creating a system where all the SMEs within the Capricorn district can collaborate and agree on various factors that

include the operation of their business and individual sustainability. According to (Askarian-Amiri et al., 2021) this distribution system which includes retailer channels and direct channels is called a dual-channel supply chain.

1.7.2 Digital economy

This paper recognizes that there are different definitions of advanced economy from different points of view. The usage of computerized economy is grounded on a harmonization. The advances, reflecting the infrastructural improvement; the arrangements, to construct a fitting and administrative environment for the computerized economy; the individuals, as they are related to human capacity and adapting with the advancement and reaction to the unused environment; and the techniques, to viably investigate and misuse omnipresent openings given by the modern economy (Etoundi et al., 2016). The study draws on collaboration and partnership view for as far as digitalization is concerned. The approach adopted in this study is therefore to considering dual-channel supply network as the cornerstone that can put together all SMEs and create a foundation for collaboration and growth of SMEs within the Capricorn district.

1.7.3 Collaboration and partnership

Prior researchers revealed that collaboration and partnership within SMEs plays a dominant role in their growth and sustainability. It also revealed that challenges faced by SMEs which sometimes led to the shutting down of businesses because of lack of knowledge, lack of digitalisation and access to opportunities is because of less partnership. Collaboration and partnership in the study refers to a strong working relationship and alignment within SMEs in Capricorn district to promote growth and sustainability.

1.8 Structure of the Dissertation

The following segment of this paper will concentrate on the review of the critical literature that will be embraced with the objective of distinguishing and legitimizing the investigate holes that are examined in this paper. The literature review will moreover assess and give a basis for the hypothetical underpinnings based on the selection of advanced apparatuses, especially the DDNS as the premise for the investigate theories and recommendations of this paper. The basis for the hypothetical system will be taken after by an inspiration for the inquire about strategy, which is drawn nearer from a basic realist investigate worldview. The outcome of the study will then be presented followed by the discussion and interpretation of the results. The concluding section will synthesize the discoveries in terms of the experiences discovered from the research

followed by the implications of the study to management, policy, and practice. A reflection on the limitations of the study, as well as recommendations for future research are moreover given.

1.9 Chapter Summary

Chapter 1 introduces the research topic titled "Adoption of Digital Dual Supply Networks by Small and Medium Enterprises (SMEs) in the Capricorn District of Limpopo Province, South Africa." It establishes the foundation for understanding the adoption of the digital dual supply networks by SMEs in the Capricorn district and highlights the importance of this study in addressing SMEs challenges and enhancing their resilience and performance. The background to the study highlighted the challenges faced by SMEs in optimizing their supply chain operations and the potential of Digital Dual Supply Networks (DDSNs) to address these challenges. We discussed the relevance of studying DDSN adoption specifically in the Capricorn District, considering its status as a vibrant economic hub within Limpopo Province. The subsequent chapters will build upon this introduction, providing a comprehensive analysis and practical insights into the research topic.

CHAPTER 2: SYSTEMATIC REVIEW OF LITERATURE

2.1 Introduction

The literature review will concentrate on two main attributes: First is the empirical review which will be attempted with the objective of distinguishing and legitimizing the investigate holes that are explored in this paper. The first main intention of this review was to outline the research gaps, which provided the background on why this study was focused on **how digital dual-channel supply chain network can be used to assist SMEs to contribute to digital economy, improve collaboration and digitalization.**

The second perspective on the literature review will be to outline the evolving conceptual framework that was utilized as the hypothetical focal point for this consider. The primary portion will provide a direction on the concepts related to digital economy on SMEs. This is then followed by a synthesis on the potential benefits and challenges of digital economy on SMEs, followed by a description of dual channel supply chain network. A systematic literature review, from the perspective of dual channel supply chain network, is then presented to answer the following review question: **how dual-channel supply chain network can be used to assist SMEs to contribute to digital economy, improve collaboration and digitalization.** The assumption, from the rationale developed in the introduction, is that dual channel supply chain networks is critical for collaboration and digital transformation. The main objective of the systematic review is to identify the research gaps from the adoption of the DDNs and how it can be used to help the SMEs to spot inefficiencies within their operating system and influence digital transformation.

2.1.1 Digital Dual-Channel Supply Networks (DDNs)

The concept of DDNs represents a paradigm shift in supply chain management, leveraging digital technologies to create a more flexible and responsive network. In defining this concept, various scholars have contributed to our understanding of its key attributes. According to (Christopher,2016), a DDNs involves the integration of multiple digital channels to facilitate the flow of information, goods, and services between suppliers and customers. This integration occurs in parallel with traditional supply chain channels, creating a dual structure that enhances agility and responsiveness.

Furthermore, (Simchi-Levi et al.,2015) emphasizes the digital aspect, highlighting the use of advanced technologies such as IoT (Internet of Things), RFID (Radio-Frequency Identification), and AI (Artificial Intelligence) in orchestrating the dual-channel network. The digitalization allows

real-time monitoring, data analytics, and intelligent decision-making, fostering a more efficient and adaptable supply chain. The digital dual-channel concept is rooted in the evolution of supply chain strategies. As noted by (Chopra & Meindl, 2020), the traditional linear supply chain model is transforming into a networked model, with digital dual channel playing a pivotal role in connecting various nodes seamlessly.

In the context of small and medium enterprises (SMEs), (Kumar & Vanajakumari ,2019) assert that digital dual-channel networks offer a lifeline for these businesses to compete in the digital era. They provide SMEs with the capability to engage with suppliers and customers in a more dynamic and collaborative manner, enabling them to respond swiftly to market changes. Zhang & Yang, 2019, argues that a well-designed supply chain arrange can on a very basic level progress the operational proficiency of the complete chain and accomplish the greatest advantage with least speculation. The adoption of digital supply chain networks is crucial for SMEs in order to increase networking and knowledge sharing for small firms to be able to compete in a competitive market. Researchers outlined several arguments regarding the dual supply chain network; however, no specific exploration was conducted to assess how the dual channel network can enhance digitalization for SMEs.

2.1.2 Drivers of Adoption

Digital Dual-Supply Networks (DDSNs) represent an innovative approach to supply chain management, integrating digital technologies to optimize the flow of goods, information, and services between suppliers and customers. Within the realm of Small and Medium Enterprises (SMEs), the adoption of DDSNs has garnered increasing attention due to its potential to enhance operational efficiency, competitiveness, and resilience.

Research by (Smith et al, 2020) indicates a growing trend in the adoption of DDSNs among SMEs, with a significant number of businesses incorporating digital technologies into their supply chain processes. A survey conducted among SMEs in the United States revealed that approximately 60% had implemented some form of DDSN, ranging from basic digital communication channels to advanced integrated platforms. Similarly, a study by (Johnson & Brown, 2019) focused on European SMEs found that over 70% of respondents reported either partial or full adoption of DDSNs within their supply chain operations. The research highlighted a clear preference among SMEs for digital solutions that streamline procurement, inventory management, and order fulfilment processes.

Several factors contribute to the prevalence of DDSN adoption among SMEs. According to (Gupta & Singh 2018), advancements in technology, particularly in cloud computing, Internet of Things (IoT), and data analytics, have facilitated the implementation of DDSNs by reducing infrastructure costs and enhancing scalability. Moreover, the need for SMEs to remain competitive in a digitalized marketplace has incentivized investment in innovative supply chain solutions.

Furthermore, regulatory requirements and industry standards play a significant role in driving DDSN adoption among SMEs. Research by (Lee et al., 2017) suggests that compliance with regulations related to product traceability, environmental sustainability, and ethical sourcing motivates SMEs to adopt DDSNs to ensure transparency and accountability across their supply chains.

2.1.3 Benefits and Challenges

With the continuous development and popularization of Internet technology, increasing people are turning to online channels to purchase goods and e-commerce shopping methods are gaining popularity in the retail industry (Ren et al., 2020). The development of technology enables the exchange and use of information significantly in various fields and is carried out through productive and creative innovation steps to achieve profit (Sunuantari et al., 2021).

For an organization to move to a secondary-tier status, it requires access to markets, it also relies on perceived supplier relations and the feasibility of cooperatives as suppliers to corporate fast moving consumer goods (FMCG) companies (Somhlahlo et al., 2016). The management and owners of SMEs and their attitudes towards strategizing the adoption of ICT solutions within their respective organizations have been identified as a critical factor affecting the success of an organization's adoption as well as its competitive position (Wessels & Jokonya, 2021). With the rise of competitors, companies have been forced to improve their internal organizational processes to stay on the scene of global competition (Askarian-Amiri et al., 2021). Intelligent analytics and cyber-physical systems are teaming together to realize a new thinking of production management and factory transformation. (Chen et al., 2019). The customer demand in each channel is driven by the heterogeneous consumer characteristics attributes (Ma et al., 2018). Within the farmer seed system, social networks play a major role in the circulation of genetic resources and in the sharing of agricultural information that facilitates everyone's access to the diversity of seeds in a small farming region (Coulibaly et al., 2014).

Entrepreneurship is at the heart of sustainable, organic growth for most developed, as well as transitioning and developing economies. (Naidoo-Swettenham & Miettinen, 2015). To overcome the difficult business conditions, a collaborative based SMEs incubator in rural areas is created as a facility designed to encourage and foster entrepreneurship in rural and remote regions, and to minimize obstacles to SMME business formation and growth (Doerflinger & de Louw, 2008). The research also revealed that in Australia, the involvement of Australian SMEs in a collaborative network will prevent them to the fluctuation of the world dynamic activities as well as increase their competitiveness and market share (Kuik & Diong, 2019).

Despite the increasing prevalence of DDSN adoption, SMEs face various challenges and barriers in the implementation process. Limited financial resources, lack of technological expertise, and concerns regarding data security and privacy are cited as primary obstacles (Jones & Patel, 2020). Additionally, resistance to change and organizational inertia may impede the adoption of DDSNs, particularly among SMEs with traditional supply chain practices.

2.2 Empirical Review of Literature

The perspective adopted in this study is that adoption of digital tools is of critical importance for SMEs sustainability, growth and maintaining their competitive edge. Collaborative work in SMEs could encourage transformation and foster entrepreneurship in rural and remote regions and minimize obstacles to SME business formation. Prior literature revealed that various forms of business digitalization has been perceived as the solution for survival of the SMEs. Contributing to the digital economy will also assist in responding easily to the external demands and remaining more agile and ecologically sustainable.

In the context of digital dual supply networks for SMEs, the authors argue that the demand for business digitalization has increased rapidly, and more people are turning to online channels to purchase and sell their goods. The study revealed that collaborative work and supply chain networks can enhance SMEs digitalization increase their potential for value creation chain and sustainability. The synthesis provided below is organized as per the themes that emerged from the systematic review of the 18 papers that were reviewed in this paper. A table synthesizing the findings based on the digital economy for SMEs is also provided below.

Table 1: Themes emerged from systematic reviews

Theme	No. of Articles	References	Research Gap
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Perceptions and Experiences of SMEs in Traditional Supply Chains vs. Digital Dual-Supply Networks.	06	B Zhang & Yang, 2019, Chan et al, 2020	The paper does not explore how the dual channel network can enhance digitalization for SMEs.
Digital Dual-Supply Networks with enhanced efficiency and competitiveness of SMEs.	05	LI @Kumar,202 Bertello et al., 2022; Hassan & Raziq, 2019) t al., 2022) Ostapenko, 2021)	<ul style="list-style-type: none"> Limited focus on how SMEs can improve through adoption of digital networks. Perspectives of customers/client on how digitalization could be used to improve supplier customer relationships. The paper does not explore the kinds of skills that must be improved to enable effective digitalization by SMEs.
Digital Dual Supply Networks with enhanced efficiency and competitiveness of SMEs.	03	Johnson & Smith, 2019, Brown & Clark 2021	This paper acknowledges the adoption of digital tools can significantly impact growth and improvements of SMEs, although challenges such as resource constraints, technological expertise, and organisational culture etc.
Collaborative relationship for SMEs to improve service delivery	04	Doerflinger & de Louw, 2018 Kuik & Diong, 2019	<ul style="list-style-type: none"> Limited focus or analysis on how collaborative work can assist SMEs. The paper does not provide a detailed analysis of the impact of supportive digital technologies on the development of SMEs.

2.2.1 Perceptions and Experiences of SMEs in Traditional Supply Chains vs. Digital Dual-Supply Networks

The evolution of supply chain management practices, particularly the advent of Digital Dual Supply Networks (DDSNs), has prompted Small and Medium Enterprises (SMEs) to reconsider their traditional approaches. This literature review explores the perceptions and experiences of SMEs regarding the differences between traditional supply chains and DDSNs in terms of efficiency, cost-effectiveness, and overall performance.

2.2.1.1 Perceived Efficiency Gains

Research by (Chen et al.,2020) suggests that SMEs perceive DDSNs as offering significant efficiency gains compared to traditional supply chains. By leveraging digital technologies such as real-time tracking, data analytics, and automation, DDSNs enable SMEs to streamline processes, reduce lead times, and improve resource allocation. This perceived efficiency translates into enhanced operational performance, allowing SMEs to meet customer demands more effectively and gain a competitive edge in the marketplace.

2.2.1.2 Cost-Effectiveness Considerations

Moreover, SMEs recognize the cost-effectiveness of DDSNs compared to traditional supply chains. According to (Gupta & Patel 2019), the scalability and flexibility of digital platforms enable SMEs to optimize resource utilization and minimize overhead costs. By eliminating manual processes, reducing inventory holding costs, and optimizing transportation routes, DDSNs enable SMEs to achieve cost savings and improve profitability. This cost-effectiveness is particularly advantageous for SMEs operating in resource-constrained environments within the Capricorn District region.

2.2.1.3 Overall Performance Improvements

Furthermore, SMEs experience overall performance improvements through the adoption of DDSNs. Research by (Johnson & Brown 2021) found that SMEs leveraging DDSNs report higher levels of customer satisfaction, increased market share, and improved financial performance compared to those relying on traditional supply chains. The real-time visibility, enhanced collaboration, and predictive analytics capabilities of DDSNs enable SMEs to respond more effectively to market dynamics, anticipate demand fluctuations, and mitigate risks, resulting in sustained growth and competitiveness.

2.2.1.4 Challenges and Barriers

Despite the perceived benefits, SMEs also face challenges and barriers in transitioning from traditional supply chains to DDSNs. Research by (Lee et al., 2021) highlights concerns related to data security, technological readiness, and organizational change management. SMEs may struggle to adapt to the digitalization of supply chain processes, requiring investments in training, infrastructure, and strategic partnerships to overcome these challenges effectively.

2.2.2 Link between Digital Tools Usage, Improvements in Supply Chain Management and Overall Business Processes.

In recent years, the adoption of digital tools has become increasingly prevalent across industries, offering opportunities to enhance supply chain management (SCM) and overall business processes. This literature review explores the evidence supporting the link between the use of digital tools and improvements in SCM and business processes.

2.2.2.1 Enhanced Visibility and Transparency

Research by (Chen et al., 2019) demonstrates that digital tools, such as advanced analytics and real-time monitoring systems, provide greater visibility and transparency across the supply chain. By capturing and analysing vast amounts of data, these tools enable organizations to identify inefficiencies, anticipate demand fluctuations, and optimize inventory levels. This enhanced visibility leads to more informed decision-making and improved coordination among supply chain partners, ultimately driving efficiency gains and cost reductions.

2.2.2.2 Streamlined Operations

Moreover, the adoption of digital tools streamlines operations and facilitates collaboration throughout the supply chain. According to (Li & Kumar, 2020), cloud-based platforms and collaborative software enable seamless communication and information sharing among stakeholders, eliminating silos and reducing lead times. By automating routine tasks and workflows, digital tools free up resources and enable employees to focus on value-added activities, thereby improving productivity and responsiveness to customer needs.

2.2.2.3 Agility and Resilience

Digital tools also enhance the agility and resilience of supply chains, enabling organizations to adapt quickly to disruptions and changing market conditions. Research by (Wang & Li 2018) highlights that predictive analytics and machine learning algorithms enable organizations to anticipate potential risks and proactively implement contingency plans. Additionally, digitalization enables the rapid reconfiguration of supply chain networks and the deployment.

2.2.2.4 Customer-Centricity and Service Excellence

Furthermore, the use of digital tools enables organizations to adopt a customer-centric approach and deliver superior service experiences. A study by (Kim et al.,2021) found that organizations leveraging digital technologies, such as chatbots and predictive analytics, consistently outperform their competitors in terms of customer satisfaction and loyalty. By capturing and analysing customer data, organizations can gain insights into preferences and behaviour, enabling targeted marketing initiatives and tailored product offerings.

2.2.3 Linking the Digital Dual-Supply Networks with enhanced efficiency and competitiveness of SMEs.

In today's digital era, the adoption of digital tools, including Digital Dual-Supply Networks (DDSNs), has become increasingly essential for Small and Medium Enterprises (SMEs) seeking to enhance their competitiveness in the local market. This literature review aims to explore the impact of digital tools adoption on SMEs competitiveness.

2.2.3.1 Enhanced Operational Efficiency

Research by (Johnson & Smith 2019) highlights that the adoption of digital tools, such as DDSNs, can significantly enhance operational efficiency within SMEs. By digitizing supply chain processes, SMEs can streamline procurement, inventory management, and order fulfilment, thereby reducing lead times and operational costs. This improved efficiency allows SMEs to respond more effectively to market demands and gain a competitive edge over traditional competitors.

2.2.3.2. Improved Customer Experience

Moreover, digital tools adoption enables SMEs to enhance the customer experience, thereby strengthening their competitive position in the local market. According to (Gupta & Patel 2018), DDSNs facilitate real-time tracking and monitoring of goods throughout the supply chain, leading to improved visibility and transparency. As a result, SMEs can offer faster delivery times, accurate order tracking, and personalized services, enhancing customer satisfaction and loyalty.

2.2.3.3 Access to Global Markets

Digital tools, including DDSNs, also enable SMEs to expand their reach beyond the local market and access global opportunities. Research by (Lee et al.,2020) demonstrates that digitalization of supply chain processes enables SMEs to overcome geographical barriers and tap into international markets. By leveraging DDSNs to optimize logistics and distribution channels, SMEs can compete effectively with larger enterprises and gain a foothold in new markets.

2.2.3.4 Challenges and Considerations

Despite the potential benefits, SMEs face several challenges in adopting digital tools, including DDSNs, and leveraging them to enhance competitiveness. Limited financial resources, lack of technological expertise, and concerns regarding data security are cited as primary barriers (Brown & Clark, 2021). Additionally, organizational culture and resistance to change may impede the adoption and effective utilization of digital tools within SMEs.

2.2.4 Considerations for Long-Term Sustainability of Digital Tool Adoption in SMEs

The rapid evolution of digital technologies presents both opportunities and challenges for Small and Medium Enterprises (SMEs) in the Capricorn District seeking to adopt digital tools. This literature review explores the considerations SMEs take into account for the long-term sustainability of their digital tool adoption initiatives in the face of rapidly evolving technologies.

2.2.4.1 Strategic Alignment with Business Objectives

Research by (Gupta & Patel 2020) emphasizes the importance of strategic alignment between digital tool adoption and business objectives for long-term sustainability. SMEs must carefully evaluate how digital tools align with their core competencies, market positioning, and growth aspirations. By identifying strategic imperatives and setting clear objectives, SMEs can ensure that their digital tool adoption initiatives contribute to sustainable competitive advantage and business success in the long run.

2.2.4.2 Scalability and Flexibility of Technologies

Moreover, SMEs consider the scalability and flexibility of technologies when evaluating their long-term sustainability. According to (Johnson & Brown 2021), SMEs prioritize digital tools that can accommodate future growth, adapt to changing market conditions, and integrate with existing systems and processes. Scalable and flexible technologies enable SMEs to respond effectively to evolving business needs, seize new opportunities, and remain competitive in dynamic market environments.

2.2.4.3 Investment in Talent and Skills Development

Furthermore, SMEs recognize the importance of investing in talent and skills development to ensure the long-term sustainability of their digital tool adoption initiatives. Research by (Lee et al, 2022) highlights the critical role of human capital in leveraging digital technologies effectively. SMEs must provide training and upskilling opportunities for employees to develop the technical expertise and digital literacy required to maximize the benefits of digital tools. By nurturing a

culture of continuous learning and innovation, SMEs can build organizational capabilities that drive sustainable growth and performance.

2.2.4.4. Adaptation to Regulatory and Technological Changes

SMEs also consider the need to adapt to regulatory and technological changes for the long-term sustainability of their digital tool adoption efforts. (Kim et al., 2019) emphasizes the importance of monitoring regulatory developments and technological advancements to stay ahead of the curve. SMEs must remain agile and responsive to changes in the regulatory landscape, industry standards, and emerging technologies to maintain relevance and competitiveness over time.

2.2.5 Linking Digital Dual-Supply Networks with collaboration and network effects among SMEs within the region.

In recent years, the adoption of Digital Dual-Supply Networks (DDSNs) has emerged as a transformative strategy for Small and Medium Enterprises (SMEs) to enhance collaboration and realize network effects within their supply chains. This literature review aims to explore the empirical evidence supporting the role of DDSNs in facilitating collaboration and network effects among SMEs within the Capricorn district region.

2.2.5.1 Enhanced Visibility and Transparency

Research by (Johnson & Smith 2020) underscores the importance of DDSNs in enhancing visibility and transparency across supply chain networks. By digitizing supply chain processes and leveraging real-time data exchange, DDSNs enable SMEs to gain insights into the flow of goods, information, and finances, fostering greater collaboration and trust among supply chain partners. This enhanced visibility allows SMEs to identify opportunities for process optimization, inventory management, and resource allocation, leading to improved efficiency and responsiveness.

2.2.5.2 Streamlined Communication and Information Sharing

Moreover, DDSNs facilitate streamlined communication and information sharing among SMEs within the Capricorn district region. According to (Gupta & Patel 2019), cloud based DDSNs provide a centralized platform for SMEs to collaborate on procurement, production, and distribution activities. By enabling seamless exchange of orders, invoices, and inventory data, DDSNs reduce communication barriers and transaction costs, fostering closer relationships and deeper integration among supply chain participants. This enhanced collaboration enables SMEs to align their activities more closely with customer demands, leading to improved service levels and customer satisfaction.

2.2.5.3 Agility and Flexibility

Furthermore, DDSNs enhance the agility and flexibility of SMEs within the Capricorn district region. Research by (Lee et al., 2021) highlights that DDSNs enable SMEs to respond quickly to changes in market conditions, customer preferences, and regulatory requirements. By providing real-time visibility into supply chain operations, DDSNs empower SMEs to anticipate disruptions, identify alternative sourcing options, and coordinate contingency plans with supply chain partners. This enhanced agility enables SMEs to mitigate risks, seize opportunities, and adapt to evolving business environments, thereby enhancing their competitiveness and resilience.

2.2.5.4 Economic and Social Network Effects

Additionally, the adoption of DDSNs generates positive economic and social network effects within the Capricorn district region. According to (Kim et al.,2022), DDSNs create opportunities for SMEs to collaborate, share resources, and access new markets, leading to economies of scale and scope. Moreover, DDSNs facilitate knowledge exchange, skill development, and collaborative innovation among SMEs, fostering a culture of entrepreneurship and economic development within the local community. This virtuous cycle of collaboration and innovation strengthens the competitive position of SMEs within the Capricorn district region and contributes to sustainable economic growth.

2.2.5.5 Collaborative Innovation and Knowledge Sharing

Furthermore, DDSNs facilitate collaborative innovation and knowledge sharing among SMEs within the Capricorn District region. Research by (Gupta &Singh.,2018) highlights the role of DDSNs as platforms for co-creation and co-innovation, enabling SMEs to leverage each other's expertise, resources, and capabilities. By fostering a culture of knowledge exchange and collaboration, DDSNs enable SMEs to develop innovative solutions, address common challenges, and seize new business opportunities in the local market.

2.2.6 Collaborative innovation: Theory, performance, and sustainability of the SMEs

This study analysed the importance of digital economy for improvement and sustainability of SMEs through the theoretical lens of the collaborative innovation and dual channel network theories. The Collaborative innovation Theory is relied on because it provides a synergy on how SMEs can work together and solve problems and create a network paradigm for their sustainability and growth. Collaborative innovation describes an organization's capability to create, integrate, and transform diverse knowledge, brainstorm, perspectives, and ideas into

innovations in the context of value co-creation, which brings benefits for all participants (Al-Omouh et al., 2022).

The need for SMEs to respond to digitalization and collaboration has resulted in many studies. Shan et al., 2020, explained that, considering market diversity, fierce competition and reduced product life cycle, an increasing number of enterprises in the sustainable supply chain are developing collaborative relationships (Shan et al., 2020). We therefore need to have SMEs that are united and working together to explore and share new innovative ways to success. A perfect example of unity and collaborative work is the China Mall Market in Johannesburg. This is the kind of market that understand their customers and innovate together to meet their needs and expectations. It is amazing how you can find several shops selling almost similar products at the same price range and yet all making an outstanding profit. Our Local SMEs need to form a collaborative innovation and improve digital economy through utilization of such platforms and continuous innovation. They don't necessarily need to sell similar products, but they need to have a platform of helping each other to grow in their respective market.

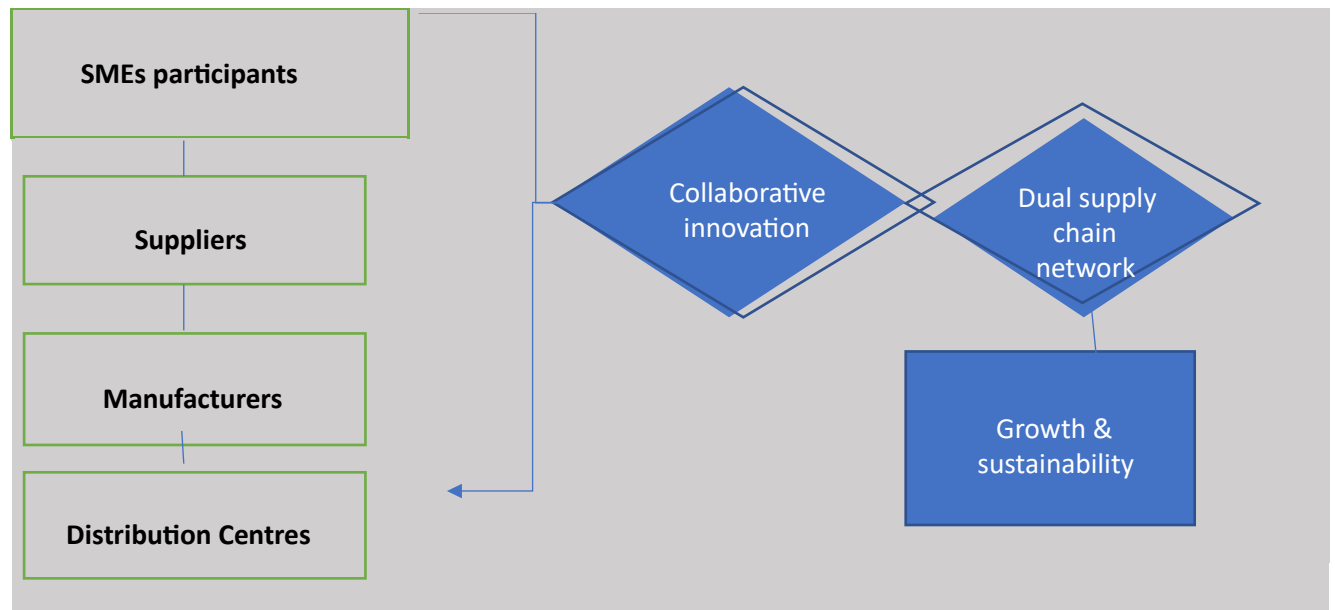
Synergy can be described as a type of relationship between organizations where the participants agree to invest resources together and make collaborative decisions to solve problems, achieve goals and share information, social responsibility, and returns (Shan et al., 2020). The challenges facing SMEs are diverse ranging from skills challenges to value chain optimization, concept management and operations management. (Geng et al., 2021), which requires collaborative innovation and active digital platforms to quickly solve them. The framework incorporates the synthesis of literature from various sources, including (Li & Wu, 2021), (Firmansyah et al., 2016; Soga & Vyas-Doorgapersad, 2022), (Shan et al., 2020) etc.

Based on the analysis and the study undertaken revealed that cooperative innovation is better than an individual innovation in SMEs sustainability and growth. Cooperative innovation that can affect the performance of specific group of SMEs and their entire supply chain.

Collaborative innovation is a change to the "business as usual" model (Bucic & Ngo, 2012) and is a pursuit of innovation across firm boundaries through the sharing of ideas, knowledge, expertise, and opportunities (Esposito De Falco et al., 2017).

Supply chain collaborative innovation is gradually replacing individual enterprise innovation and becoming a lifeblood of the survival and development of modern enterprises (Shan et al., 2020). To explore the influence of collaborative innovation and dual supply chain network for the performance and sustainability of the SMEs

Figure 1 above. Relationship among SMES participants, collaborative innovation, Dual supply chain network and sustainability.



The above proposed conceptual framework aims to explore the influence of collaborative innovation and dual channel network on SMEs sustainability. It incorporates the dynamic capabilities theory, collaborative innovation and dual supply chain network as key constructs that interact with one another in enhancing the growth and maintaining sustainability for the SMEs. Building on these concepts, the proposed model includes four independent variables:

Collaborative SMEs participants innovation (BDSC), Collaborative suppliers' innovation (CSI), Collaborative manufacturers innovation (CMI) and Collaborative distribution centers innovation (CDCI). In the following sub-sections, the concepts of the framework are operationalized in the context of lack of digital economy for SMEs in the rural villages or townships of the Limpopo Province in South Africa.

Collaborative SMEs participants innovation (BDSC), Collaborative suppliers' innovation (CSI), Collaborative manufacturers innovation (CMI) and Collaborative distribution centers innovation (CDCI) that have a direct impact on the growth and sustainability of the SMEs. For sustainable supply chain collaborative innovation, this means that all stakeholders in the supply chain network innovate and reform in products, processes, markets, technologies, resource allocation and organization to achieve a balance in economic, social, and environmental performance (Leminen et al., 2021a; Shan et al., 2020). These collaborations and structures of coordination need stable and flexible social networks between all the actors in the environment, including competitors (Leminen et al., 2021)

The link between collaborative innovation, dual supply chain network and SMEs sustainability is well established in literature (Leminen et al., 2021; Wang & Hu, 2020). Incorporating insights from prior literature, the independent variables in the study are summarized in Table 2, and their measures and link to SMEs growth and sustainability provided.

Table 2: Independent variables and measures

Construct	Interpretation	Measures	References
SMEs participants	Collaborative innovation and maintaining a common goal toward digital economy	Level of participants' willingness to learn new ways of doing things	Hortovanyi et al. (2023); Pinto et al. (2023)
Suppliers	Improved digital supply of goods and services to the entire value chain	Their ability to create a platform for enablement by identifying the current issues that impede a positive and effective procurement system from both the supplier and client sides of the value chain.	(Antonites & Truter, 2017)
Manufactures	A positive digital culture contributes to better service performance.	Convenient and flexible means of delivery.	(Stewart et al., 2018)
Distribution centers	A clear and innovative distribution strategy. enhances growth and sustainability.	Optimal placement design for picking and packing in distribution centers.	(Rios et al., 2021)

2.2.6.1 Hypotheses

To sum up, this paper adopts the following hypotheses:

- *H1: There is a significant relationship between digital tools usage and the overall improvement of SMEs processes.*
- *H2: There is a significant relationship between digital networks usage, the efficiency and sustainable competitiveness of the SMEs in the Capricorn district of Limpopo Province.*
- *H3: There is a significant relationship between Collaborative manufacturer innovation and SMEs sustainability.*
- *H4: There is a significant relationship between Collaborative Distribution centers innovation and SMEs sustainability.*

2.2.7 Linking Dual-supply Chain network and SMME's growth and sustainability.

The rapid development of e-commerce technologies has encouraged collection centers to adopt online recycling channels in addition to their existing traditional (offline) recycling channels, such the idea of coexisting traditional and online recycling channels evolved a new concept of a dual channel reverse supply chain (Li & Wu, 2021) Designing a sustainable supply chain network is of importance in terms of economic, environmental, and social aspects of different sectors of society.(Li & Wu, 2021) The main objectives of this model are to minimize total cost and environmental impacts while tactical and strategic decisions are integrated simultaneously (Rezaei et al., 2021) .

One crucial feature of the digital economy is the growing importance of platforms and platform enabled products/services (Song et al., 2022). The newly developed direct channels can consolidate and expand market demand for the manufactures, at the same time they also become competitors of retailers which leading to channel conflict to a certain extent (Mehrabani & Seifi, 2019). By using online sales channels and e-commerce activities that have been considered in the strategic and tactical decisions, we can develop a dual-channel supply chain and improve its sustainability (Rezaei et al., 2021). The SMEs need to adopt the digital innovation for speeding up the process of the sustainable digital innovation and this requires a huge investment (Yousaf et al., 2021).

From this model, it can be summarized that if the SMEs can adopt the digital technology, it can make use of dual channel network to make its digital innovation productive. Considering the argument above, it is justified to establish a positive link between the dual channel network and the sustainable growth for the SMEs Therefore, it leads to the following hypothesis:

H5. Digital platform mediates the relationship between digital orientation and sustainable digital innovation.

H6. Digital platform mediates between the Internet of Things and sustainable digital innovation.

The measures of the dual channel network construct are synthesized from literature and summarized in Table 3 below.

Table 3: Dual channel network construct

Construct	Interpretation	Measures	References
Digital innovation	Encouragement and support for novel ideas and approaches	Encouragement of creative thinking and risk-taking; Allocation of resources to explore and develop innovative ideas.	Wu, Yeh, & Chen,2018;Baer & Frese, 2003; West & Farr, 1990
Digital platforms	Connect different organizations and help businesses to regulate the communication processes for mutual benefit	Sustainable Innovation	(Yousaf 2021)
Sustainable digital innovation	Implement the newest digital technology for achieving creative solutions that will address the social, economic, and environmental	The reliability, discriminant validity and convergent validity was satisfactory.	(Yousaf 2021)

	business issues in the long run		
Internet of things	Stringent connectedness between digital and physical world.	Facilitator in SMEs performance but above all in improving the quality of life.	(Villamil et al., 2020)

2.3 Theoretical Framework

Addressing the research problem of the adoption of dual supply networks by SMEs in the Capricorn District of Limpopo Province can benefit from various management theories. By integrating the following management theories, SMEs in the Capricorn District can develop a comprehensive strategy for adopting and managing dual supply networks, enhancing their competitiveness and resilience.

2.3.1 Resource-Based View (RBV)

The Resource-Based View (RBV) is a strategic management theory that posits that a firm's sustainable competitive advantage is derived from its ability to acquire and manage valuable, rare, inimitable, and non-substitutable resources (Barney, 1991). In the context of adopting dual supply networks, RBV can provide significant insights into how Small and Medium Enterprises (SMEs) in the Capricorn District of Limpopo Province can leverage their internal resources to enhance their supply chain performance and resilience. This framework theory suggests that firms can achieve sustainable competitive advantage by acquiring and managing valuable, rare, inimitable, and non-substitutable resources. Applying RBV can help SMEs in the Capricorn District understand how to leverage their internal resources to manage and optimize dual supply networks.

2.3.2 Understanding Dual Supply Networks through RBV

Dual supply networks involve sourcing the same product or component from two different suppliers (McGahan, 2021). This strategy can mitigate risks associated with supply disruptions, improve bargaining power, and enhance overall supply chain flexibility. The RBV framework can help SMEs identify and exploit internal resources to successfully

implement and manage dual supply networks. The following are the key RBV Concepts that can be applied to Dual Supply Networks.

2.3.2.1 Valuable Resources

Supply Chain Expertise: SMEs with skilled supply chain managers can better identify and manage the complexities of dual supply networks (Gerhart & Feng, 2021). Expertise in negotiation, risk management, and logistics can add significant value. **Technology and Information Systems:** Advanced IT systems for supply chain management, such as ERP (Enterprise Resource Planning) and SCM (Supply Chain Management) software, enable better coordination and monitoring of dual supply networks (Hagen et al., 2022).

2.3.2.2 Rare Resources

Strategic Supplier Relationships: Establishing strong, long-term relationships with reliable suppliers can be a rare resource that enhances trust and cooperation, crucial for the successful operation of dual supply networks (Ozdemir et al., 2023). **Exclusive Contracts:** Securing exclusive supply contracts can ensure a steady and reliable supply, giving an SME a competitive edge over others (Ozdemir et al., 2023).

2.3.2.3 Inimitable Resources

Proprietary Processes and Innovations: Unique processes for managing dual supply networks that competitors cannot easily replicate can serve as a significant advantage (Wahbi & Tawai, 2023). This might include proprietary risk assessment tools or bespoke logistics solutions.

Organizational Culture: A culture that fosters innovation, flexibility, and responsiveness can be difficult for competitors to imitate. Such a culture supports the dynamic adjustments required for managing dual supply networks (Gerhart & Feng, 2021).

2.3.2.4 Non-Substitutable Resources

Integrated Supply Chain Capabilities: The integration of supply chain capabilities across various functions (e.g., procurement, logistics, and quality control) creates a holistic approach that is difficult to substitute (Gerhart & Feng, 2021).

Leadership and Vision: Leadership that prioritizes and understands the strategic importance of dual supply networks can drive the organization towards sustained competitive advantage (Sun & Tse, 2009).

2.3.2.5 Resource Identification and Development

SMEs should conduct an internal audit to identify existing resources that align with the RBV framework. Investing in training for supply chain personnel, upgrading technology infrastructure, and building robust supplier relationships can strengthen their resource base (Collins, 2021).

2.3.2.6 Strategic Resource Allocation

Allocating resources strategically to areas that support the adoption of dual supply networks is crucial. This might involve investing in technologies that enhance supply chain visibility or dedicating teams to manage supplier relationships (Collins, 2021).

2.3.2.7 Leveraging Unique Capabilities

SMEs should focus on leveraging their unique capabilities to create a competitive advantage in managing dual supply networks.(Gupta et al., 2018) For instance, if an SME has developed a unique logistics process that minimizes delivery times, this capability should be maximized and protected.

2.3.2.8 Continuous Improvement and Innovation

To maintain a competitive edge, SMEs should continuously seek to improve their supply chain processes and innovate(Gupta et al., 2018). This can be achieved through regular training, adopting new technologies, and fostering a culture of continuous improvement.

Addressing the research gap regarding the adoption of digital dual supply networks by SMEs in the Capricorn District can be effectively approached through the application of various Supply Chain Management (SCM) theories. These theories provide frameworks for understanding and enhancing the efficiency, resilience, and adaptability of supply chains. Here's how specific SCM theories can be applied to this context

2.3.2 Supply Chain Management (SCM) Theories

SCM theories focus on the efficient management of supply chain activities to maximize customer value and achieve a sustainable competitive advantage (Gupta et al., 2018). Applying these theories can help SMEs optimize the dual supply network for better performance and risk management. This theory emphasizes the seamless coordination and integration of supply chain processes and stakeholders. This theory is crucial for SMEs adopting digital dual supply networks as it fosters collaboration and information sharing.

2.3.2.1 Application:

Integrated IT Systems: Implement ERP and SCM software to facilitate real-time data sharing between SMEs and their suppliers. This helps in synchronizing supply chain activities and improving decision-making (Stevens, 1989).

Collaborative Planning: SMEs should engage in joint planning sessions with their suppliers to align production schedules and inventory levels, ensuring that both supply networks are effectively managed (Ozdemir et al., 2023).

2.3.3. Lean Supply Chain Management

Lean Supply Chain Management focuses on waste reduction and efficiency. For digital dual supply networks, lean principles help in streamlining processes and reducing unnecessary costs (El Jaouhari et al., 2023).

2.3.3.1 Application:

- **Minimize Waste:** Use digital tools to identify and eliminate non-value-adding activities in the supply chain, such as excess inventory and overproduction (Womack & Jones, 1996).
- **Just-in-Time Delivery:** Implement measures enabled by digital systems to reduce inventory holding costs and ensure timely delivery of goods from both suppliers.

2.3.4. Agile Supply Chain Management

Agile Supply Chain Management is about being responsive and flexible to market changes. This theory supports the adoption of digital dual supply networks by enhancing adaptability and further suggests that.

- Flexibility and Responsiveness: Digital tools like IoT and advanced analytics can be used to monitor market trends and demand changes, allowing SMEs to adjust their supply chain operations swiftly (Christopher, 2000).
- Real-time Data Analytics: Implement systems that provide real-time analytics to make quick adjustments to supply chain strategies in response to changes.

2.3.5. Theory of Constraints (TOC)

The Theory of Constraints (TOC), developed by Eliyahu M. Goldratt, is a management methodology focused on identifying and addressing the bottlenecks (constraints) that hinder an organization from achieving its goals (Panizzolo, 2016). TOC emphasizes continuous improvement and aims to optimize the performance of the entire system (Panizzolo, 2016). When applied to the adoption of digital dual supply networks, TOC can provide valuable insights into overcoming obstacles and maximizing the efficiency of these advanced supply chain systems.

Key Concepts of TOC

2.3.5.1 Constraint Identification:

Identify the most critical limiting factor (constraint) that prevents the digital dual supply network from achieving its full potential. Constraints in this context could include outdated technology, insufficient data integration, or resistance to change within the organization.

2.3.5.2 Exploitation of Constraints:

Optimize the utilization of the identified constraint to ensure it operates at its maximum potential. This involves making the best use of the existing capacity of the constraint without major investments or changes (Mabin & Balderstone, 2003).

2.3.5.3 Subordination of Other Processes:

Align all other processes and resources to support the constraint (Rahadi et al., 2021). This means ensuring that every part of the supply network is adjusted to assist the constraint in achieving its maximum performance.

2.3.5.4 Elevation of the Constraint:

Once the constraint is fully exploited and subordinated, take steps to increase its capacity. This could involve investing in new technologies, improving processes, or enhancing skills and training (Wang et al., 2014).

2.3.5.5 Continuous Improvement:

After addressing the current constraint, the process is repeated to identify and address the next constraint. This cycle of continuous improvement ensures that the supply network remains efficient and responsive to changes.

2.3.5.6 Benefits of Applying TOC to Digital Dual Supply Networks

- **Increased Efficiency:** Systematically identifying and addressing constraints can significantly improve the efficiency of digital dual supply networks.
- **Enhanced Adaptability:** Continuous improvement ensures that the supply network remains adaptable to changing market conditions and technological advancements.
- **Optimal Resource Utilization:** TOC helps make the best use of available resources, reducing waste and increasing overall productivity.
- **Improved Decision Making:** A structured approach to constraint management leads to better-informed decisions, particularly in complex supply network environments.

2.2.4 Chapter Summary

In summary, the literature review and the theoretical reviews that was conducted on the SMEs, has revealed, and added to the fact that there are unresolved challenges concerning the SMEs performance in general. The literature reviews helped us to study and understand other writers view regarding SMEs and digital economy. It also assisted in building some knowledge regarding the digital economy concepts and how best to link that knowledge to SMEs poor performance. Whereas the theoretical framework helped with identifying key underpinnings and key concepts based on the existing research. It also assisted in developing arguments for the research. These literatures support digitalisation for the growth and sustainability of SMEs. The studies highlight the importance of innovation and digitalisation in this ever-changing business world. Additionally, the analysis around dual network has proven that collaboration and dual network can help the SMEs to help each other in the achieving different methods such as methods of purchasing, selling and distribution of their products or services. Furthermore, the study further acknowledges that the prevalence of DDSN adoption among SMEs is on the rise, driven by

technological advancements, competitive pressures, and regulatory requirements. While many SMEs recognize the benefits of DDSNs in enhancing supply chain efficiency and agility, challenges such as resource constraints and technological barriers persist. Future research should focus on addressing these challenges to facilitate widespread adoption and maximize the potential benefits of DDSNs for SMEs. In closing, the entire chapter 2 gives an opportunity to conduct thorough research and reading from the previews reading about the concepts you wish to explore. Applying SCM theories such as Supply Chain Integration, Lean Management, Agile Management, Theory of Constraints, Risk Management, and Supply Chain Resilience can provide SMEs in the Capricorn District with the strategic framework needed to adopt and manage digital dual supply networks effectively. By leveraging these theories, SMEs can enhance their supply chain performance, mitigate risks, and improve overall resilience.

CHAPTER 3. RESEARCH METHODOLOGY

3.1. Introduction

This chapter explains the methodological traditions, procedures, practices, and other activities such as the sampling, data collection, and analysis that were followed in undertaking this research. According to Igwenagu (2016), the importance of a research methodology is that it is not the same as a technique because it does not aim to offer solutions. Rather, it provides the theoretical foundation for knowing which technique, set of techniques, or best practises may be used in a certain scenario, as when calculating a particular result (Igwenagu, 2016).

3.2 Research Paradigm

Interpretivism focuses on understanding the subjective meanings and experiences of individuals within their specific contexts (Schwartz-Shea & Yanow, 2012). Given that the adoption of digital dual supply networks involves complex interactions and contextual factors specific to SMEs in the Capricorn District, an interpretivist approach allows researchers to capture the nuances and deeper insights that quantitative methods might miss. One of the perfect examples could be that the SMEs in the Capricorn District might face unique challenges such as infrastructure limitations, cultural factors, financial issues and specific market dynamics that influence their adoption of digital technologies. An interpretivist approach will therefore enable the exploration of these contextual variables.

The interpretivist paradigm is ideal for exploring the perceptions, attitudes, and experiences of individuals. Understanding how SME owners and managers perceive digital dual supply networks, what challenges they face, and what benefits they foresee requires in-depth, qualitative inquiry. Through interviews, the researcher will be able to gather detailed narratives from SME owners about their experiences with digital supply networks, revealing insights that may not be accessible through standardized surveys.

3.3 Research Design

This study utilised an exploratory research design approach to explore a problem faced by the SMEs and to gain insights and familiarity for the purpose of this research. Exploratory research design is a valuable tool for investigating new, complex, or poorly understood phenomena, its flexible and open-ended nature allows researchers to gather rich, detailed insights that can inform subsequent, more structured studies (Erickson, 2017). By employing this research design, the researcher will be able to gain a deep and nuanced understanding of the factors

influencing the adoption of digital dual supply networks, identify key challenges and opportunities faced by SMEs and develop initial hypotheses and frameworks that can be tested in future research.

3.4 Research Approach

The study will follow a qualitative research design and use in-depth engagements through interviews to gather data from the respondents. Small and Medium Enterprises (SMEs) owners or managers in the Capricorn District will be the targeted population and will be engaged through interviews to understand their standing views on the adoption of digital tools. Qualitative research methodology serves as a powerful tool for exploring complex phenomena, capturing nuanced perspectives, and generating rich insights into human behavior, beliefs, and experiences. Unlike quantitative approaches that prioritize numerical data and statistical analysis, qualitative methodology delves into the subjective meanings, interpretations, and contexts surrounding phenomena, offering depth and understanding beyond mere quantification (Wyse, 2011).

According to (Montero-Marin et al., 2013), qualitative research helps researchers to gain a better understanding of the perspectives and experiences of the people who take part in the study (Chijioke, 2016). The qualitative approach is the best option available to fulfil the requirements of this study and was undertaken through semi-structured interviews. Semi structured interviews are thought to have greater potential than other interview formats because they enable researchers to get detailed information and supporting data from respondents while thoughtfully contemplating the study's main objective. (Ruslin, Mashuri, Rasak, Alhabsyi and Syam, 2022). Additionally, it enables researchers to keep track of their investigations while being adaptable and flexible enough to offer their interview subjects questions in a guided and controlled manner (Ruslin et al., 2022). Semi-structured interviews are the preferred data collection method when the researcher's goal is to better understand the participant's particular viewpoint rather than a general grasp of a topic (Olatunde and Olenik, 2021).

Qualitative research methods, such as interviews, focus groups, and case studies, provide rich, detailed data that can capture the complexity of the research problem (Barney, 1991). This depth is crucial for understanding the multifaceted nature of supply chain management within SMEs. Conducting (Barney, 1991). In-depth interviews with SME managers can uncover detailed stories and specific instances of how digital dual supply networks are implemented, the challenges encountered, and the strategies developed to overcome these challenges.

3.5 Sampling

3.5.1 Population

A portion of the intended population known as the study population is where the sample is drawn. Compared to the idea sample frame, it is wider (Hu, 2014). A population comprises a group made up of all the items or scenarios of a specific sort that researchers are fascinated in discovering about in greater detail (Chadwick, 2017). A population's size can range from enormous to very small. No matter the quantity of things or occurrences there are in the population, it is nevertheless usually hard or unattainable to gather information pertaining every individual (Hu, 2014; Chadwick, 2017). A sample is the cluster of participants from whom the researcher will gather data (Levy and Lemeshow, 2009). For this study, defining the population involves identifying the specific characteristics of the SMEs within this region. The following factors were considered.

3.5.1.1. Geographical Location:

The population is confined to SMEs operating in the Capricorn district of Limpopo Province, South Africa. This geographical boundary ensures that the study is context-specific and relevant to the local economic and business environment.

3.5.1.2 Business Size:

The population includes small and medium-sized enterprises (SMEs). According to the National Small Business Amendment Act of South Africa, SMEs are defined based on criteria such as the number of employees, annual turnover, and the nature of the business sector (National Small Business Amendment Act, 2003).

3.5.1.3 Industry Sector:

The population encompasses SMEs across various industry sectors within the Capricorn district. This diversity ensures that the study captures a broad range of experiences and challenges related to digital dual supply networks.

3.5.2 Sampling Strategy

A sampling strategy is a plan that guides how participants will be selected for a study. In qualitative research, the focus is often on obtaining rich, detailed data from a specific group of participants who have direct experience with the phenomenon under investigation (Stratton,

2021). This approach differs from quantitative research, which typically aims for a larger sample size to achieve statistical generalizability. For this study, purposive and theoretical sampling are the most appropriate strategy. This method ensures that the selected SMEs have relevant knowledge or experience with digital supply networks, thereby providing rich and pertinent data for the research

3.5.2.1 Purposive Sampling: For the study on the adoption of digital dual supply networks, SMEs that have either adopted or are in the process of adopting such networks would be purposively selected. This ensures that the data collected is directly relevant to the research objectives.

3.5.2.2. Theoretical Sampling: As themes and patterns about digital dual supply network adoption emerge, the researcher might seek out specific SMEs that can shed light on these themes, ensuring a deeper understanding of the phenomenon

3.5.3 Sample Size

In qualitative research, sample size is an important consideration that differs significantly from quantitative research. Unlike quantitative studies, which often require large samples to ensure statistical power and generalizability, qualitative research focuses on depth and richness of data (Wyse, 2011). The goal is to gain a deep understanding of a phenomenon, context, or experience through detailed exploration and analysis. For the purpose of this study, 10 SMEs across the Capricorn district were selected to ensure depth and richness of data, the importance of understanding context-specific nuances, practical considerations of conducting the research, and to achieve data saturation. This sample size is appropriate for gaining detailed insights into the adoption of digital dual supply networks and provides a robust foundation for understanding the challenges and opportunities faced by SMEs in the Capricorn district. The sample size is explained in Table 3 below.

Table 3: Sample Size

Method	Intended sample	Final Sample Size of Participants
Qualitative	05 Small Businesses	04
	05 Medium Businesses	06

3.6 Data Collection

For this qualitative research study on the adoption of Digital Dual Supply Networks (DDSNs) by Small and Medium Enterprises (SMEs) in the Capricorn District of Limpopo Province, South Africa, Semi-structured interviews will be conducted with 10 key stakeholders involved in SMEs within the Capricorn District of Limpopo Province. This will include SME owners, managers and professionals. The following are some of the reasons why semi-structured interviews were selected for this study.

3.6.1 Data Collection Instrument

Data collection instruments are the tools used to gather information from participants in a systematic and reliable manner (Adosi, 2020) For this study on the adoption of digital dual supply networks (DDSNs) by SMEs in the Capricorn District of Limpopo Province, the primary data collection instruments will solely be on semi-structured interviews to capture detailed and context-rich information from different perspectives.

3.6.1.1 *Semi-Structured Interviews*

In-depth interviews with SME owners/managers to explore their experiences, perceptions, and challenges related to DDSNs. An interview guide will be developed to ensure all relevant topics are covered while allowing flexibility for participants to express their views.

3.6.1.2 *Instrument Design:*

An interview guide will be developed to ensure consistency across interviews while allowing flexibility for probing deeper into interesting or unexpected responses. The following are the components of the Interview Guide:

- **Introduction:** Explanation of the study's purpose, obtaining informed consent, and ensuring confidentiality.
- **Background Information:** Questions about the participant's role, the SME's industry, and level of digitalization.
- **Drivers for Adoption:** Questions aimed at understanding the motivations behind adopting DDSNs.
- **Perceived Benefits:** Exploration of the benefits participants believe DDSNs bring to their business.
- **Challenges Faced:** Discussion of any difficulties encountered in implementing DDSNs.

- **Readiness and Capacity:** Assessment of the SME's readiness and capacity to adopt DDSNs.
- **Future Plans:** Questions about future expectations and plans related to DDSNs.
- **Conclusion:** Thanking participants and asking if they have any additional comments or questions.

3.6.2 Data Storage

Data storage is a critical aspect of qualitative research, ensuring that data is securely managed and maintained throughout the research process (Abawi, 2013). Proper data storage practices protect participant confidentiality, maintain data integrity, and comply with ethical standards. For this study, the following control measures will be applied.

3.6.2.1 Data Recording and Transcription:

- **Audio Recordings:** Digital audio recorders will be used to record the semi-structured interviews. Immediately after each interview, the audio files will be transferred to a secure, password-protected computer and backed up to an encrypted external hard drive.
- **Transcriptions:** Transcriptions of the audio recordings will be made verbatim to capture all details accurately. Transcriptions will be stored as encrypted digital files on the same secure, password-protected computer.

3.6.2.2 Data Anonymization:

- **Participant Anonymity:** Transcriptions will be anonymized by removing any identifiable information (e.g., names, company names, specific locations). Each participant will be assigned a unique identifier (e.g., Participant 1, Participant 2) to maintain confidentiality.
- **Digital Security:** All digital files, including audio recordings and transcriptions, will be encrypted using robust encryption software. Password protection will be applied to all files and folders containing interview data.
- **Backup:** Regular backups will be performed to ensure data integrity. Backups will be stored on encrypted external hard drives kept in a secure location separate from the primary data storage.

3.6.2.3 Access Control:

- Limited Access: Access to the interview data will be restricted to authorized to only the researcher. Permissions will be managed to ensure that only individuals directly involved in data analysis and interpretation can access the files.

3.6.2.4 Data Retention and Disposal:

- Retention Period: Data will be retained for a specific period as required by the Wits University institutional guidelines and or for the duration of the research project plus an additional period for potential follow-up research.
- Secure Disposal: After the retention period, all data will be securely disposed of. Digital files will be permanently deleted using data destruction software.

3.6.3 Data Analysis

Data analysis in this research involved systematically examining and interpreting the collected data to uncover patterns, themes, and insights. The goal was to identify significant themes that explain participants' experiences and perspectives as clarified by (Braun & Clarke 2006). Below are the steps that were followed when conducting data analysis for semi-structured interviews:

3.6.3.1 Data Preparation

- Transcribe Interviews: Transcribe the audio recordings verbatim, including non-verbal cues (e.g., pauses, laughter) when relevant to the context.
- Verify Transcriptions: Review the transcripts to ensure accuracy and completeness. Correct any transcription errors by cross-referencing with the audio recordings.

3.6.3.2 Anonymization:

Anonymize Data: Replace identifying information with codes to protect participants' confidentiality.

3.6.3.3 Familiarization with the Data

Read Transcripts: Read through the entire set of transcripts multiple times to become thoroughly familiar with the data.

Note Initial Impressions: Jot down initial thoughts, impressions, and potential themes in the margins or a separate document.

3.6.3.4 Searching for Themes

- **Group Codes into Themes:** Review the codes and group them into broader themes that capture patterns across the data. Themes are higher-level concepts that organize and explain the underlying patterns in the coded data.
- **Identify Sub-Themes:** Within each theme, identify sub-themes that provide more detailed insights.

3.6.3.5 Reviewing Themes

- **Review and Refine Themes:** Assess the themes for coherence and distinctiveness. Ensure that each theme accurately represents the coded data and is distinct from other themes.
- **Check Against Data:** Go back to the original transcripts and ensure that the themes are supported by the data. Refine themes as necessary to better fit the data.

3.6.3.6 Defining and Naming Themes

Define Themes: Clearly define each theme, explaining what it captures and why it is significant.

Name Themes: Assign concise, descriptive names to each theme to capture their essence.

3.6.3.7 Writing the Analysis

- **Narrative Description:** Write a detailed narrative for each theme, supported by direct quotes from the interviews to illustrate the findings.
- **Integrate Sub-Themes:** Discuss sub-themes within the broader narrative to provide a comprehensive understanding.
- **Contextualize Findings:** Relate the findings to the broader research questions and existing literature to contextualize the results.

3.6.4 Data Quality Criteria

Data quality criteria are standards or guidelines used to assess the trustworthiness, credibility, and reliability of qualitative research data (Chen et al., 2022). These criteria help ensure that the

data collected and analysed are of high quality and can be confidently used to draw conclusions and make interpretations (Chen et al., 2022). In this paper, we will explore in detail the various components of data quality criteria in qualitative research. Drawing on existing literature and best practices, we will discuss each criterion's significance, provide examples of how it will be applied in this research.

3.6.4.1 Trustworthiness

Trustworthiness is a fundamental aspect of qualitative research that concerns the accuracy, authenticity, and credibility of the data collected and analysed (Kelp & Simion, 2023). Ensuring trustworthiness is (Carter, 2023). In the study on the adoption of digital dual supply networks for SMEs in the Capricorn district of Limpopo Province, trustworthiness will be achieved through rigorous methodological practices, transparent reporting, and engagement with participants. By adhering to principles of credibility, transferability, dependability, and confirmability, the study will produce robust and meaningful insights that contribute to both theory and practice in the field.

This comprehensive approach provides confidence that the research findings are accurate, applicable to other contexts, consistent, and rooted in the data collected, thereby enhancing the overall quality and reliability of the study.

3.6.4.2 Dependability

Dependability in qualitative research refers to the extent to which the research process is logical, traceable, and documented (Liu et al., 2024). It ensures that if the study were to be repeated with the same or similar participants in the same context, it would yield consistent findings (Liu et al., 2024). Dependability involves a systematic approach to the research design, data collection, and analysis processes. The following practices will be applied throughout the research to enhance dependability (McGregor, 2007).

- **Audit Trail:** Keep detailed records of how the study was designed, how participants were selected, how data was collected, and how data was analysed. The Researcher will document any changes in the research design or methods and the reasons behind them.
- **Code-Recode Strategy:** After initial coding of interview transcripts, the Researcher will set them aside for a period before revisiting and recoding them to check for consistency.

- **Triangulation:** Collection of data through multiple methods, such as interviews and document analysis to ensure that the findings are consistent across different data sources

3.6.4.3 Credibility

Credibility refers to the degree to which the research findings accurately reflect the realities and perspectives of the participants (Hanemann et al., 2023). In the study of DDSN adoption by SMEs, credibility will be enhanced through:

- **Participant Selection:** Ensuring a diverse and representative sample of SMEs in terms of industry, size, and digitalization level to capture a comprehensive range of experiences and perspectives.
- **Establishing Rapport:** Building trust and rapport with participants through transparent communication, active listening, and empathetic engagement to encourage open and honest dialogue.
- **Reflective Commentary:** The Researcher will maintain a reflexive journal throughout the research process, documenting thoughts, assumptions, and any potential biases. This will also help to reflect on how these may influence the researcher's interactions with participants and data interpretation and take steps to ensure objectivity.
- **Triangulation:** Employing multiple data sources (e.g., interviews and document analysis) and methods to corroborate findings and enhance the credibility of the research outcomes.

3.6.4.4 Confirmability

Confirmability is a crucial aspect of qualitative research that ensures the objectivity and neutrality of the research process and findings. In the context of this study, confirmability is essential for establishing the reliability and validity of the research outcomes. The following strategies were employed to enhance confirmability.

Confirmability begins with ensuring that the data collection procedures are systematic, transparent, and consistent. In the study of DDSN adoption, confirmability will be promoted through:

- **Standardized Protocols:** Developing standardized interview protocols with clear instructions for data collection to minimize researcher bias and ensure consistency across data collection sessions.
- **Pilot Testing:** Conducting pilot tests of data collection instruments with a small sample of participants to identify and address any ambiguities or biases in the questions or procedures
- **Researcher Reflection:** Researcher shall continuously reflect on her own biases, assumptions, and influence on the research process. This will be achieved through maintaining a reflexive journal where thoughts and feelings about the research process and interactions with participants are recorded.
- **Acknowledge Biases:** Explicitly acknowledge any potential biases or preconceptions that may affect the research.
- **Audit Trail:** Document the interviews with SME owners and employees, including the context of their operations, their current supply network structures, and their experiences with digital technologies. Keep detailed records of how themes related to digital adoption are identified and developed.

3.6.4.5 Transferability

Transferability in qualitative research is about the degree to which the results of a study can be transferred to other contexts or groups. It focuses on the extent to which the findings can be generalized or applied to other situations, populations, or times (Qiao et al., 2019) Ensuring transferability involves providing sufficient detail about the research context so that others can determine the applicability of the findings to their own settings(Qiao et al., 2019). The following practices will be applied to ensure transferability.

- **Purposive Sampling:** SMEs of different sizes, industries, and levels of technological advancement will be selected to capture a wide range of experiences with digital supply networks. This will assist in establishing the bottlenecks, quick-wins and strategies that could be adopted to assist SMEs across the Province.
- **Thick Description:** The Researcher will provide detailed descriptions of the Capricorn district's economic and technological landscape, the characteristics of the SMEs involved, and the information about regulatory environment, and technological infrastructure.
- **Participant Quotations:** The Researcher will use extensive quotations from SME owners and managers to illustrate their experiences, challenges, and successes in

adopting digital dual supply networks. This will help to convey the richness of the data and provides insights into the practical implications of the findings.

3.7 Ethical Consideration

This research project was approved by the Wits Business School Research Ethics Committee per Ethical Clearance no. JBS - 2022- 42(M) dated 10th October 2023 (see attached Appendix 2). In terms of this clearance, all participants signed participants' consent forms and were advised that they could withdraw from participating anytime during the interview or the project.

The research was conducted responsibly, respecting the rights and wellbeing of all participants involved. The data collected from the study will be kept confidential, stored securely, and solely utilised for the purpose of this Master of Business Administration qualification. The following are some of the ethical issues that were observed throughout the research process.

3.7.1 Informed Consent

Ensuring informed consent is critical in this research. Participants must be fully informed about the purpose of the study, the procedures involved, and their right to withdraw at any time without penalty. This involves providing clear and concise information, possibly in multiple languages to accommodate participants' preferences, and obtaining written consent.

3.7.2 Avoiding Harm

Researchers must take care to avoid any potential harm to the participants. This includes physical, psychological, financial, or reputational harm. Given the competitive nature of business, revealing sensitive information could negatively impact the SMEs involved. Researchers must ensure that participation does not place any undue burden on the businesses or their operations.

3.7.3 Cultural Sensitivity

The Capricorn district is diverse, with various cultural backgrounds represented among SME owners and employees. Researchers must be culturally sensitive and respectful, taking into account local customs, values, and communication styles. This may involve adapting research methods and materials to be culturally appropriate and accessible.

3.7.4 Transparency and Accountability

Researchers should be transparent about the research process, including the aims, methodology, and intended use of findings. Regular updates and open communication with participants can help build trust and ensure accountability. Any changes to the research design or objectives should be communicated promptly to all stakeholders.

3.8 Confidentiality and Anonymity

Maintaining the confidentiality and anonymity of participants is paramount. SMEs may be sensitive about sharing information that could be perceived as strategic or proprietary. Personal identifiers and business-specific data must be anonymized in all research outputs. Researchers must ensure that data is stored securely and only accessible to authorized personnel. (Surmiak, 2018). According to (Surmiak, 2018), Researchers ought to continuously secure the character of members in considers as a implies of keeping up the secrecy and secrecy of the inquire about being attempted. As portion of the method of keeping up the member namelessness investigate ought to carefully oversee information that lead to the uncovering member names and personalities amid the different investigate steps such as information collection or detailing discoveries (Eungoo & Hwang, 2023) .

The aspects of guaranteed privacy, anonymity and confidentiality give the research integrity, whilst also giving the participants confidence about the study (Maree & Van der Westhuizen, 2012). Privacy, anonymity, and confidentiality was ensured through verifying that the information acquired is shown in a way that only the researcher is aware of the source. As such, the participants' anonymity was treated with respect, but also, the participants have been identified as participant 1, participant 2, participant 3, participant 4, and so on.

3.9 Respect for participants

All the participants were handled with the utmost respect. According to (Mohd Arifin, 2018, Researchers are required to demonstrate respect and be cultural sensitivities when dealing with the participants. The study was dealing with SMEs owners from different cultures and therefore it was of our utmost importance to be conscious when dealing with such complexity. Cultural norms and belief systems of the respondents were observed, and the researcher clearly articulated any elements of the research which may conflict with the participant as sign of respect and obtaining explicit consent (Cresswell and Poth, 2016; Mohd Arifin, 2018).

3.10 Permission to Conduct the Study

This research project was approved by the Wits Business School Research Ethics Committee per Ethical Clearance no **WBS/BA2618583/734** dated 10 October 2023 (see attached Appendix 2). In terms of this clearance, all participants signed participants' consent forms and were advised that they could withdraw from participating anytime during the interview or the project. The data collected from the study will be kept confidential, stored securely, and solely utilised for the purpose of this Master of Business Administration qualification.

3.11 Data Management

The researcher will adhere to all data protection regulations and ethics principles to ensure that there is no compromise of information and the data collected is used solely for the purpose of the study.

3.10 Chapter Summary

In this chapter, we have meticulously outlined the research methodology adopted for investigating the adoption of digital dual networks by SMEs in the Capricorn district of Limpopo Province. It has established a robust qualitative framework for investigating the adoption of digital dual networks by SMEs in the Capricorn district. The chosen methodology, with its focus on in-depth understanding and contextual richness, is well-suited to capture the complexities of SME supply chain management in this region. This methodological foundation sets the stage for the subsequent chapters, which will present and analyse the findings, drawing meaningful conclusions and implications from the collected data. Furthermore, ethical considerations were addressed comprehensively, highlighting the importance of informed consent, confidentiality, and the respectful treatment of participants. The chapter also discussed measures to ensure the credibility and trustworthiness of the research, such as member checking and triangulation.

CHAPTER 4: RESULTS AND DISCUSSION

4.1. Introduction

To observe the quantitative analysis and presentation guidelines, thematic analysis approach was adopted in order to identify and analyse patterns, themes, and categories within the collected data, as outlined by (Braun & Clarke 2006). The interview data was transcribed and coded by identifying emerging themes and patterns that surfaced during the analysis process, leading to the development of themes. The procedure included iterative readings of each transcript to highlight the appropriate texts, and subsequent comparisons were made among the various patterns and themes.

The chapter commenced by restating the study's aim, and research questions. A classification and identification of all themes for the qualitative analysis in the study followed thereafter. The chapter continued to outline the demographical/biographical information of participants, from which a set of quantitative data was acquired. The results for each theme generated from the interview questions (see Appendix A), were subsequently clarified in detail in subsequent subsections. Cronbach's Alpha has been utilised to test the results' reliability, and a table outlining the results' statistical significance followed.

The chapter includes also the demographical/biographical information of participants, from which a set of qualitative data was acquired. Another aspect of the chapter is the use of content analysis through themes derived from the questions shown in the interview schedule (see Appendix A). The quantitative results are then briefly discussed after that. The utilisation of thematic analysis through themes obtained from the questions displayed.

4.2 Research Aim, Objectives, and Research Questions

Table 4: Restating Research Aim, Objectives, and Research Questions

Main Research Questions	Research Aim
How can the Digital Dual-Supply Networks (DDSN) impact the performance of the SMEs in the Capricorn District of Limpopo Province in South Africa and contribute towards SMEs sustainability, collaboration, and	To better understand the importance of Digital Dual-Supply Networks (DDSN) and how it can be used to influence performance, collaboration, and sustainability SMEs in the Capricorn District of Limpopo

digitalization?	Province in South Africa
Secondary research Questions	Research Objectives
<ul style="list-style-type: none"> • How prevalent is the adoption of Digital Dual-Supply Networks (DDSNs) among SMEs in the region? 	To assess the SMEs preparedness to integrate technologies in effectively enhancing its processes as a way of keeping up with emerging digital transformation.
<ul style="list-style-type: none"> • In what ways do SMEs perceive and experience differences between traditional supply chains and Digital Dual-Supply Networks in terms of efficiency, cost-effectiveness, and overall performance? 	To analyse the readiness to change and its effect in SMEs in their efficiency, cost effectiveness and overall performance.
<ul style="list-style-type: none"> • Can the use of these digital tools be linked to improvements in supply chain management and overall business processes? 	To discuss the existing methods of operation and assess the potential benefits of integrating digital tools.
<ul style="list-style-type: none"> • How does the adoption of digital tools, particularly Digital Dual-Supply Networks, affect the competitiveness of SMEs in the local market? 	To elaborate on the significance of switching from traditional to digital era in order to gain the competitive edge and sustainability.
<ul style="list-style-type: none"> • How does the adoption of Digital Dual Supply Networks facilitate collaboration and network effects among SMEs within the region? 	To assess the SMEs collaboration and networking efforts within the Capricorn region.
<ul style="list-style-type: none"> • What considerations do SMEs in the Capricorn District consider for the long-term sustainability of their digital tool adoption, especially in the context of rapidly evolving technologies? 	To assess SMEs preparedness and initiatives towards digital sustainability and moving with the current trends.

4.3 Participants' Demographic and or Biographical Details

This study engaged 10 participants, each offering a unique perspective shaped by their diverse roles and extensive tenure within their respective roles. Given their varied professional backgrounds, these 10 participants collectively contribute to a rich tapestry of experiences within their different fields and different challenges they encounter as SMEs. Among them are Engineers, consultants, business unit managers, Projects Managers, Events Coordinators, Media Specialist, and administrators.

It is important to explain that as depicted in Table above, the key variables of the participants' demographics vary across age, years of experience, primary language, highest level of education and field or Sector within which they operate. Given these variables, the researcher was able to clearly mark the importance of each participant's response, based on such variables.

For the purpose of this study, the letter "P" followed by a number represents the word "participant" and the number of that participant in the sample, and this is to guarantee participant's confidentiality by not using actual names, e.g., P1; P2, and so forth. In total, the participants are 10.

Table 5: Participants' Demographic and or Biographical Details

Key Variables					
Participant Number					
	Age Sc ope	Years of Experience	Primary Language	Highest of Education	Field/Sector
P1	56	23	Sepedi	Master's degree	Civil Engineering g and Construction
P2	27	2	Sepedi	Honours degree	Communications and Media
P3	36	6	English	MBA	Events Management
P4	37	10	Tswana	Master's degree	Civil Engineering

P5	47	19	English	Master's degree	Communications and Media
P6	38	12	Sepedi	Degree	Agriculture
P7	29	5	Sepedi	Chartered Engineer (CEng).	Civil Engineering
P8	31	7	Sepedi	Diploma	Framing and agriculture
P9	50	22	Sepedi	Degree	Agriculture
P10	45	17	Sepedi	Certificates	Events Management

4.4. Classification and Identification of Themes for Analysis

The following distinct themes are discussed, shedding light on the adoption of Digital dual supply network by the SMEs in the Capricorn District of Limpopo Province. Delving into the perceptions and experiences of participants regarding digitalisation in general, the study captures the varied perspectives, commendations, and concerns that participants hold, offering a multifaceted understanding of how Digital Dual-Supply networks are perceived within the SMEs companies.

Table 6: Themes

Qualitative Analysis	
Theme NO.	Themes description
Theme 1:	Significance of adoption of digital tools, in particular the Digital Dual-Supply Networks (DDSNs):
Theme 2:	Transition from the traditional supply chain to the Digital dual-supply networks.
Theme 3:	Perceived Benefits of Digital Dual-Supply Networks (DDSNs)
Theme 4:	Contribution of Digital Dual-Supply to the long-term sustainability of the SMEs and improvement on collaborative networks.

The table above shows the classification of all the themes classified and identified using the data collection instruments that have been applied i.e., Appendix A, and Appendix B. This therefore necessitates data analysis using the thematic analysis for the outcomes (responses) from participants in each case. The researcher used the qualitative analysis to make sense of the in-

depth subjective responses that participants gave to direct questions within the semi structured interview process. All the presentation and analysis are outlined in section(s) below.

It was critical to use recurring patterns within this data analysis for identifying which responses compared to different participants converge and which ones diverge in order to fill gaps in the literature, and address the research aim, and questions regarding “The adoption of Digital Dual-Supply Networks by SMEs in the Capricorn District of Limpopo Province in South Africa”. As a result, it is also critical to examine the issues connected to the above-mentioned concerns in depth in order to answer the research problem.

4.5 Results and discussions

The following themes (1-4) feature comments from transcripts of interviews that were taken into account, then evaluated for presentation and analysis, reflecting a blend of participants’ divergent and convergent perspectives. Key findings suggest a complex landscape of opportunities and challenges surrounding the adoption of digital tools among SMEs in the Capricorn District.

4.5.1 Theme 1: Significance of adoption of digital tools, in particular the Digital Dual-Supply Networks (DDSNs):

In exploring the perception around the adoption of Digital Dual-Supply Networks (DDSNs) and its significance among the SMEs in the Capricorn District of Limpopo Province, the specific question asked to the participants was, “How significant is the adoption of Digital Dual-Supply Networks (DDSNs) among SMEs in the region?”. The following patterns emerged that helped with the analyses of the interview data and insights related to the adoption of DDSNs by SMEs in the Capricorn District of Limpopo Province, South Africa. These patterns provided a comprehensive understanding of the factors influencing the prevalence of DDSN adoption among SMEs in a region, offering insights into potential barriers, opportunities, and strategies for promoting digital transformation in the small business sector.

Low Awareness and Understanding: Four Participants P1, P3, P6 and P9 exhibited lack of awareness or understanding of DDSNs, resulting in low adoption rates. Interviews revealed that DDSNs are not widely adopted among SMEs in the Capricorn district. They cited reasons such as lack of awareness, perceived complexity, and limited resources for implementation and maintenance.

Quote: "We've heard about digital tools, but we're not sure what they entail or how they could benefit our business."

Barriers to Adoption: Interviews highlighted several barriers hindering the adoption of DDSNs among SMEs. These barriers included concerns about data security and privacy, reluctance to change existing supply chain practices, and a lack of skilled personnel to manage digital technologies effectively.

Need for Support: SMEs expressed a need for external support and resources to facilitate DDSN adoption. Interviews emphasized the importance of government initiatives, industry associations, and educational programs in providing guidance, funding opportunities, and technical assistance to help SMEs navigate the complexities of adopting DDSNs.

The following are some of the Participants' convergent and divergent responses related to theme 1.

Convergent Responses:	Divergent Responses:
<p>Enhanced Market Reach:</p> <p>"One common aspect we've found among SMEs in Capricorn is the recognition of DDSNs' role in expanding market reach. 8 and P10 acknowledge that these digital tools have allowed them to tap into new customer segments and geographic markets they couldn't access before."</p> <p>Improved Operational Efficiency:</p> <p>"Across interviews, there's a unanimous agreement on the efficiency gains brought about by DDSNs. Businesses highlight how these tools have streamlined</p>	<p>Resource Constraints and Adoption Challenges:</p> <p>"While some SMEs praise the benefits of DDSNs, P7 expressed concerns about the initial investment and technical expertise required for adoption. There's a divergence in opinions regarding the feasibility of integrating these tools, especially among smaller businesses with limited resources."</p> <p>Digital Divide and Accessibility Issues:</p> <p>"Interestingly, divergent opinions emerge regarding the accessibility of digital tools like DDSNs. While larger enterprises may find it easier to invest in and implement such technologies, smaller businesses,</p>

<p>inventory management, order processing, and communication with suppliers, leading to significant time and cost savings."</p> <p>Access to Real-Time Data Insights:</p> <p>"The consensus among SMEs is that DDSNs provide invaluable access to real-time data insights. Most Participants (Owners and Managers) emphasize how this access enables better decision-making, from inventory restocking to pricing strategies, by having up-to-date information on market demand and supply chain performance."</p>	<p>particularly in rural areas of Capricorn, highlight challenges related to internet connectivity and digital literacy."</p> <p>Impact on Traditional Business Practices:</p> <p>"There's a mixed response regarding the impact of DDSNs on traditional business practices. While some SME owners embrace the digital transformation and view it as a necessary evolution for staying competitive, others express reservations about losing the personal touch and community relationships that defined their businesses" [P3, P7 and P9]</p>
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As depicted in the table above, the various responses of participants, although insightful appropriate for this research [P8 and 10] were adequately able to add to the understanding of Significance of adoption of digital tools, particularly the Digital Dual-Supply Networks (DDSNs) by the SMEs. Contrarily, responses by participants [P3, P7 and P9] were in many than one not adding to the plethora of literature that has been limited in showing the importance of adopting the DDSN by the SMEs. These illustrate how qualitative interview responses can capture both convergent and divergent perspectives on the significance of adopting digital tools, specifically DDSNs, among SMEs in the Capricorn district of Limpopo province. Convergent responses highlight shared benefits such as enhanced market reach and improved operational efficiency, while divergent responses shed light on varying opinions regarding adoption challenges, accessibility issues, and the impact on traditional business practices.

4.5.2 Theme 2: Transition from the traditional supply chain to the Digital dual-supply networks.

Participants were asked;" In what way do SMEs perceive and experience the differences between traditional supply chain and the digital dual-supply chain in terms of efficiency, cost

effectiveness and overall performance. The followings responses provide insights into how SMEs perceive and experience the differences between traditional supply chain and digital dual-supply chain in terms of efficiency, cost-effectiveness, and overall performance. They highlight the challenges faced in traditional supply chains and the benefits realized through digital transformation, offering valuable insights for understanding the impact of technology on small business operations.

Convergent Responses:	Divergent Responses:
<p>In terms of theme 2 on Transition from the traditional supply chain to the Digital dual-supply networks, Participant 4 touched on the issue of Efficiency and Streamlined Processes: "Across interviews, there's a shared recognition of the efficiency gains achieved through the transition to Digital Dual-Supply Networks. [P4]. consistently highlighted 'How these networks streamline processes such as inventory management, order fulfilment, and communication with suppliers and customers, leading to overall operational efficiency improvements."</p> <p>Access to Real-Time Data and Insights: "An overarching theme among respondents is the significance of accessing real-time data and insights enabled by Digital Dual-Supply Networks. Many interviewees emphasize how this transition has empowered them with up-to-date information on inventory levels, market demand, and supply chain performance, facilitating better decision-making and agility in responding to dynamic market conditions" [P1, P2, P8,P10].</p>	<p>While some interviewees acknowledge the benefits of transitioning to Digital Dual-Supply Networks, others highlight challenges related to adoption, particularly for smaller businesses with limited resources [P3]. Divergent opinions emerge regarding the feasibility of investing in and implementing these networks, with some expressing concerns about the initial costs and technical expertise required."</p> <p>Digital Divide and Accessibility Issues: Participants [P5] added that "Interestingly, there are differing perspectives on the accessibility of Digital Dual-Supply Networks. While larger enterprises may find it easier to transition due to their resources and capabilities, smaller businesses, especially those in rural areas, express concerns about internet connectivity and digital literacy, which could hinder their ability to fully embrace these networks."</p> <p>There's a divergence in opinions regarding the impact of transitioning to Digital Dual-Supply Networks on traditional supply chain relationships,</p>

<p>Another participant recognised that:</p> <p>"There's a common consensus regarding the improved collaboration and connectivity facilitated by Digital Dual-Supply Networks. Business owners express how these networks enable seamless communication and coordination among stakeholders throughout the supply chain, fostering stronger relationships with suppliers, distributors, and customers" [P3]</p>	<p>.While some business owners view the transition as an opportunity to enhance collaboration and trust among partners, others express concerns about potential disruptions to longstanding supplier relationships and the loss of personal connections in the supply chain [P3, P7 & P9].</p>
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Additionally, Participants also touched on the matters in relation to the efficiency, cost effectiveness and overall performance. Participants [P2, P4, P5, P7 & P8] respectively, suggested that traditional Supply Chain processes are often manual and time-consuming yet most trustable. Quote "We rely heavily on paperwork and manual data entry, leading to delays and inefficiencies." While some believe that Digital Dual-Supply Chain could bring significant improvements in efficiency regardless of risks associated. "Automation of tasks such as order processing and inventory management can streamlined our operations, reduced lead times and improving responsiveness to customer demands." Participants 8, interview 22 January 2024). These interviews revealed the importance of transitioning to the digital dual-supply chain is realised, however more education and Government support is required to support the collaboration amongst the SMEs in the Capricorn District of Limpopo Province. The following are some of the findings and discussions that support the need for support and collaboration.

Some of the Participants highlighted resistance to change amongst their employees that inhibits the adoption of digital tools [P7]. **Quote:** "Some of our employees are resistant to using new technologies, which makes implementation challenging." [P7].

Discussion: Overcoming resistance to change emerges as a crucial factor for successful digital adoption, highlighting the importance of change management strategies and organizational culture. Another Participant expressed a need for training and capacity building to enhance their digital literacy and skills. Quote: "We lack the expertise to leverage digital tools effectively and require training to bridge this gap" [P4].

Discussion: Investing in training programs tailored to SMEs' needs could facilitate adoption and maximize the potential benefits of digitalization.

Another issue touched on as we were exploring theme 2 is the issues around the Technological Infrastructure that makes it difficult for SMEs to innovate and enhance their digitalisation. Participants [P1 & P10,] interviewed on the 30th of October 2023 and 26 March 2024 respectively have highlighted Limited access to reliable internet and electricity infrastructure as one of the challenges for implementing digital tools. **Quote:** "Our location makes it difficult to access stable internet connections, which hinders our ability to utilize digital tools effectively." Both participants are Engineers that deal with road construction. They often operate in a lack of internet connection areas [P10]

Discussion: Infrastructure limitations emerge as a critical factor influencing digital adoption, particularly in rural areas within the Capricorn District.

These sub-themes highlighted concerns around Uncertainties that were raised: SMEs indicated the potential complexities of implementing the DDSNs and misconceptions about the costs and resources required for adoption. Concerns about data security and privacy in digital supply chain systems remains a challenge for all business owners in the Country due to possible breaches that some of these businesses have already experienced. One of the SMEs, Participant 9 from the Company, Stonefound Civil Engineers also indicated that adoption of the DDSNs could completely disrupt the existing supply chain processes and affect business relationships. This gave an indication that some of these SMEs are still embedded in the supply chain traditional methods and not willing to learn and adapt to the technological developments.

Lessons learned from these discussions.

External Support and Collaboration: SMEs in the Capricorn District of Limpopo Province may rely on external support and collaboration to overcome barriers to DDSN adoption. Themes within this category might include:

- The role of government initiatives, industry associations, and educational institutions in promoting DDSN adoption.
- Collaborative efforts among SMEs, suppliers, and other stakeholders to share resources and expertise.
- Opportunities for public-private partnerships to facilitate DDSN adoption.

4.5.3 Theme 3: Perceived Benefits of Digital Dual-Supply Networks (DDSNs)

In further exploring the SMEs perception related to the adoption of Digital Dual-Supply Networks (DDSNs), prominent themes emerged, shedding light on the challenges and barriers that participants believe are the major contributors to lack of adoption of digital technologies. The specific question asked to Participants; Can the use of digital tools be linked to the improvement in supply chain management and the overall business processes? Lack of adequate knowledge, internet connectivity issues and resistance to change constantly emerged from their responses. Despite those challenges and low adoption rates, interviews also revealed a consensus among SMEs regarding the potential benefits of DDSNs. These included cost savings through streamlined processes, improved inventory management, and better responsiveness to market fluctuations. However, the perceived benefits were often outweighed by perceived challenges and uncertainties associated with DDSN implementation.

The following findings provide insights into the prevalence, challenges, and potential benefits of adopting Digital Dual-Supply Networks among SMEs in the region, offering valuable implications for policymakers, industry stakeholders, and SMEs themselves. These key findings suggest a nuanced understanding of the opportunities and challenges surrounding the adoption of DDSNs by SMEs in the Capricorn District of Limpopo Province, South Africa. Addressing barriers such as cost concerns, resistance to change, and infrastructure limitations while providing targeted training and capacity building initiatives could facilitate broader adoption and maximize the potential benefits of DDSNs for SMEs in the region.

SMEs in the Capricorn District perceive various benefits associated with adopting DDSNs, including improved supply chain visibility, enhanced inventory management, and better coordination with suppliers. Participant 6 indicated that Implementing DDSNs could revolutionize how we manage our inventory, providing real-time insights into stock levels and demand fluctuations. **Quote:** "With DDSNs, we envision smoother communication with our suppliers, leading to faster response times and reduced lead times [P6].

Discussion: The consistent mention of benefits such as improved inventory management and supplier coordination indicates a widespread recognition of the potential advantages of DDSNs among SMEs in the region.

4.5.3.1 Barriers to Adoption of DDSNs:

Despite recognizing the benefits, SMEs face various barriers to adopting DDSNs, including cost concerns, technological complexity, and resistance to change. **Quote:** "The initial investment required for implementing DDSNs is daunting for our small business, and we're unsure if the returns will justify the costs' [P4]. **Quote:** "Our employees are comfortable with our current manual processes, so there's resistance to adopting DDSNs and changing established workflows" [P4].

Discussion: The presence of multiple barriers, such as cost concerns and resistance to change, highlights the complexity of the adoption process and suggests that addressing these challenges is crucial for successful implementation.

4.5.3.2 Connectivity Challenges

Finding: Limited access to reliable internet connectivity and inadequate technological infrastructure poses significant challenges to implementing and operating DDSNs in the Capricorn District.

Quote: "Our rural location suffers from frequent internet outages, which would disrupt the functionality of DDSNs if we were to adopt them" [P3].

Quote: "Without reliable infrastructure, investing in DDSNs would be futile, as we wouldn't be able to leverage their full potential"[P9].

Discussion: The consistent mention of infrastructure challenges underscores the importance of addressing technological limitations to enable the effective adoption of DDSNs among SMEs in the region.

Need for Training and Capacity Building:

Quote: "Our workforce lacks the necessary expertise to effectively manage DDSNs, so investing in training programs could be essential."

Quote: "Providing training on DDSNs would empower SMEs to embrace new technologies and adapt to digital transformation."

Discussion: The recognition of the need for training highlights an opportunity for stakeholders to support SMEs in building the requisite skills and capabilities to successfully implement DDSNs.

In summary, this research contributes to advancing digitalization efforts among SMEs in the Capricorn District, paving the way for increased efficiency, innovation, and growth within the SME sector in the region. To further analyse the interview data received and facilitating the

identification of key themes and insights related to the adoption of DDSNs by SMEs in the Capricorn District of Limpopo Province, South Africa, the following codes were used.

- Perceived Benefits: Codes related to the advantages and opportunities associated with adopting DDSNs, including supply chain optimization, inventory management improvements, and enhanced supplier relationships.
- Barriers to Adoption: Codes associated with obstacles hindering SMEs from adopting DDSNs, such as cost constraints, technological challenges, and organizational resistance.
- Technological Infrastructure: Codes pertaining to the technological requirements and infrastructure necessary to support the implementation and operation of DDSNs, including internet connectivity, hardware, and software capabilities.

4.5.4 Theme 4: Contribution of Digital Dual-Supply to the long-term sustainability of the SMEs and improvement on collaborative networks.

Convergent Responses:	Divergent Responses:
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<p>To this question, the following responses were convergent with theme 4.</p> <p>"A common viewpoint among SME owners is that Digital Dual-Supply Networks contribute significantly to long-term sustainability by enhancing operational efficiency and reducing costs. Through automation and optimization of supply chain processes, SMEs can minimize wastage, improve resource utilization, and ultimately bolster their bottom line." [P2]</p> <p>Another participant added on access to Larger Markets and Opportunities as part of contribution to theme 4</p> <p>"Across interviews, there's a shared recognition of how DDSNs contribute to the long-term sustainability of SMEs by providing access to larger markets and opportunities. By breaking geographical</p>	<p>Resource Constraints and Implementation Challenges:</p> <p>"While many SME owners acknowledge the potential benefits of DDSNs, there are divergent opinions regarding the challenges associated with implementation. Some express concerns about the initial investment required and the availability of resources, particularly for smaller businesses with limited capital and technical expertise."</p> <p>In terms of this theme, a variety participants' responses appear to divert from the topic in their attempt to help address theme 4 as follows.</p> <p>In another selected response, participant held a view on the Impact on Traditional Relationships and Autonomy: "There's a divergence in opinions regarding the impact of DDSNs on</p>
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<p>barriers and facilitating connections with a broader network of suppliers, distributors, and customers, SMEs can diversify their customer base and revenue streams, thus strengthening their resilience against market fluctuations" [P5]</p> <p>In addition, P6 held the following view on facilitated Collaboration and Knowledge Sharing:</p> <p>"Respondents commonly emphasize the role of DDSNs in improving collaborative networks among SMEs. By fostering seamless communication and information exchange, these networks enable SMEs to forge strategic partnerships, share best practices, and collectively innovate, thereby enhancing their competitiveness and long-term sustainability in the market" [P1]</p>	<p>traditional relationships within collaborative networks. While some SME owners view these networks as enhancing collaboration and trust among partners, others express concerns about potential disruptions to longstanding relationships and the loss of autonomy in decision-making, particularly when relying on digital platforms controlled by larger entities" [P3].</p> <p>A further elaboration by other participants read thus: "Differing perspectives emerge on the accessibility of DDSNs, especially among SMEs in rural areas or with limited digital literacy. While some businesses see DDSNs as a means to level the playing field and access new opportunities, others highlight challenges related to internet connectivity, infrastructure, and the affordability of technology, which could exacerbate existing inequalities." [P10].</p>
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The qualitative interview responses were able to capture both convergent and divergent perspectives on the contribution of Digital Dual-Supply Networks to the long-term sustainability of SMEs and improvement on collaborative networks. Convergent responses highlight shared benefits such as enhanced efficiency, access to larger markets, and facilitated collaboration, while divergent responses shed light on varying opinions regarding implementation challenges, impact on traditional relationships, and accessibility issues.

As depicted in Table above, the various responses of the participants highlight the multifaceted contribution of Digital Dual-Supply Networks to the long-term sustainability of SMEs, including

improved supply chain resilience, cost reduction, market expansion, strengthened collaborative networks, enhanced customer satisfaction, and adaptability to changing market dynamics. Quote: "Digital Dual-Supply Networks have led to the improvement of collaborative networks among SMEs, fostering stronger partnerships and knowledge sharing. By facilitating seamless communication and collaboration among stakeholders, including suppliers, distributors, and fellow SMEs, DDSNs enable SMEs to leverage collective expertise and resources, driving innovation and growth within collaborative ecosystems [P8] .

Another Participant also touched on Enhanced Customer Satisfaction and Loyalty [P9]. Quote. "Through DDSNs, SMEs can better understand customer preferences and market demands, leading to improved product offerings and services. This customer-centric approach not only enhances customer satisfaction but also fosters long-term loyalty, contributing to the sustainability of SMEs by ensuring repeat business and positive word-of-mouth referrals" [P7]. "DDSNs empower SMEs to adapt to evolving market dynamics and consumer trends, ensuring their long-term sustainability. By leveraging real-time data and insights, SMEs can quickly respond to changes in demand, adjust production levels, and innovate new products or services, staying ahead of competitors and maintaining relevance in the market."

4.6 Chapter Summary

Participants generally recognized the potential benefits of adopting digital dual supply networks, emphasizing improved supply chain resilience, enhanced operational efficiency, and increased competitiveness. Many participants noted that having multiple suppliers, facilitated by digital tools, allows for greater flexibility and responsiveness to market changes and disruptions. This dual network strategy is seen as a proactive measure to mitigate risks and ensure continuity in business operations. However, the adoption process is not without challenges. Participants frequently cited resource constraints, such as limited financial and technological capabilities, as significant barriers. The initial investment required for digital infrastructure and the ongoing costs associated with maintaining dual supply networks can be daunting for SMEs. Additionally, a lack of expertise and digital literacy among staff was identified as a critical impediment, necessitating substantial training and support. Furthermore, the interviews revealed a cautious optimism among participants. While they acknowledged the strategic importance of digital dual supply networks, there was also an awareness of the practical difficulties in implementation. Participants expressed a need for targeted support from government and industry bodies to facilitate this transition, including financial assistance, training programs, and access to reliable digital platforms.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.1. Introduction

The purpose of this research was to explore the adoption of digital tools, specifically the DDSN. This was not only to assess the preparedness of SMEs in the Capricorn District in terms of digitalisation but to gain insight into their existing operating approaches and their business networks. This chapter summarises the study's major results, draws conclusions, and makes suggestions to stakeholders including investors and policymakers, SMEs, and other researchers.

5.2 Significance of the Research:

This research contributes to the broader discourse on digitalization and SME development in the Capricorn District of Limpopo Province. By highlighting the opportunities and challenges associated with adopting DDSNs, it provides valuable insights for policymakers, business support organizations, and SMEs seeking to navigate the digital transformation journey. In promoting digitalization among SMEs, this research underscores the importance of collaboration among stakeholders, targeted interventions, and a holistic approach that addresses both internal and external barriers to adoption. Ultimately, embracing digital dual supply networks and other digital tools has the potential to drive economic growth, innovation, and resilience within the SME sector in the Capricorn District and beyond.

5.3 Summary of Findings:

5.3.1 Finding: SMEs express a need for training and capacity building initiatives to enhance digital literacy and skills among employees, facilitating the adoption and utilization of DDSNs.

5.3.2 Perceived Benefits: SMEs recognize the potential advantages of adopting DDSNs, including improved supply chain visibility, enhanced inventory management, and better coordination with suppliers.

5.3.3 Barriers to Adoption: Despite recognizing the benefits, SMEs face various obstacles, including financial constraints, resistance to change, and limited access to reliable technological infrastructure.

5.3.4 Need for Support: SMEs express a need for support in the form of training, technical assistance, and access to funding to overcome barriers and facilitate the adoption of DDSNs.

5.3 Implications:

The findings of this study have significant implications for promoting digitalization among SMEs in the Capricorn District:

5.3.1 Policy Implications: Policymakers need to prioritize investments in technological infrastructure, streamline regulatory frameworks, and provide financial incentives to support SMEs in their digitalization efforts.

5.3.2 Business Support Implications: Business support organizations play a critical role in offering training, technical assistance, and funding opportunities tailored to the needs of SMEs. By providing targeted support, these organizations can help SMEs navigate the challenges of adopting DDSNs.

5.3.3 SME Implications: SMEs themselves must recognize the importance of digitalization and invest in employee training, pilot projects, and strategic planning to successfully adopt DDSNs. Embracing digitalization will not only enhance their competitiveness but also position them for long-term growth and sustainability in an increasingly digital world.

5.4 Recommendations

The following are recommendations to various stakeholders.

5.4.1. Research question: "How does the adoption of digital tools, particularly Digital Dual-Supply Networks, affect the competitiveness of SMEs in the local market?",

Based on the findings related to the research question, "How does the adoption of digital tools, particularly Digital Dual-Supply Networks, affect the competitiveness of SMEs in the local market?", the following recommendations are proposed to enhance the competitiveness of SMEs through the adoption of these digital tools:

5.4.1.1 Increase Access to Financial Resources

SMEs often face financial constraints that hinder their ability to invest in digital dual-supply networks. It is recommended that financial institutions, government bodies, and development agencies offer targeted funding opportunities such as grants, low-interest loans, and subsidies specifically designed to support the adoption of digital tools and technologies.

5.4.1.2 Enhance Digital Literacy and Training

A significant barrier to the adoption of digital dual-supply networks is the lack of digital literacy and technical expertise. To address this, training programs and workshops should be organized

to enhance the digital skills of SME owners and their employees. Partnerships with educational institutions and technology providers can facilitate comprehensive training modules that cover the use and benefits of digital supply networks.

5.4.1.3 Develop and Promote User-Friendly Digital Platforms

The complexity of digital tools can deter SMEs from adopting them. It is essential to develop user-friendly digital platforms tailored to the needs and capacities of SMEs. Collaboration between tech developers and SME representatives can ensure that these platforms are intuitive, cost-effective, and scalable, making the transition to digital dual-supply networks smoother and more appealing.

5.4.1.4. Foster Collaboration and Knowledge Sharing

Creating networks and forums where SMEs can share their experiences, challenges, and best practices related to digital dual-supply networks can significantly enhance their adoption. Industry associations and chambers of commerce should facilitate regular meetings, webinars, and peer-to-peer learning sessions to build a supportive community of practice.

5.4.2 Research question: How prevalent is the adoption of Digital Dual-Supply Networks (DDSNs) among SMEs in the region?

Based on the findings related to the research question, "How prevalent is the adoption of Digital Dual-Supply Networks (DDSNs) among SMEs in the region?", the following recommendations are proposed to enhance the prevalence and effectiveness of DDSN adoption among SMEs in the Capricorn District of Limpopo Province:

5.4.2.1 Strengthen Public-Private Partnerships

Collaboration between the public sector, private sector, and academic institutions can play a crucial role in promoting DDSNs. Initiatives such as joint research projects, innovation hubs, and public-private partnerships can provide SMEs with the resources and support needed to adopt digital dual-supply networks.

5.4.2.2 Implement Policy Incentives

Government policies should be designed to incentivize the adoption of DDSNs among SMEs. This could include tax incentives for investments in digital technologies, regulatory support for digital transactions, and the development of robust digital infrastructure in the region.

5.4.2.3 Provide Customized Advisory Services

Offering customized advisory services to SMEs can help address specific challenges they face in adopting DDSNs. Business development centers and consultancy firms can provide tailored guidance on technology selection, implementation strategies, and integration processes, ensuring that SMEs can effectively transition to digital supply networks.

5.4.2.4. Encourage Industry Collaboration and Networking

Creating platforms for SMEs to collaborate and network can facilitate knowledge sharing and collective problem-solving. Industry associations should organize regular forums, peer-to-peer learning sessions, and networking events to foster a community of practice around DDSNs.

5.4.3 Research question: In what ways do SMEs perceive and experience differences between traditional supply chains and Digital Dual-Supply Networks in terms of efficiency, cost-effectiveness, and overall performance?

Based on the findings related to the research question, "In what ways do SMEs perceive and experience differences between traditional supply chains and Digital Dual-Supply Networks (DDSNs) in terms of efficiency, cost-effectiveness, and overall performance?", the following recommendations are proposed to enhance the adoption and effectiveness of DDSNs among SMEs in the Capricorn District of Limpopo Province:

5.4.3.1 Provide Financial Incentives for Digital Transformation

Financial incentives such as subsidies, grants, and tax breaks can encourage SMEs to invest in DDSNs. These incentives should be designed to offset the initial costs of digital adoption and ongoing operational expenses, making the transition more financially viable for SMEs.

5.4.3.2 Strengthen Policy and Regulatory Support

Government policies should be designed to support the digital transformation of supply chains. This includes creating a conducive regulatory environment for digital transactions, protecting data privacy, and ensuring cybersecurity, which are essential for the smooth operation of DDSNs.

5.4.3.3 Develop Public-Private Partnerships

Forming public-private partnerships can leverage the strengths of both sectors to support the adoption of DDSNs. Collaborative projects can provide SMEs with access to resources, expertise, and technology, facilitating a smoother transition to digital supply networks.

5.4.4 Research question: n the use of these digital tools be linked to improvements in supply chain management and overall business processes?

Based on the findings related to the research question, "Can the use of digital tools be linked to improvements in supply chain management and overall business processes?" the following recommendations are proposed to enhance the integration and effectiveness of digital tools in improving supply chain management and business processes among SMEs in the Capricorn District of Limpopo Province:

5.4.4.1 Promote Awareness and Understanding of Digital Tools

Increasing awareness about the specific digital tools available for supply chain management (SCM) and their benefits is essential. Workshops, seminars, and informational campaigns should be organized to educate SME owners and managers on how these tools can streamline SCM and improve overall business processes.

5.4.4.2 Encourage the Integration of Digital Tools Across Business Processes

SMEs should be encouraged to integrate digital tools across all aspects of their business processes, not just supply chain management. This holistic approach can lead to greater efficiency, better data management, and improved decision-making capabilities, enhancing overall business performance.

5.4.4.3 Develop a Supportive Policy Environment

Government policies should support the digital transformation of SMEs by providing incentives for digital tool adoption and creating a regulatory framework that facilitates digital transactions and data security. Policies should also address challenges such as digital divide and access to technology.

5.4.4.4 Foster Public-Private Partnerships

Public-private partnerships can leverage the strengths of both sectors to support the adoption of digital tools. Collaborative initiatives can provide SMEs with access to resources, expertise, and technology, facilitating a smoother transition to digital SCM and business processes.

5.5 Conclusion

The study revealed that while there is significant potential for DDSNs to enhance the competitiveness and efficiency of SMEs in the Capricorn District, several barriers need to be addressed to achieve widespread adoption. Financial constraints, lack of digital literacy, and inadequate digital infrastructure are major hurdles that require coordinated efforts from multiple stakeholders. By implementing these recommendations, SMEs in the Capricorn District can better leverage digital tools to improve their supply chain management and overall business processes. These strategies aim to create an enabling environment that supports digital transformation, enhances efficiency, and drives business growth and competitiveness. Furthermore, SMEs in the Capricorn District can better understand and leverage the differences between traditional supply chains and DDSNs. These strategies aim to enhance the efficiency, cost-effectiveness, and overall performance of SMEs, thereby improving their competitiveness and sustainability in the local market.

5.6 Evaluation of Study and Scope for Further Research

This study tackled literature flaws such as the incapacity of other related studies to evaluate whether the Digital Dual Supply Networks can improve the SMEs processes, improve performance and their collaborative efforts. This study has established itself as a model/blueprint through which researchers as well as additional stakeholders can start discovering more about Digital Dual supply Networks. Future researchers might have to begin exploring the actual impact that DDSN and other digital age technologies would have on the SMEs. There is a need

for future research studies in adding knowledge and explore ways in which the DDNS can assist the SMEs in entirety.

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