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The Impact of Technology-Driven Supply Chain Systems on Market Penetration of SMES In Developing Economies: A Study of Nigerian SMES

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The Impact of Technology-Driven Supply Chain Systems on Market Penetration of SMES In Developing Economies: A Study of Nigerian SMES

by

Olawale Temowo

A Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree

Of

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In the Robinson College of Business

Of

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2024

ACCEPTANCE

This dissertation was prepared under the direction of the *OLAWALE TEMOWO* Dissertation Committee. It has been approved and accepted by all members of that committee, and it has been accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Business Administration in the J. Mack Robinson College of Business of Georgia State University.

Richard Phillips, Dean

DISSERTATION COMMITTEE

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DEDICATION

To God, who authored and finished this crowning achievement… To my family and friends, whose faith and sacrifices kept me a willing vessel to complete this work.

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I am eternally grateful to my committee; Dr. Subhashish Samaddar, Dr. Peter Zhang, and Dr. Satish Nargundkar, whose continuous guidance, relentless feedback and insightful recommendations reshaped this noble mission into a worthy academic contribution. Their wealth of experience and commitment to academic excellence have reshaped my perspective and will form the basis for my entrepreneurial journey henceforth.

I am equally grateful to the many businesses, who eagerly shared their story to provide the indispensable data on which this research is founded. Your supply chains walk now, so that future SMEs may fly.

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ABSTRACT

The Impact of Technology-Driven Supply Chain Systems on Market Penetration of SMES In Developing Economies: A Study of Nigerian SMES

by

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April 2024

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The adoption of Information and Communications Technology (ICT) in supply chain management (SCM) has transformed businesses globally, from large corporations to small enterprises. Emerging market economies have not fully exploited the opportunities technology affords to improve their SCM practices. This lag constitutes a competitive disadvantage for emerging market businesses and economies in global markets, and in domestic economic growth. These economies, whose markets and workforces are dominated by SMEs, can catch up through technology deployment in SCM. Technology adoption offers benefits in scale, efficiency, geographic reach, and market insights.

There exist barriers to technology adoption, which SMEs must surmount. To achieve this, SMEs must be primed to adopt SCM technology, gauged by their preexisting level of technology adoption and the readiness of their ecosystems to deploy compatible technology. SMEs must accurately attribute the gains from deploying such technology. Two indices are popular in tracking supply-chain-driven outcomes; market penetration, which tracks their share of customers in existing markets; and market development, a measure of their entry into new markets.

Within this context, this qualitative research project examines the benefits of ICT adoption in the supply chains of SMEs in Nigeria. The research answers four questions, respectively focused on the status of ICT adoption, the barriers to adoption, the extent of market penetration and development, and the effect of technology adoption on market penetration and development. The study, employing qualitative face-to-face interviews and case studies with 20+ SMEs, reveals that most have incorporated digital technologies into their SCM systems, contributing to revenue growth, profit increase, and customer base expansion. Barriers to adoption include complexity, a talent gap, financial requirements, and vulnerability to digital attacks. Building on these findings, the research discusses implications for emerging supply chains and suggests collaborative opportunities for researchers, stakeholders, and SMEs in emerging economies to facilitate technology adoption. However, a key limitation of the study is that 20 SMEs were engaged in the data collection exercise. The sample size may not be representative of the entire population, and the qualitative nature of the study limits the establishment of direct causality between ICT adoption and market penetration.

INDEX WORDS: Supply Chain Management, Information Communication Technology,
Emerging Markets, Small and Medium Enterprises, Market Penetration

I CHAPTER ONE: INTRODUCTION

I.1 Background of Study

"SMEs are the most important business component in any economy. They play a crucial in role in creating job opportunities for the teeming population and contributes to government fiscal stability in form of tax remittance. Throughout the world, SMEs facilitates economic growth and play a crucial role in addressing poverty, inequality, and unemployment. The sector is the backbone of major developed economies and a critical catalyst for industrial and technological advancement."

Excerpts from Lynda Saint-Nwafor, Chief Enterprise Business Officer at MTN Group Plc on the importance of SMEs.

Globally, developing the capabilities of small and medium enterprises (SMEs) is imperative for fostering socioeconomic development, with these enterprises being fundamental drivers of economic advancement and job creation (Avasilicai, 2009). In both developed and emerging economies, SMEs play multifaceted roles that extend from national to subnational levels, exerting facilitating economic integration, productivity, and innovation.

The ubiquity of SMEs supports their role as engines of economic development, constituting 95% of businesses globally and contributing over 50% to total employment (BIAC, 2016). Their impact is visible from external and internal perspectives, operating nationally and subnational levels. At the national level, SMEs facilitate economic integration into global supply chains, serving as crucial links between local markets and the global economy (World Bank, 2020). Conversely, at the subnational level, SMEs drive productivity and innovation, contributing significantly to job creation and improved living standards (OECD, 2019; United Nations, 2017).

In markets, SMEs foster competitive dynamics, influencing pricing, product design, and

operational efficiency (European Commission, 2019). This competition stimulates innovation and better products and services, especially in sectors requiring localized presence or strong community ties, such as agriculture, tourism, and hospitality. Along the supply chain, SMEs provide essential support services, creating an interconnected ecosystem that fuels economic activities (Asian Development Bank, 2018). They also dominate various segments within the services sector, bringing agility, flexibility, and personalized attention to clients.

While the role of SMEs is widely acknowledged globally, their significance is even more pronounced in emerging economies. In emerging economies, contribution of formalized SMEs to national income (GDP) is estimated at some 40%, with informal SMEs further amplifying these numbers (World Bank, 2020). Given the prevalence and significance of SMEs, there is a pressing need for these enterprises to adopt effective tools, technologies, practices, and strategies. This is particularly relevant in supply chains, where technology utilization can empower SMEs to access vast opportunities offered by market globalization. Consequently, this study seeks to contribute to both academic and industry knowledge by evaluating the impact of adopting ICT-driven supply chain systems on the market penetration and market development of SMEs in emerging markets.

In recent decades, information and communication technology (ICT) have rapidly advanced, leading to increased adoption and utilization of the Internet. These advancements have streamlined business operations and trade, enhancing the design and cost-effectiveness of SCM (Manochehri, Esmail, & Ashrafi, 2012). In developed markets, ICT tools have been widely embraced in SCM, enhancing operational efficiency and economic performance. Adoption levels of technology in supply chains within emerging market economies remains low, creating a disparity between global Fortune 500 companies and businesses in Sub-Saharan Africa (Ejem et al., 2021).

Poor adoption of comprehensive ICT-based commerce in SME operations in developing countries hinders their ability to become more globally competitive (Rahayu & Day, 2017; Tob-Ogu et al., 2018; Zafar & Mustafa, 2017). This research emphasizes the crucial role of ICT in SMEs at the domestic level, highlighting its importance for economic prosperity of emerging economies, particularly in Nigeria (Rahayu & Day, 2017; Yunis et al., 2017).

I.2 1.1 Research Problem

ICT tools have been extensively employed in global SCM by large organizations to enhance operational efficiency and focus on core value-creation activities. However, the practical implementation of ICT in SMEs is still in its nascent stage (Heeks, Subramanian, & Jones, 2015). Inspite of the wide recognition of the benefits offered by ICT, SMEs have been slow in incorporating ICT tools into their SCM practices. This is particularly true in Nigeria, where the need for and relevance of SCM have been amplified by the recent wave of ecommerce adoption and the subsequent globalization of the domestic economy. The positives of SCM in Nigeria remains under-utilized by SMEs, due to various inhibiting factors. Furthermore, research interest in this area remains limited. Despite the demonstrated importance of ICT adoption in supply chains, there is a dearth of literature examining the adoption of ICT in SCM by Nigerian SMEs and its impact on their market penetration.

In recognition of this gap in literature, this study attempts to comprehensively assess the impact of ICT-driven SCM on the market penetration of Nigerian SMEs, thereby serving as a microcosm for emerging markets. By conducting a thorough investigation into this topic, this research expands existing knowledge base and presents insights into the transformative effects of ICT adoption in the supply chains of SMEs in Nigeria and other similar economies. To achieve these, the research explores the transformative potential of technology adoption in the supply

chains of SMEs, particularly in emerging economies, by examining its impact on supply chain strength, measured by market penetration and market development. With a view on practical applications, this research x-rays the intersection of SMEs and technology adoption in supply chains, aiming to enhance our understanding of how technological advancements empower SMEs in emerging economies, leading to improved market presence and overall growth. The findings deepen body of knowledge on the strategic role of technology in strengthening the SCM systems of Nigerian SMEs.

I.3 Research Aim and Objectives

To proffer solutions to the research problems, the aim of this study was to provide empirical evidence on the impact of ICT-driven SCM on market penetration of Nigerian SMEs. Other subtending objectives were:

I. To examine the nature of ICT adoption in SCM systems by Nigerian SMEs.

II. To identify barriers to ICT adoption in supply chain system in Nigerian SMEs.

III. To assess the supply chain strength of Nigerian SMEs as it applies to market penetration and market development.

IV. To evaluate the impact of Nigerian SMEs' ICT adoption in SCM based on their market penetration and market development as measured in III above.

I.4 Research Questions

In view of state research objectives highlighted above, the study seeks to provide data-driven findings to these set of questions.

I. **Adoption:** How well has ICT been adopted in supply chain management systems by Nigerian SMEs?

II. **Barriers:** What are the barriers to ICT adoption in supply chain systems of Nigerian SMEs?

III. **Penetration:** What is the level of market penetration and market development attained by SMEs in Nigeria?

IV. **Impact:** How does technology-driven supply chain impact market penetration and market development?

I.5 Overall Research Method

This study follows an engaged scholarship approach, drawing upon relevant insights and utilizing qualitative methods to evaluate the impact of ICT-driven SCM on the market penetration and market development of Nigerian SMEs. The engaged scholarship framework, as advocated by Mathiassen (2017) and Van de Ven (2007), provides a robust foundation for investigating complex research subjects by incorporating the perspectives of multiple stakeholders.

To guide the research, two frameworks were utilized. The first framework focused on the configuration, flows, and complexity of supply chains. This framework enables thorough comprehension of the structure and dynamics of supply chains, enabling an assessment of the role of ICT in enhancing efficiency, coordination, and responsiveness within the supply chain (Mentzer et al., 2001; Lambert & Cooper, 2000). By examining the configuration and flows within supply chains, the research aimed to highlight constraints, inefficiencies, and suggests areas for further refinement through ICT adoption.

The second framework involves a triple intersection of technology, organization and environment, addressed the factors that drive adoption of technology by organizations, outlining limitations and challenges associated with technology use in SMEs. This framework considered the unique characteristics and resource constraints faced by SMEs when adopting and implementing ICT tools (Premkumar & Roberts, 1999; Huq & Gilbert, 2014). By analyzing these factors within SME context, such as financial constraints, technological complexity, and organizational readiness, the research aimed to understand the barriers and enablers for ICT-driven SCM in Nigerian SMEs.

I chose the engaged scholarship approach for its ability to connect the nexus between academia and practice, allowing for a mutually beneficial exchange of knowledge and the generation of practical recommendations. By involving multiple stakeholders and considering their perspectives throughout the research process, the study aimed to generate insights that are relevant and applicable to aspiring and existing researchers in the field of SCM and ICT adoption in SMEs.

The elements of the engaged scholarship framework are summarized below.

I.5.1 *Area of Concern*

This research primarily focuses on investigating the adoption and deployment of technology by emerging market SMEs' in expanding their market reach.

I.5.2 *Theoretical Framing*

The research relies primarily on the TOE framework, a comprehensive theoretical lens that examines the connectivity between factors shaping technology internally and externally. TOE is commonly used to analyze how these factors influence SMEs in adopting and implementing technology in their supply chains (Bharati & Chaudhury, 2006). The TOE Framework unravels

valuable information on determinants of adoption decisions, such as the compatibility of technology with organizational needs, resource availability, management support, and market conditions. Adapting the framework to the research, the study built on the configuration, flows, and intricacies of supply chain relationships, as proposed by Samaddar et al. (2005) and Choi et al. (2001). This framework provides a comprehensive understanding of supply chain dynamics and serves as a foundation for analyzing the impact of technology adoption in SMEs' supply chains, putting specific context of emerging markets into consideration.

It is also important to evaluate factors such as technology infrastructure, digital literacy, data management, integration, and overall technology governance. This proved useful in identifying areas where SMEs need to enhance their capabilities to effectively leverage technology in their supply chains, exploring factors that limit, differentiate, and enhance the effectiveness of technology use in supply chains by SMEs. The framework forms the basis for the work of Ejem et al. (2021), whose studies highlighted the pros and cons of adopting and implementing technology in SME’s supply chain operations.

I.5.3 *Research Method*

The research embraced qualitative case interviews conducted with Nigerian SMEs that operate within contemporary supply chains. This approach allows for a thorough understanding of the viewpoints, perspectives, and challenges faced by SMEs in relation to technology adoption in their supply chains. Technology startups and other relevant stakeholders across the supply chain were also interviewed, providing a comprehensive understanding of the ecosystem.

I.5.4 *Contributions to Practice and Academia*

By investigating the impact of technology utilization in SMEs' supply chains in Nigeria, this study strives to better understand how technological advancements can empower SMEs in

emerging economies, leading to improved market presence and overall growth. Insights from this research would widen knowledge frontiers on the strategic role of technology in facilitating the success of SMEs within the dynamic business landscape of emerging economies.

The research has practical implications for stakeholders in emerging economies. Firstly, it seeks to identify barriers to technology adoption in SME supply chains. By shedding light on these barriers, the research has the potential to drive increased technology adoption in SME supply chains within emerging markets. Furthermore, the findings of this research aim to guide businesses in improving their market coverage through the effective use of technology-driven supply chains.

This research seeks to generate interest and stimulate further research in the field, not only within academic institutions but also through parallel research channels present in the start-up ecosystem. The research contributes to the advancement of knowledge in supply chain technology and its application in emerging market contexts, thereby narrowing the dichotomy between academia and industry.

II CHAPTER 2: LITERATURE REVIEW

Structure of Literature Review Process

Table II.1: ***Literature Review Structure***

Topical Focus	Summary	Relevant Findings
Research Framing and Context		
Supply Chain Management	Review of this thematic area reveal the contributions of technology to each activity. This can indicate the most beneficial areas to focus on to drive technology adoption in emerging market supply chains.	Supply chain as defined by Okon (2018) is the agglomeration of individuals, groups of individuals, resources and networks in the production, distribution and utilization of a product. The three main supply chain flows are product flow, information flow, and financial flow. SCM involves coordinating and integrating these flows both within and among companies (Okon, 2018).
Technology in Global Supply Chains	A look at technology use in global supply chains to establish trends and standards.	While 78% of Fortune 500 companies leverage technology-driven supply chains, this is true for only 52% of businesses in Sub-Saharan Africa (Ejem et al, 2021). Companies in Sub Saharan Africa are confronted with significant infrastructure deficit (Apulu and Latham, 2011, Tob-Ogu et al., 2018).
Alternative Drivers of Market Penetration and Development	An exploration of factors besides supply chain technology use that could drive market penetration and development	The following were identified as alternative drivers of market penetration: marketing strategies, pricing strategies, distribution channels, product differentiation, market research and insights, and customer service and support (Akamoh, 2015).
Barriers to Technology Adoption	Review of factors limiting effective utilization of technology by SMEs.	Integrations are not optimal, however, especially with multiple providers in multiple locations and diverse levels of technological competence (Barratt, 2004). The quality and volume of information a business can glean from its supply chain can be severely limited by its size and funding level. This reduced information flow can limit the market penetration of a business (Agwu, 2018).
Mechanism of SME Contribution to Economic Growth	A review of SME market penetration and market development as mechanisms of economic growth	SMEs in emerging markets like Nigeria contribute to economic growth through job creation, innovation, and market competition" (OECD, 2017; Umar and Alasan, 2021; Adio et al., 2018). Market penetration and technology adoption are crucial for SMEs to overcome infrastructural challenges and optimize supply chains, enabling greater market penetration and sustainable growth (European Commission, 2019; Ejem et al., 2021).
SMEs in Nigeria: A Snapshot of Emerging Markets	A review of technology use in supply chains in emerging markets	According to Ejem et al (2021), over half of SMEs in Nigeria outsource their logistics activities. This includes inbound and outbound transportation; custom clearing and forward; warehousing, etc. Of the active population in Nigeria, more than 70% are employed in the low-yielding informal sector, which is dominated by fragmented state of the informal MSME ecosystem (World Bank, 2005). Fasua (2006) categorized SMEs into three segments, small, medium and large based on the scale of their operations and their value creation activities (Fasua, 2006).

The engaged scholarship framework requires a comprehensive literature review. Each topical focus allows for systematic approach in reviewing literature, determining best research design method for data collection and enables the study offer evidenced-based recommendations to the identified problems. (Mathiassen, 2017). To effectively utilize the engaged scholarship framework, a comprehensive literature review is required for clear problem definition and context-setting in this study (Edmondson, 2011; Van de Ven, 2007). The literature review was conducted according to the structure in Table 2.1 above.

II.1 Supply Chain Management

Supply chain management (SCM) refers to management of flow of goods and services encompassing movement of storage of raw inputs, work-in-process inventory, and finished products from source to destination. The SCM framework includes procurement, operations management, logistics, and distribution, with the ultimate goal being converting intermediate or semi-finished products into finished items for consumption (Wieland & Wallenburg, 2011; Kozlenkova, Irina 2015; Ghiani, Laporte & Musmanno, 2004). An activities-focused definition of SCM highlights tasks such as design, planning, execution, control, and monitoring, all aimed at creating value by establishing a competitive infrastructure, leveraging global logistics, synchronizing supply with demand, and measuring performance on a global scale (Harland, 1996; Sanders & Wagner, 2011). To this end, the interconnected networks and businesses within a supply chain collaborate to provide products and services to end customers (Sanders & Wagner, 2011).

Since the 1990s, SCM has become more prominent in both research and practical application. Stevens (1989) conceptualized the supply chain as a series of connected activities involved in planning, coordinating, and transiting materials and goods from suppliers to customers. Lee and Billington (1992) defined it as platform for obtaining factors of production, producing

intermediate products, and distribution to end users. The Supply Chain Council of America defined SCM as encompassing every action undertaken in the manufacture and delivery of a product. Various scholars, including Copacino (1997) and Evas et al. (1995), offered nuanced perspectives, respectively defining SCM as the art of managing material flow, connecting suppliers, manufacturers, distributors, retailers, and end-users. Mentzer et al. (2001) characterized SCM as a strategic harmonization of activities within a supply chain, aiming to productivity and strengthen competition (Davis, 1993; Gray et al., 2013; Li et al., 2006). Recognizing SCM's boundaries is crucial for enhancing supply chain performance (Hervani et al., 2005), and a structured and systematic approach to SCM is required to access its benefits (Croxton et al., 2001).

SCM adopts an integrated, multidisciplinary, and multimethod approach (Sanders, & Wagner, 2011), with market channels playing a pivotal role (Kozlenkova, et al. 2015). In developing and penetrating markets, SCM integrates processes from manufacturers to end-users, creating valuable products, services, and information (Lambert, Cooper & Pagh, 1998). The supply chain process kickstarts with raw material sourcing to finished product delivery, including various product-related services like waste management and recycling (Mentzer et al. 2001). It relies on information systems, deployed in various elements of business functions such as resource planning, risk management and vendor management among others. In a functional economy, SCM contributes more potently to job creation, pollution reduction, energy conservation, and improved living standards (Rajeev, et al. 2017). While sharing goals with supply chain engineering, SCM focuses on a more traditional-driven and business-focused approach, distinguishing it from the mathematical model-based approach of supply chain engineering (Németh et al. 2020).

II.1.1 *Supply Chain Players and Functions*

Given its global ubiquity and the relevance of technology to the flows in its supply chain, the fashion industry is used as a reference point, as introduced in section 2.1 to create a simple narrative of how supply chain works in practice. The fashion industry is characterized by a complex network of supply chain players that collaborate to deliver products to end-users. Understanding the roles and relationships among these players is essential for comprehending the dynamics of the industry. This section outlines the critical functions of key players involved in the fashion supply chain.

Importers. Importers, such as Ekeh Uche and Sons, are an integral part of the fashion supply chain by sourcing products from international suppliers and providing them to local buyers. These products typically serve as inputs for further production, including raw materials and intermediate goods. The involvement of importers highlights the global scale of the fashion industry and its reliance on international trade (Smith, 2020).

Manufacturers and producers. Manufacturers and producers, exemplified by Da Viva, are the primary producers in the domestic supply chain. They utilize inputs from both local raw material suppliers and importers to create finished goods. Compared to other players, manufacturers and producers are considered upstream suppliers as they operate earlier in the production process. In the case of Da Viva, they specialize in producing printed cotton fabrics, commonly referred to as *Ankara* (Jones, 2019).

Retailers. Retailers serve as key intermediaries in the fashion supply chain, connecting manufacturers and producers with end users. They have the closest interaction with consumers. Retailers are primarily responsible for final distribution to end users. Multi-brand retail stores like Debra's Grace, Grey Velvet, and 41 Luxe are typical examples of retailers in the fashion industry.

Retailers play a critical role in shaping consumer demand through their assortment choices and marketing strategies (Gupta & Arora, 2018).

Agents. Agents act as intermediaries, facilitating the redistribution of resources between vendors and downstream suppliers. Their main function is to manage the flow of information regarding specifications, volumes, pricing, and demand cycles. Acting as intermediaries, agents broker relationships among various supply chain players without owning the product or inventory themselves. They are often individuals who possess industry expertise and have established networks within the fashion industry (Smith & Johnson, 2021).

Corporate clients. Corporate clients, although technically customers, are unique in that their demand influences the upstream supply choices. These clients exert considerable influence on the nature and volume of products they receive from the SME, who is the keystone supplier. In the fashion industry, corporate clients often demand branded uniforms and costumes, as seen in the case of airlines requiring uniforms for their cabin crew (Chen et al., 2020).

Service providers. Service providers contribute to the fashion supply chain by offering non-physical goods or services. Their expertise and intellectual input are essential to the production process. Fashion businesses rely on designers, marketing consultants, and content creators to enhance their product offerings and brand image (Roberts & Fletcher, 2019).

Wholesalers. Wholesalers are important facilitators of demand in the fashion industry. They acquire finished goods from the keystone supplier or receive them on consignment for distribution to retailers. Wholesalers are key in facilitating efficient distribution and availability of products across various retail channels (Chopra et al., 2022).

Distributors. Distributors are responsible for transporting finished goods from the producer to consumers. Operating between players in the demand chain, distributors play a critical role in logistics. large and small logistics service providers, including international players such as UPS, continental players such as Kobo 360, and local players such as GIG Logistics, contribute to the distribution process (Fernie & Sparks, 2021).

Keystone suppliers. In some cases, the keystone supplier or producer may choose to distribute or sell their own products directly through outlets or digital channels. Physical outlets refer to self-branded stores that exclusively carry the manufacturer's products, while online channels typically involve brand websites tied to physical distribution channels. Direct selling allows the keystone supplier to have greater control of the market (Christopher et al., 2020).

Retail customers. Retail customers are the ultimate end users of the products made by the keystone supplier or producer. They operate at the penultimate leg in the fashion supply chain, consuming and experiencing the products that have traversed through various stages of production and distribution (Fletcher et al., 2021).

Understanding the functions of the players is essential for analyzing the fashion industry supply chain structure from a holistic perspective. The complex web of relationships among importers, manufacturers, retailers, agents, corporate clients, service providers, wholesalers, distributors, outlets, direct sellers, and retail customers forms the foundation of the fashion ecosystem.

II.1.2 *Supply Chain Flows*

The work of Zailani (2012) identified three key flows within the supply chain, namely; the product flow, the information flow, and the financial flow. SCM is concerned with the effective

and efficient coordination of these flows among various stakeholders along the supply chain. In the 21st century, the management of these flows is enhanced with the utilization of ICT (Zailani, 2012).

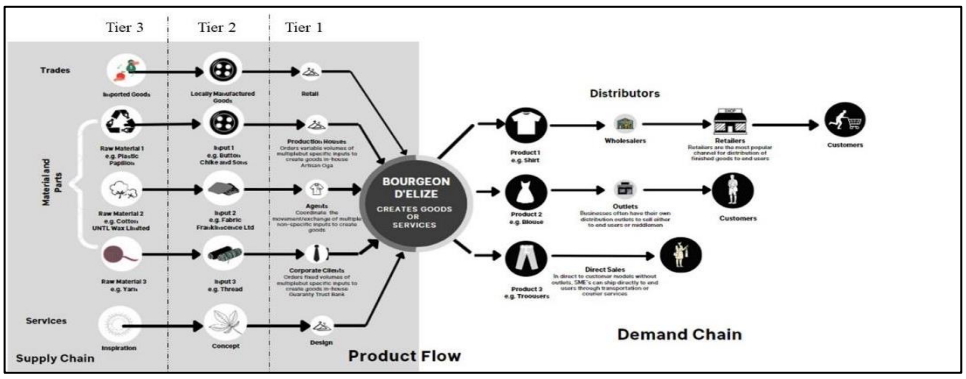
- *Product flow* pertains to the physical conveyance and transformation of goods and materials throughout the supply chain. It speaks to elements such as such as sourcing, manufacturing, warehousing, shipping and distribution. Product flow ensures the easy transfer of physical products from suppliers to manufacturers, and subsequently to distributors or retailers, and ultimately reaching the end customers (Simchi-Levi et al., 2018).
- *Information flow* involves the timely and accurate information exchange in the supply chain. It encompasses activities such as order processing, demand forecasting, inventory tracking, production planning, and coordination among supply chain partners. Effective information flow enables real-time visibility and coordination, facilitating improved planning and optimization of supply chain performance (Lambert and Cooper, 2000).
- Financial flow speaks to monetary transactions involved in the supply chain. It encompasses activities such as invoicing, billing, payment collection, financial settlement, book-keeping, account reconciliation, financial documentation. Proper management of financial flow ensures timely payment, cost control, and enhanced financial stability in the

supply chain (Chopra and Meindl, 2021). The figure paints a picture of the supply chain flow for a fashion SME.

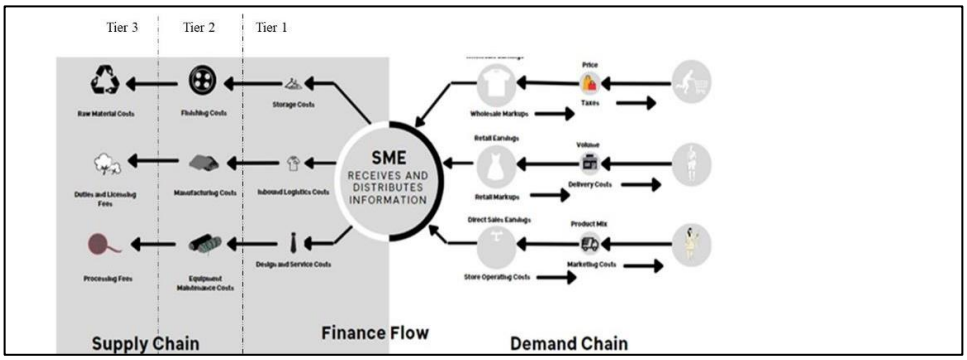
Table II.2: ***Supply Chain Flows, Benefits, and Purpose***

Process Type	**Benefits**	**Purpose**	
Product Flow	Improves quality control and shipping optimization	More effective supplier's management.	Identifying and engaging supply chain players to work with – vendors, distributors, etc.
Information Flow	Shipping optimization	Drive comprehensive supply chain visibility	Leverage technology as an early warning system
Financial Flow	Improves cash flow	Reduce time in inventory and warehouse costs	Improve supply chain agility through financial management

Product Flow



Financial Flow



Information Flow

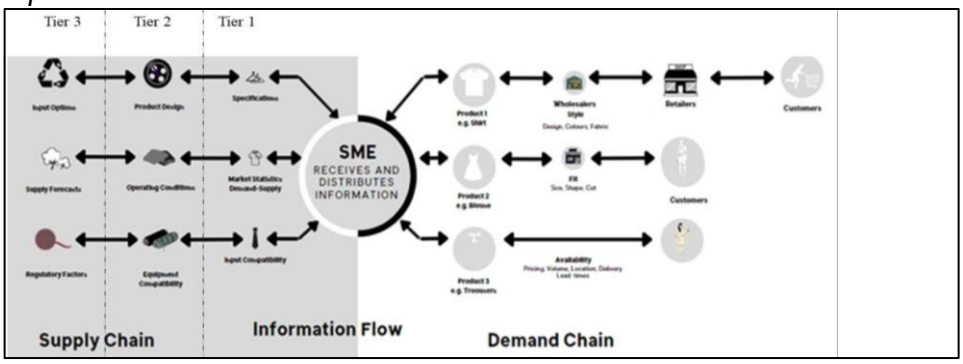


Figure II.1: ***Typical Supply Chain Flow (for a fashion SME)***
Source: Samaddar et al (2005)

As the Product Flow in figure 2.1 shows, the focus in this flow is on analysis the product and material flows in a three-tiered supplier structure—which features a mix of manufacturers, intermediate processors, agents, and finishers. Each tier plays a unique function in the supply chain

in driving the product flow. However, these roles are less distinct in the information and financial flow.

In the figure 2.1, the case study uses a fashion production business called *Bourgeon d'Elize*, which operates in Lagos, Nigeria, and specializes in the production of bridal garments and premium womenswear, as a case point.

To facilitate the supply chain flow described above, various players operate in both the supply and demand segment of the supply chain, positioned on either side of the keystone player (shown in the central circle for each flow). A keystone player is the pivotal entity within a supply chain, holding immense influence and performing critical functions that directly impact the ecosystem's success (Haksöz, 2013). The other players can be characterized as follows.

The *suppliers* along the supply chain are categorized into tiers based on their proximity to the keystone supplier/producer. Tier 1 suppliers are the closest to the keystone supplier, while Tier 3 suppliers are the farthest away from the keystone supplier. The consistency of inputs supplied varies across these tiers, with Tier 1 inputs being the most finished, and Tier 3 inputs being the least finished. Examples of Tier 3 inputs include harvested cotton, chemicals for plastic products, and timber, while examples of Tier 1 inputs include cotton fabric, plastic buttons, and wooden toggles.

This tiered supplier structure provides insights into distinct levels of both processing and value addition being undertaken in the supply chain. Understanding the tiers helps in comprehending the flow of materials and products—as well as the coordination required among suppliers at each level to ensure a smooth supply chain operation.

II.1.3 *The Differentiating Role of Product Flow in Emerging Economies*

The three flows (product, financial, and information) are interconnected and interdependent. As such, they require effective coordination and integration to ensure seamless operations, minimize disruptions, and enhance overall supply chain performance (Christopher, 2016). In the literature on emerging markets, it is widely recognized that financial and information flows are more commoditized across businesses due to limited access, lagging adoption and regulations (Christopher, 2016; Ivanov & Sokolov, 2017). Financial flows involve the transfer of funds, payments, and financial transactions between different entities in the supply chain. These flows often follow standardized processes and utilize established banking systems, payment gateways, and financial institutions. The use of international accounting standards and local regulations further enhances the consistency and interoperability of financial flows across businesses.

The commoditization of financial and information flows across businesses brings several advantages, including promoting accountability, lowering costs of transactions and enhancing supply chain operational efficiency. It allows for better visibility and tracking of financial transactions and enhances the speed and accuracy of information exchange.

More importantly, inspite of commoditization of financial and information flows, variations can still exist in systems, technologies, and platforms used by different businesses. Factors such as organizational size, industry sector, and technological capabilities can influence the level of standardization and effectiveness of these flows within individual businesses.

However, the product flow can vary significantly among businesses, who operate in low infrastructure environments. Businesses can gain an edge in product flows through differences in physical distribution networks as well as technological capabilities. Admittedly, this flow is premised on information exchange related to various supply chain factors, including demand

forecasts, inventory levels, production schedules, transportation status, and customer feedback. Yet, the quality, accuracy, timeliness, and accessibility of this information is largely dependent on the physical infrastructure along the supply chain. As such, they can vary depending on the systems, processes, and technologies employed by different businesses. As such, this research prioritizes the impact of technology as manifested through product flows.

II.1.4 *Technology as a driver of Information Flow*

As far as supply chain is concerned, information flow plays a critical role and significantly impacts on the financial and product flows. Indeed, most businesses gain their technological supply chain advantages through information systems. The information flow not only performs its own functions but also acts as a facilitator for the other two flows. Without efficient information flow, the financial and product flows would be limited. Therefore, it is crucial to examine the ICT infrastructure, particularly the software layer, in supply chains.

In today's competitive business environment, effective management of information flow through technology can provide serve as a source of competitive advantage for entities. Following are some ways in which information flow can create such an advantage.

Real-time visibility. Technology-enabled information flow provides visibility in real time into distinct aspects of the supply chain, enabling data-driven decision-making and quick responsiveness to changes. This leads to optimized inventory levels, reduced stockouts, minimized transportation delays, and overall enhanced supply chain efficiency (Kamble et al., 2020).

Collaborative planning and coordination. Through technology, information flow facilitates collaborative planning and coordination among supply chain stakeholders. Cloud-based platforms, data sharing portals, and collaborative tools facilitates exchange of information in real-time. This empowers players in the supply chain to anticipate future demand, make plans for

production and inventories. This results in improved coordination, reduced lead times, and better alignment of supply chain activities with customer demand (Cui et al., 2019).

Enhanced communication and connectivity. Information flow through technology improves communication and connectivity across the supply chain. Communication channels such as emails, instant messaging, and video conferencing enable faster and more effective communication between suppliers, manufacturers, distributors, and customers. This promotes better understanding, proactive problem-solving, and timely decision-making.

Data analytics and insights. Information flow facilitates creation of value from data. Through information flow, supply chain actors can source, analyze and extract valuable information on prevailing and future trends within the industry. Sophisticated analytics such as generative artificial intelligence can extract valuable insights from this data, allowing for data-driven decision-making, trend identification, and performance monitoring. Access and use of data helps supply chain players to identify gaps and take data-driven actions in bolstering operational efficiency.

Risk management and resilience. Effective information flow through technology allows for improved risk management actions in supply chains. Early warning systems as well as monitoring of supply chain operations helps supply chain operators determine existing and future risks that could pose challenges to supply chain systems. Through effective information flow, supply chain actors can devise approaches that would help minimize exposure to systematic risks. This enhances the resilience of the supply chain and forestalls the occurrence of favorable events.

Enhanced Data Analytics. Technology empowers advanced data analytics and insights from the vast volumes of supply chain data. Supply chain actors ranging from suppliers, manufacturers to distributors can tap into the opportunities offered by data to glean valuable

information into critical aspects of the supply chain. These insights drive informed decision-making, process optimization, and strategic planning, thereby providing a competitive edge (Akter et al., 2020b).

Agility and responsiveness. Technology-enabled information flow enhances supply chain agility and responsiveness. Access to real-time data and insights quickens responsiveness to changes in demand, supply, or market dynamics, allowing for rapid adaptation of supply chain operations. This leads to quicker response times, lowered turnover period and betterment in customer service delivery (Mandal, 2019).

Innovation and differentiation. Technology-driven information flow fosters creativity and differentiation in the supply chain. Capitalizing on the opportunities presented by modern technologies such as the Internet of Things (IoT), artificial intelligence (AI), and blockchain enables businesses to capture and analyze data from connected devices, automate processes, and ensure data integrity and security. Such innovative approaches to information flow differentiate businesses from their competitors, leading to increased competitive advantage (Gajek et al, 2022).

II.2 Technology in Global Supply Chains

To drive market penetration and expansion, two main types of technology are prominent in supply chain systems: hardware and software. Since the late 90's, discourse on technology have typically revolved around software and ICT, which have become more ubiquitous. This emphasis can be attributed to the increasing awareness of recent innovations in modern ICT environments, making digital information systems, characterized by a reduced reliance on tangible actions, distinct from traditional information storage methods such as bookkeeping, which rely on tangible media and observable actions. This bias is furthered by the prevalence of computers as the primary medium for ICT (Laudon & Laudon, 2016).

When considering hardware and physical infrastructure, however, the landscape becomes more intricate. The wheels on a basic cart used to transport pallets or the crowbar used to open boxes are simple machines—technological artifacts that have existed for thousands of years. Such tools typically do not confer a competitive advantage, as they are commonly used across various supply chains and tools of a particular type are often indistinguishable from each other. In contrast, other hardware components, such as RFID chips and specialized lifting equipment, possess unique advantages that enhance process efficiency. Pieces of equipment such as these are distinct differentiators for effective SCM. Moreover, they tend to seamlessly integrate with digital information systems (Cao, Zhang, &Sarkis, 2000; Simchi-Levi, Kaminsky, & Simchi-Levi, 2008).

In the context of this research, the term "technology" encompasses modern hardware and software that provide operational functions in supply chain operations. This definition encompasses all software applications employed in supply chains and all hardware capable of leveraging or integrating with such software without requiring significant modifications. For instance, ICT in SCM pertains to the use of inter-organizational systems for information exchange and processing across organizational boundaries. Therefore, in addition to internal ICT systems, such as those for enterprise resource planning (ERP), identification technologies such as RFID are also considered to be within the scope of this investigation (Fasanghari et al., 2008; Gunasekaran & Ngai, 2004). Some of these technology tools are presented in Table 2.3 and Table 2.4 below.

Table II.3: ***Examples of Supply Chain Technology***

Technology Category	**Hardware Example (Infrastructure Layer)**	**Software Example**
Planning	Digital Communication Equipment	Generative and predictive AI, Data Analytics, Product Lifecycle Management (PLM) Software
Sourcing	Manufacturing Equipment, RFID Equipment, Sensors	AI/ML, Data Analytics, PLM Software, Electronic Data Interchange (EDI), Product Design Software, Procurement and Order Management Software, Material Requirements Planning Software, Blockchains
Manufacturing	Robotics, Smart Manufacturing Equipment, Sensors	AI/ML, EDI, Data Analytics, Tracking Software, PLM Software, Manufacturing Execution Software, Blockchains
Deliver	Sorters, Automobiles, RFID Equipment, Automated Trucking, Sensors	AI/ML, Data Analytics, Tracking Software, EDI, Internet of Things, PLM Software, Shipping Software & Online Platform, Point of Sales Software, Blockchains
Return	Transport Equipment, RFID Equipment	AI/ML, EDI, Data Analytics, Tracking Software, Internet of Things, PLM Software, Blockchains

Table II.4: ***Information Technology in Supply Chain Infrastructure***

ICT infrastructure capability	**Thematic Construct**	**Supporting References**	**Brief explanation**
Incorporation of ICT in SCM	EDI integration	Truman 2000	Two types of EDI integration exist in literature. Firstly, integration between EDI and internal systems and integration among internal systems.
	EDI embeddedness	Chatfield 2000	Measured by collaborative strategic actions and EDI integration with internal systems.
	System integration	Barua et al., 2004	Information exchange across the supply chain.
	ICT infrastructure integration	Rai et al., 2006	Consistency in transfer of supply chain information.
	IS integration	Saraf et al, 2007	IS applications working in wholesome.
SC ICT flexibility	IS flexibility	Saraf et al, 2007	IS applications open to adjustments.

Source: Reddy (2021)

II.2.1 *Information and Communication Technology*

The concept of ICT serves as an expansive descriptor for Information Technology (IT) with a focus on unified communications (Murray, 2011). It encompasses telecommunications (encompassing telephone lines and wireless signals) and computers, coupled with essential enterprise software, middleware, storage, and audiovisual components. This incorporation empowers people to not only obtain, keep, and disseminate information but also comprehend and

manipulate it. The concept of ICT is also employed to denote the unification of audiovisuals and telephone networks with computer networks via a unified cabling structure. The gains in amalgamating telephone and computer networks into a single, cohesive structure are significant, involving unified cabling, signal distribution, and management. ICT encompasses a wide array of communication devices, ranging from radio, television, and cell phones to computer and network hardware, satellite systems, and associated services like video conferencing and distance learning. This broad term extends to analog technologies, including paper communication, and any mode facilitating the transmission of communication (Ozdamli, & Ozdal, 2015). As a multifaceted field, ICT's concepts are in a constant state of evolution (Blackwell, Lauricella, & Wartella, 2014). It encompasses products capable of electronically keeping, restoring, manipulating, sending, or receiving information in digital form, such as personal computers (including smartphones), digital television, email, and robots. Models like the Skills Framework for the Information Age are quite functional in the management of skills and capabilities for ICT professionals in the 21st century (Gillings, et al. 2016).

II.2.1.1 *ICT in Supply Chain Management*

The realm of IT applications in supply chain management (SCM) is still in its early stages, with scholars underscoring the significance of information technology (IT) integration into SCM (Ben-Daya et al., 2019; Marinagi et al., 2014). Zhong et al. (2017) delved into storage technology, data processing, data visualization, big data analytics, and various models and algorithms as key technologies. Meanwhile, Ivanov et al. (2019) explored the relationship between digitalization and risk of disruption in the supply chain. The application worth of radio-frequency identification (RFID) in SCM has been extensively examined (Michael & McCathie, 2005; Musa & Dabo, 2016;

Srivastava, 2004; Tajima, 2007). However, many existing models assume knowledge sharing and limitless flow of information, despite the operational inefficiencies due to technological barriers.

In the face of ever-evolving customer demands, Supply Chain Management (SCM) requires the latest technologies to ensure optimization and maximum efficiency. There is substantial pressure from customers, both individuals and enterprises, for faster and more cost-effective products and services. Technological innovations enable rapid information sharing, precise data analysis, and high-capacity processes within short timeframes. For instance, advancements in IT, particularly in data sharing and communication, are utilized to achieve synchronization and coordination among SCM participants. Tigga et al. (2021) highlight the efficacy and potency of IT capabilities on supply chain performance, emphasizing the importance of technological advancements (Lambert et al., 1998).

Intelligent transportation systems (ITSs) and vehicular ad hoc networks (VANETs) offer innovative approaches to enhance commuter experiences. VANETs, as wireless communication networks, enable vehicles to communicate with each other and fixed roadside units, facilitating cooperative driving applications (Koberg & Longoni, 2019). For effective SCM, IT integration is crucial, enhancing communication, data and information collection and transfer, and overall supply chain performance. Technological advancements and shopping behavior influence Small and Medium Enterprises (SME) retailers to adopt information systems, as explored by Hermawan et al. (2019) (Mentzer et al., 2001). The Internet of Things (IoT) is a significant IT development, connecting physical and virtual objects to enhance flexibility, perceptibility, monitoring, and information dissemination in SCM processes (Zimmer et al., 2017). Organizations are increasingly turning to modern solutions, such as artificial intelligence (AI) for supply chain agility and robotic

machinery and systems to boost organizational performance, decrease costs, and save time (Rajeev et al., 2017).

II.2.1.2 *Categories of ICT in SCM*

In earlier investigations, the application of IT in SCM can be dimensioned from two standpoints: internal and external (Savitskie, 2007; Zhang et al., 2016). Internal IT use involves implementing IT within the internal operational boundaries of an organization to facilitate in-house dissemination of information (Zhang et al., 2016; Savitskie, 2007). It encompasses applications within the focal firm that streamline in-house operations and foster synergy among various units within the organization. Traditional systems like ERP showcases instances of IT utilization internally (Zhang et al., 2016). In contrast, external IT use is not tied to a particular use but reflects the degree to which IT, such as EDI, CRM, Internet, or cloud computing, integrates SC actors and digitizes activities beyond the geographical boundaries of an entity (Zhang et al., 2016; Xue et al., 2013). External use of IT synergizes supply chain actors across the supply chain ranging from suppliers, distributors, warehouse facility providers, producers, etc. (Zhang et al., 2016; Gonzalvez-Gallego et al., 2015). Supply-side IT use harmonizes vendors and automate supply-side driven functions like input sourcing, procurement and stock management, while demand-side IT use also harmonizes customer-driven business functions and automate customer-side activities such as delivery and selling (Xue et al., 2013). These respectively apply to the supply and demand chains discussed in section 2.1.4

While internal IT use, exemplified by ERP systems, helps firms manage interruptions to a limit by superintending over in-house processes, there remains a challenge in collecting external information through this approach (Zhang et al., 2016). Despite the availability of modern applications and IT tools and resources for in-house operations in most firms, coping with SC

disruptions still poses difficulties. On the contrary, Leveraging IT to synergize activities between suppliers, producers, distributors and customers broadens and deepens information, influencing the effectiveness of responses, adaptations, and recovery from SC disruptions. For instance, amidst the negative outcomes attributed to covid-19 pandemic, Haier demonstrated resilience by relying on robust external IT harmonization with global partners for strategic planning around production and distribution, ensuring quality delivery of services to customers even in turbulent period.

II.2.2 *The Role of Technology in Supply Chain Management*

Technology is sine qua non in supply chain management, and its impact on business performance can be twofold. Firstly, technology enables operational efficiency in SCM. Through automation, data analytics, and other advanced technologies, efficiency of supply chain operations can be strengthened to reduce costs, improve productivity, and enhance overall operational efficiency (Alicke et al., 2003). This allows them sell their offerings at affordable yet competitive prices, attracting price-oriented customers and gaining increased market share. While this aids market penetration, it is not the primary mechanism through which technology enables market penetration (Swaminathan & Tayur, 2003).

Secondly, technology can drive topline sales growth resulting from market penetration. By harnessing the opportunities presented by technology in supply chain management, companies would be able improve their ability to reach and serve customers, expand into new markets, and create new sales channels (Aryapadi et al., 2020). This is the primary mechanism through which technology drives market penetration. For example, e-commerce platforms and digital marketplaces enable companies to retail products or services online, reaching a broader customer base and increasing their market penetration. Additionally, technology can enable companies to customize their products or services based on customer preferences, gather data on customer

behavior and preferences, and use that data to develop targeted marketing campaigns to drive sales growth and increased market penetration (Aryapadi et al., 2020).

II.2.2.1 The Role of Technology in Operational Efficiency for Supply Chain Management

One significant advantage of technology in SCM is in the area of streamlining of processes, which drives faster movement of products at reduced costs. Automation eliminates manual tasks, enhances accuracy, and accelerates operations. For instance, automated inventory management systems improve inventory accuracy, minimize stockouts, and reduce holding cost, leading to cost savings and improved productivity (Alicke, Brintrup & Siemoneit, 2003).

Data analytics is another technology-driven capability that enhances operational efficiency. By analyzing large volumes of data collected throughout the supply chain, companies are able to access in-depth information into demand trends in the market. These insights enable better forecasting, inventory optimization, and overall supply chain planning (Swaminathan & Tayur, 2003).

Furthermore, advanced technologies like internet of things, blockchain supports business forecasting by enabling companies project market trends, demand volume, pinpoint possible constraints and take data-driven and evidence-based corrective action to mitigate risks. Perceptibility in real-time into supply chain operations enhances formulation of decisions and enables quick responses to changing market conditions (Alicke et al., 2003; Swaminathan & Tayur, 2003).

Competitive pricing is another benefit of operational efficiency through technology in the management of supply chain. By optimizing workflow and reducing costs, companies can lower prices on products or services, entice customers largely sensitive to price adjustment, and deepen competitiveness in the market. Price competitiveness remains one of the strongest links between

operational efficiency and geographical reach in driving market penetration, as customers prefer products or services gives them maximum value for their money (Alicke et al., 2003; Swaminathan & Tayur, 2003).

In emerging markets, the link between operational efficiency through technology and market penetration is quite complex. Emerging markets often have unique challenges such as inadequate infrastructure, fragmented supply chains, and limited access to information, which can hinder operational efficiency, elevating cost structure and limiting a business' ability to offer their products or services at competitive prices. However, by leveraging technology, companies can overcome these challenges and improve their supply chain operations, resulting in cost savings and improved operational efficiency. This, in turn, can help them offer their products or services at competitive prices, penetrate the market, and gain market share (Saldanha et al., 2015).

II.2.2.2 The Role of Technology in Topline Sales Growth and New Sales Channels

In a more direct mechanism, technology is pivotal in driving topline sales growth in terms of enabling companies to reach and serve customers more effectively. It plays a pivotal role in creating new sales channels and reaching untapped customer segments in emerging markets. For instance, mobile technology has rapidly expanded access to the Internet and e-commerce in many emerging markets, creating opportunities for companies to reach customers who were previously inaccessible. By utilizing technology to address the unique challenges of emerging markets and tap into new customer segments, companies can achieve revenue growth through market penetration and market development (Bourlier & Gomez, 2016).

E-commerce platforms and digital marketplaces have revolutionized the way companies sell products or services. They provide opportunities for companies to establish an online presence and reach customers beyond traditional brick-and-mortar stores. Technological advancements

facilitate market development by expanding a business' ability to reach its customers (Aryapadi, Raghavan & Mani, 2020).

Moreover, technology enables customization based on customer preferences. By leveraging data on customer behavior and preferences, companies can design their products or services to address the actual pain points of customers. This customization enhances customer experience, increases retention, and drives sales growth (Aryapadi et al., 2020). Targeted marketing campaigns are also made possible by technology. Through data analytics and customer segmentation, companies customize their digital and offline marketing strategies to catch the attention of their target audience. Relevant and targeted messaging increases customer engagement, drives sales, and enhances market penetration (Aryapadi et al., 2020).

II.3 Alternative Drivers of Market Penetration and Market Development

Beyond the deployment of technology in an SME's supply chain, several factors can drive improvements in market penetration and development.

Marketing strategies. Effective marketing strategies, such as targeted advertising, promotions, branding, and product positioning, can help create awareness, generate demand, and attract customers to a company's products or services. Strong marketing efforts that align with the target market's needs and preferences can drive market penetration by creating a favorable perception of the brand and stimulating customer interest (Kotler & Keller, 2016).

Pricing strategies. Pricing is a critical factor in market growth. Offering competitive pricing, discounts, or other pricing incentives can attract budget-focused customers and encourage them to switch from competitors to the new SME's products or services. SMEs can use smart pricing strategies—including penetrative approach, in which products or services are initially offered at lower prices to enter into new market and compete with existing players (Hinterhuber

& Liozu, 2014).

Product differentiation. Offering unique features, functionalities, or benefits that differentiate the SME's value offerings from existing products in the market can be a compelling factor in market penetration. By providing quality products superior to competitors and addressing unmet customer needs, an SME can attract customers and increase market share (Aaker, 2014).

Customer service and support. Providing excellent customer service, timely support, and responsive after-sales service can help build customer loyalty and advocacy. Customers with positive purchase experience are likely to maintain patronage with such company and even refer to families, friends and associates, which can positively impact market growth (Zeithaml & Bitner, 2018).

Market environmental analysis: Periodic market environment scanning and analysis into customer preferences and market trends can inform strategic decisions and help tailor products, services, and marketing efforts to the target market. This can improve the effectiveness of market-based strategies and drive better results (Malhotra, 2017).

II.4 Barriers to Technology Adoption in SME Supply Chains

To answer the research questions, it was highly imperative to address the factors limiting the adoption of technology in SME supply chains. According to Harris et al. (2015), these barriers or otherwise constraints can be dimensioned from seven areas (a) user-related barriers, (b) economic and financial factors, (c) operation-related barriers, (d) management inclination to technology, (e) technology-related barriers, (f) collaborators' influence, and (g) policy-related barriers. Quite a number of these challenges are prominent in the Nigerian transport and logistics industry due to poor infrastructural development, poor technological advancement, the digital divide, and shift in government's focus away from technology and innovation (Apulu and Latham,

2011, Tob-Ogu et al., 2018).

Constraints relating to users in adopting outsourcing technology are also an issue and can result in disarray within an organization (Harris et al., 2015, Harindranath et al., 2008, Kuan and Chau, 2001, Stefansson, 2002). This impacts the ability of SMEs to procure and adopt high-quality digital tools for effective outsourcing (Pokharel, 2005, Tob-Ogu et al., 2018). Operations-related barriers for users can be improved and resolved through training (Pokharel, 2005, Hollenstein, 2004, Zeimpekis and Giaglis, 2006). Organizational inertia among traditional logistics operators can also manifest as resistance to technology adoption (Perego et al., 2011, Huckridge et al., 2010). These corroborates with Lyytinen et al.'s (2009) argument that social and behavioral factors impact application of technology among prospective users. The issues can be mitigated by advanced planning for socio-technical issues that could disrupt the implementation of ICT innovation in logistics and supply chains (Kumar et al., 2018).

Some other constraints to technology adoption among SMEs relates to technology innovation and policy and regulations. Technology-related barriers include poor interoperability of logistics systems and data protection concerns (Harris et al., 2015). Policy-related barriers speaks to deployment of technology and must align with regulations and be subject to in conducting organizational activities (Meyer and Rowan, 1977).

Table II.5: ***Barriers to technology adoption and potential solution targets***

Barrier	Examples	Target for Solution
User-related barriers	Technological literacy: Poor knowledge and understanding of technology by supply chain professionals. Operational skills: Challenges in implementing technology in day-to-day supply chain operations	Users of technology along the supply chain
Economic and financial factors	Low financial allocation to supply chain development	C-level executives underestimate budgeting required for technology use in supply chain activities
Operation-related barriers	Poor organizational structure that discourages collaboration Subpar processes that are poorly structured and thus cannot be optimized with technology	Processes and standards for activities along the supply chain
Management capability	Agency problems causing misalignment between the needs of the business and the interests of decision makers	Decision makers along the supply chain
Technology-related barriers	Insufficient physical infrastructure that causes gaps or discontinuities in the application of technology to operations Lack of compatibility between innovative technologies and existing technology/infrastructure in the organization	Technology use and selection along the supply chain
Collaborators' influence	Incentive misalignment across multiple supply chain players makes it difficult to synchronize and achieve supply chain goals	Decision makers operating internally and externally can shape supply chain structure.
Policy-related barriers	Stiff licensing regimes limit SMEs' agility and responsiveness to innovations across the value chain	Government through agencies with mandate of promoting information technology and innovation, policymakers, supply chains, technologies, and businesses

In addition to limiting SME processes, the barriers outlined in table 2.5 holds negative implications for SMEs, narrowing the value addition from technology use in their supply chains. As such, to improve market penetration, these barriers must be addressed.

Among these factors is the compatibility of technology solutions with the core business functions of an SME, which is crucial for effective communication and collaboration. When these technology solutions are incompatible or do not integrate seamlessly with each other, data silos, redundant processes, and communication gaps can emerge that hinder the free flow of information along the supply chain. This manifests in two ways, as follows.

Data issues. Insufficient data standardization and integration can thwart technology utilization. When data formats, data quality, and/or data-sharing protocols lack standardization, it can hinder the effective use of technology solutions for data exchange and collaboration among supply chain players.

Trust issues. Trust and collaboration among supply chain players are crucial for effective use of technology solutions. If trust and collaboration are lacking among the connected supply chain players, it can hinder sharing of information and data through technology solutions, which can impact the compatibility of technology use.

In Nigeria, the power of technology in supply chain activities has become a focal point for SMEs, who dominate the country's business landscape. To ensure perfection and optimization of supply chain processes, many business owners and managers have incorporated—or are planning to incorporate—technology into their supply chain activities.

II.5 Mechanism of SME Contribution to Economic Growth

SMEs contribute to economic growth through specific mechanisms. It is pertinent to thoroughly examine the mechanisms when appraising the value of technology in SME growth and efficiency.

Job creation and poverty reduction. In emerging markets, SMEs are often the primary drivers of job creation. They create massive job opportunities given their employment-generative capabilities, including low-skilled and semi-skilled workers. SME growth can therefore lead to poverty reduction by creating jobs, wealth, and improving livelihoods (OECD, 2017).

Economic resilience and diversification. SMEs contribute to the economic resilience of emerging markets. They foster economic diversification by operating in various sectors and niches,

reducing concentration risk. This diversification helps countries minimize exposure to instability in global and domestic markets, and even sector-specific risks (OECD, 2017).

Innovation and technology adoption. SMEs in emerging markets often bring innovation and technological advancements to industries. They are agile and adaptable, embracing new technologies and finding creative solutions to overcome challenges within the operating environment. SMEs drive innovation through their entrepreneurial spirit, contributing to industry competitiveness and productivity growth (Umar and Alasan, 2021).

Market competition and consumer choice. Small and Medium Enterprises (SMEs) are integral in the promotion of competition within emerging markets by providing alternative products and services, dampening the economies of scale of larger corporations. While larger businesses dominate markets through scale, which leads to cost and price advantages and may result in monopolistic pressures, SMEs compete through product differentiation as proposed by Porter (1985). The competition facilitated by SMEs encourages efficiency and bolsters product quality without compromising the lower prices offered by larger firms (Adio et al., 2018)

Local value creation and community development. SMEs in emerging markets exhibit strong connections to their local communities, contributing significantly to local value creation. Through practices such as sourcing inputs locally, supporting providers of raw materials, and channeling resources to development of host communities, these SMEs play a pivotal role in driving regional development. Their involvement extends to supporting infrastructure improvements, thereby enhancing the overall quality of life in local communities (Manzoor et al, 2021).

Entrepreneurship and skills development. SMEs in emerging markets foster an entrepreneurial culture and contribute to skills development. This is particularly important in

emerging economies where shortage of skilled manpower is prevalent. They provide opportunities for aspiring entrepreneurs to set up new businesses, encouraging innovation and self-employment. SMEs also contribute to skills development by providing on-the-job training and opportunities for upskilling and reskilling (OECD, 2022).

II.5.1 *Why SMEs Need Market Penetration and Market Development*

Achieving effective market reach allows SMEs to operate at their optimum capacity. The following factors highlights the critical importance of market development and market penetration for SMEs.

Business growth. Market penetration allows SMEs to widen their clientele base and accelerate their sales level in existing markets. SMEs that adopted a market penetration strategy grew their sales by an average of 20% over a three-year period (European Commission, 2019). Equally, market development into new territories helps SMEs sustain their growth exponentially.

Profitability. Customer base expansion can increase SME profitability through scale-based efficiency, like lower effect of fixed production costs per unit and increased negotiating power. A Harvard Business School study found that SMEs that increased their market share by 10% experienced a 5% increase in profitability (Harvard Business School, 2017). Such market share growth can be achieved through market penetration and development.

Competitive advantage. A study by the MIT Sloan School of Management found that SMEs that gained a competitive advantage through market penetration were have a higher tendency to survive and thrive in today's increasing competitive business landscape. By actively pursuing new customers and developing their presence in new markets, SMEs can distinguish themselves from competing entities and create a lasting impression in customer's mind. This both

creates a barrier for new entrants and makes it more difficult for existing competitors to challenge their market position (MIT Sloan School of Management, 2015).

Learning and adaptation. Market penetration in emerging markets provides SMEs with valuable opportunities to build resilience and adaptability in the local business environment, customer preferences, and cultural nuances (London Business School, 2013). Similarly, market development allows SMEs to better understand market-specific needs in new territories, which lets them adapt their products, services, and marketing strategies accordingly.

Access to resources. Market expansion in emerging markets can trigger positive sentiment from investors, partners, and suppliers (University of Oxford's Saïd Business School, 2011). As SMEs demonstrate their ability to succeed and grow in these emerging markets, they become more attractive to external stakeholders who may provide additional resources, such as funding, technology, expertise, or distribution networks. Access to such resources can further fuel SME growth and expansion (University of Toronto's Rotman School of Management, 2010).

Market resilience. A study by the Booth School of Business at the University of Chicago found that SMEs that diversified their customer base by penetrating emerging markets were more resilient to economic downturns. By penetrating emerging markets, SMEs can widen their clientele base and reduce concentration risk from specific markets or regions. Diversifying across markets enhances their resilience to economic downturns, market fluctuations, or political risks in any single market. It spreads their risk and allows them to navigate uncertainties more effectively (University of Chicago's Booth School of Business, 2009).

II.5.2 *The Combined Impacts of SMEs Contribution and Market Penetration*

As described above, the economic productivity of SMEs contributes to national economic growth, as market penetration and new market development support SME growth and

sustainability. As the following points illustrate, this market growth is crucial for SME contributions to national economic growth.

Increased employment opportunities. As SMEs penetrate new markets and expand their operations, they intensify their job-creation capabilities. Hiring more employees helps to reduce unemployment rates and increase income levels, leading to improved living standards for individuals and families. The overall increase in employment contributes to economic growth by boosting consumer spending and stimulating demand for goods and services (European Commission, 2019).

Enhanced productivity and efficiency. Growth, especially in new markets, often requires SMEs to invest in expanding their production capacity, adopting new technologies, and improving their processes. These investments can lead to increased productivity and efficiency in the SME sector.

Encouraging entrepreneurship and innovation. Market penetration by SMEs fosters entrepreneurship and innovation. Also, when SMEs enter new markets, they tend to inject fresh ideas in the market, leverage innovation to bring new products to the market. This injection of entrepreneurial activity and innovation contributes to the economy's overall dynamism and competitiveness. It also encourages other entrepreneurs and businesses to replicate this great feat, leading to a vibrant ecosystem of innovation and economic growth (Harvard Business School, 2017).

Spillover effects and supply chain development. SMEs that penetrate new markets often stimulate the growth of related industries and supply chains. As they expand their operations, they require inputs from suppliers and forge strategic partnerships with other businesses. This creates a

multiplier effect, generating economic activities and employment opportunities throughout the supply chain (University of California, Berkeley, 2016).

Increased tax revenues. Successful market penetration by SMEs leads to increased sales and profits, which in turn result in higher tax revenues for governments. These tax revenues can be channeled to productive undertakings such as investments in infrastructure, education, healthcare, and other areas that support economic development. The government's ability to fund such investments further stimulates economic growth and creates an enabling environment for SMEs to thrive (International Monetary Fund, 2019).

Export expansion. Market penetration can pave way for SMEs to penetrate international markets and engage in export activities globally. By exporting their products or services to the world economy, SMEs contribute to foreign exchange earnings and enhance the country's export capacity. Export-led growth has a multifaceted impact on economic development, generating employment, attracting foreign investment, and increasing competitiveness on the global stage (United Nations Conference on Trade and Development, 2018).

II.6 SMEs in Nigeria: A Snapshot of Emerging Markets

Emerging economies present an intriguing case study for examining the use of technology in supply chains. While these economies tend to lag the global average in terms of technology adoption, their growth heavily relies on the efficient movement of goods and services. Therefore, emerging economies are expected to increasingly embrace technology in their supply chains. To provide a practical perspective, this paper focuses on Nigeria as an emerging economy. Nigeria is chosen due to its substantial contribution to Africa's economic output; its GDP represents nearly 20% of Africa’s economic output (Nwafor et al, 2021). Secondly, the Nigerian economy is well integrated with economies of neighboring countries in West Africa, mainly through informal

channels. This provides a picture into a broader demographic and geographic base than the country itself. Lastly, the diversity of the country's geography presents a microcosm of the continent's economic diversity. Critically, the division of the country into 6 culturally unique regions provides context for studying market development patterns by SMEs.

SMEs play a massive role in Nigeria's business landscape, representing approximately 96% of all businesses in the country (Oyelaran-Oyeyinka, 2020). However, these SMEs have limited access to IT resources, which hampers their ability to construct IT-based systems that could give them competitive advantages in their supply chains. Efficient supply chain networks, characterized by real-time information sharing and comprehensive visibility, can enhance productivity and customer satisfaction (Rowland, 2008). Nevertheless, integration within supply chains may not be fully optimized, as multiple providers at separate locations often operate with varying levels of technological competence (Barratt, 2004). This is particularly problematic in emerging economies, and it underscores the importance of selecting technological tools that is consistent with the specific requirements of supply chain partners, while ensuring that the solutions are integrated effectively with diverse connectivity protocols.

Outsourced logistics activities have gained traction across the African continent, with over 50% of business entities outsourcing various functions to technologically advanced service providers. The outsourced activities include outbound and inbound transportation, custom clearing and forwarding, packaging, stock management, branding and distribution (Ejem et al., 2021). Comparatively, a survey by Forrester Research revealed that a higher percentage of Fortune 500 companies in the United States outsource transportation, distribution, and manufacturing services (Forrester Research, as cited in Ejem et al., 2021). The high adoption of outsourced logistics in Nigeria, despite infrastructural challenges, highlights the trust placed by SMEs in technology and

outsourced logistics.

Several infrastructural challenges can impede the adoption of outsourced logistics in Nigeria. These challenges include inadequate transportation infrastructure, inefficient customs and clearing processes, limited warehousing and storage facilities, power supply issues, limited technology adoption, and security concerns. Inadequate road networks, port facilities, airports, and rail systems result in delays, damage, and increased shipping costs (Ejem et al., 2021). Complex customs and clearing processes, high import duties, and bureaucratic procedures can hinder the smooth product flow (Ejem et al., 2021). Poor warehousing facilities can pose risks to the storage and security of goods. Unreliable power supply infrastructure and limited technology adoption further complicate logistics operations (Ejem et al., 2021). Moreover, security concerns such as theft and piracy heighten additional costs and risks to logistics operations.

These infrastructural challenges pose limitations on the market penetration of SMEs in Nigeria, a constraint not faced by their counterparts in developed markets. To maximize their market penetration, SMEs in emerging markets need to leverage technology more effectively in their supply chains. Market penetration serves as a comprehensive indicator of the strength and resilience of an SME's supply chain.

II.7 Selection and Adoption of Supply Chain Technology by Nigerian SMEs

The choice of selecting outsourcing partners in Nigeria are influenced by multiplicity of factors ranging from Service level, Reputation, Price, Relationship, and Finance. Information technology was identified as critical by decision-makers, as shown in table 2.6 below (Ejem et al., 2021).

Table II.6: ***Supply Chain Experts Criteria for Selecting ICT Solutions noted by Ejem et al, (2021)***

High Frequency/ Desirability Attributes		Low Frequency/ Desirability Attributes	
Criteria	**Frequency**	**Criteria**	**Frequency**
Service Level	8	Asset Ownership	1
Reputation	5	Technical competence	1
Price	5	Capacity to create value	1
Risk-pooling	5	Experience	1
Finance	5	Competence	1
Information Technology	3	Location	1
Delivery	2	Security	1
		Problem-solving skills	1

Crucially, the criteria rated above Information Technology are themselves severely limited without technology. Service level depends on the ability to combine technological aids with human problem-solving capabilities to maintain high satisfaction levels. Cost competitiveness has also crossed the threshold of human ability, to being achieved through technological advantage. Maximizing optimal value at the very least cost is inevitably a technological play (Ejem et al, 2021).

Gains from logistics outsourcing in Nigeria lays credence to its importance, as expressed by the costs businesses are willing to pay. Nigerian SMEs face infrastructural failures along their supply chains that encourage bad actors. By outsourcing logistics, they can focus on their core value creation activities, while leveraging technology to solve their logistical challenges. Such optimization allows them to maximize performance on both ends, thus improving their market penetration (Rabinovich et al., 1999; Sohal et al., 2002).

However, the selection and adoption of outsourcing partners by individual organizations can be a complex process, involving multidimensional criteria that encompass both tangible and intangible factors (Ejem et al., 2021). Organizations often struggle to identify the perfect set of selection criteria that aligns with their specific needs. Also, due to the small sizes and capital bases

of SME's, integration within supply chains may not be fully optimized, as multiple providers with varying levels of technological competence operate in separate locations (Barratt, 2004). This underscores the importance of selecting software solutions that meet the specific requirements of supply chain partners while integrating effectively with diverse connectivity protocols.

II.8 Market Penetration, Market Development, Operational Efficiency and the Role of Technology

II.8.1 *Market Penetration and Market Development in Consumer Markets*

In defining market penetration, it is important to draw an understanding of the concept of a market. A market is a platform where buyers and sellers interact to exchange value. These buyers are in need of a particular need that can be met by interacting with one another (Kapoor, 2020). Markets are, however, of different kinds, ranging from business to global, to consumer and non-profit markets. The focus of this study is on consumer markets in Nigeria, which are defined as follows: Companies selling mass products and services, such as toothpaste, soaps, television sets, air tickets, etc., for the personal consumption of the consumer. Consumer goods, are economically representative and physically tangible, making them easier to examine and analyze within the supply chain (Kapoor, 2020; Stern, El-Ansary & Coughlan, 2006). Individuals and families constitute consumer markets (Kapoor, 2020). These markets are selected for the study because they are economically representative of the incentives of players along the supply chain, which can be consistently measured by profits. Also, the primary physical nature of consumer goods shapes the viewpoint of this study.

Businesses employ two classes of strategies to increase their business activities; product-based strategies and market-based strategies. Market-driven strategies are executed by increasing sales to customers in an existing market, while also seeking out potential customers to expand

sales volume in new markets without changing their primary product strategy (Ansoff, 1957). These market-based strategies are respectively called market penetration and market development. The choice of external distribution channels is one of the key decisions that influence market penetration and development. SMEs must carefully select and structure their delivery channels to ensure that their value offerings get to the target audience. This may include using online sales channels, partnering with distributors or retailers, or establishing a strong presence in key geographic locations (Rosenbloom, 2017).

Market penetration speaks to the share of the target market and has customers using its products or services. It is computed by the total addressable market reached by the company (Kapoor, 2020) As a measure, market penetration represents a strategic decision within the Ansoff growth framework, aimed at expanding market share within the existing market (Uko & Ayatse, 2014). This approach focuses on expanding share and securing a sustainable position in a market where the product already exists (Hutzschenreuter et al., 2014).

Market development involves the successful introduction and sale of goods or services in a new market. In both cases, effectiveness is determined by the sales volume achieved in relation to the target market for that particular product or service (Richardson & Evans, 2007). Both serve as market-based growth strategies for businesses as outlined in the Ansoff Matrix, and as such rely on the strength of an SME's distribution network.

Manufacturing organizations can achieve growth through market penetration, particularly when the growth strategy is aligned with a competitive strategy that provides consumers with choices (Allen & Helms, 2006). To sustain this growth, manufacturing firms must match their market entry strategy by distinguishing themselves from other brands to capture a significant part of the market (Li & Dimitratos, 2014). Therefore, the research aligns with the Ansoff's framework

and recognizes the effect of firm size on market penetration strategy and performance within the industry (Li & Dimitratos, 2014; Armstrong, 2013).

Market penetration and market development collectively contribute to market growth for a company, aiming to increase sales by emphasizing existing products in existing marketplace and introducing existing offerings in a new market (Hughes et al., 2010). The goal is to discover new avenues for boosting sales, enhancing customer loyalty, and expanding market share.

Market-based strategies enables firms to lower their operational costs and improve on their efficiency (Han et al., 2013). Researchers have also found that market-based strategies can lead to improved financial performance due to reduced inventory costs (Han et al., 2013). This concept highlights the potential for SME owners/managers to embrace market penetration and market development to enhance performance.

In the context of Nigerian SMEs' supply chains, market penetration and development anchors on the robustness of the supply chain, including geographical reach and speed of product or service delivery. Geographical reach reflects the level of coverage of the company's supply chain network across the six geopolitical regions within Nigeria which for the purposes of this research will be treated as unique markets. A broader geographical reach allows SMEs to reach more customers and expand their market penetration (Stern et al., 2006). The presence of an SME's operations above a threshold of customers in each geopolitical region is indicative of its market development. Speed of product or service delivery refers speaks to the amount of time required for end-to-end delivery of products or services from the point of production to end customers. Faster delivery times give SMEs a competitive advantage, meeting customer expectations for timely and efficient service. It also contributes to higher customer satisfaction, repeat purchases, and increased market penetration (Stern et al., 2006).

Based on these, this study assesses market penetration and development on key attributes: the geographical reach of supply chain of the SMEs, the aggregate market share across regions and the speed of product or service delivery from the keystone supplier (the business being interviewed) to the customers. Each has different implications for the different flows involved in the management of supply chain.

II.8.2 *The Influence of Supply Chain Flows on Market-based Growth for SMEs in Nigeria*

For SMEs in Nigeria, the robustness of their supply chain serves as an indicator of supply chain quality. The distribution of intermediaries and their speed in moving products, finances, and information along the supply chain determine SMEs' market penetration and development. As a result, penetration and development are aggregate outcomes of the three supply chain flows, from the manufacturer to the consumers as highlighted in in figure 2.2 below.

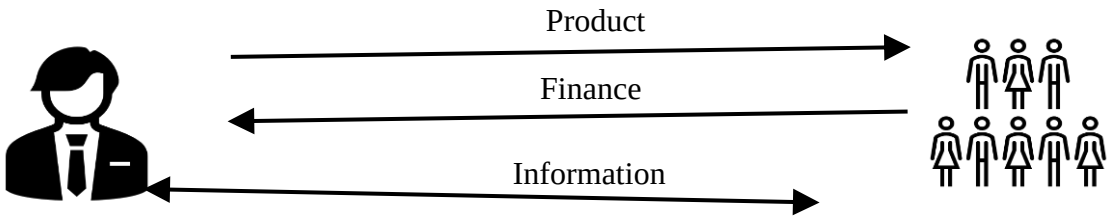


Figure II.2*: Supply Chain Flows Between Customers and Suppliers*

The Figure 2.3 below shows the dependencies of activities and players along the value chain.

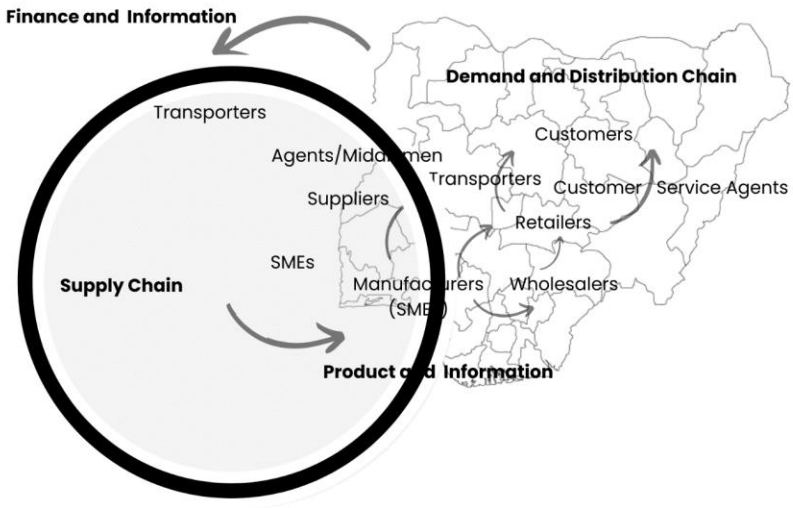


Figure II.3*: Supply Chain Flows in Nigeria*

Efficiency and speed of the *product flow*—that is, conveyance of physical products along the supply chain—significantly impact market penetration and new market entry, as delays or disruptions can result in stockouts, customer dissatisfaction, and missed sales opportunities (Stern et al., 2006).

Effective *information flow*—including data about inventory levels and customer preferences—enables better coordination and decision-making in the supply chain, leading to higher level of operational efficiency and enhanced market penetration and development (Stern et al., 2006).

Efficient *finance flow*—including payment terms and invoicing between suppliers, manufacturers, and other supply chain partners—ensures smooth financial operations, fosters trust, and promotes collaboration among supply chain participants, contributing to market-based growth (Stern et al., 2006).

Dependencies along the value chain also influence market penetration and development in Nigerian SMEs', because collaboration and coordination among supply chain partners are crucial

for ensuring a smooth flow and optimizing market penetration (Stern et al., 2006).

III CHAPTER THREE: THEORETICAL FRAMEWORK

III.1 Theoretical Framework: The Technology-Organization-Environment (TOE) Framework

Technology adoption is backed up numerous theoretical underpinnings such as the technology acceptance model (TAM), the theory of planned behavior (TPB), the unified theory of acceptance and use of technology (UTAUT), and the theory of reasoned action (TRA) (Davis, 1989; Davis et al., 1989; Ajzen, 1991; Venkatesh et al., 2003; Ajzen & Fishbein, 1975). However, this rational choice is not considered as a relevant theory on the subject matter as the theory prioritizes technology and neglects the role of individuals and entities in driving adoption.

The study adapted the TOE framework propounded by DePietro et al. (1990). The choice of this framework anchors on the need to determine firm-specific factors driving technology adoption. The TOE framework is known to espouse factors shaping firm's decisions to adopt a particular type of technology. The framework has been applied to examine value creation and innovation acceptance in various dimensions (Gangwar et al., 2015; Senyo et al., 2016). It offers valuable insights into the dynamics of firms based on their internal and external factors (Tornatzky et al., 1990). The TOE framework has widespread application to more advanced technologies, such as the IoT, cloud computing, and RFID, and can be extended to the technology-driven approach to SCM (Hsu & Yeh, 2017; Gangwar et al., 2015; Wang et al., 2010).

At organizational level, the TOE framework consists of three parts: technological, organizational and environmental-specific factors. These components influence the decision-making process of innovation adoption within a firm (Baker, 2012). Technology factors focus on the attributes of ICT and information systems and their impact on innovation distribution, emphasizing the advantage of relationship building and data quality (Tornatzky et al., 1990).

Organizational factors speak to those attributes peculiar to organization itself, such as scope, nature of functions and management capabilities, which have been found to be particularly important for information system distribution (Zhu & Kraemer, 2005). The environmental context examines external factors, including the industry, competitors, and government regulations, and their influence on information system distribution (Tornatzky et al., 1990).

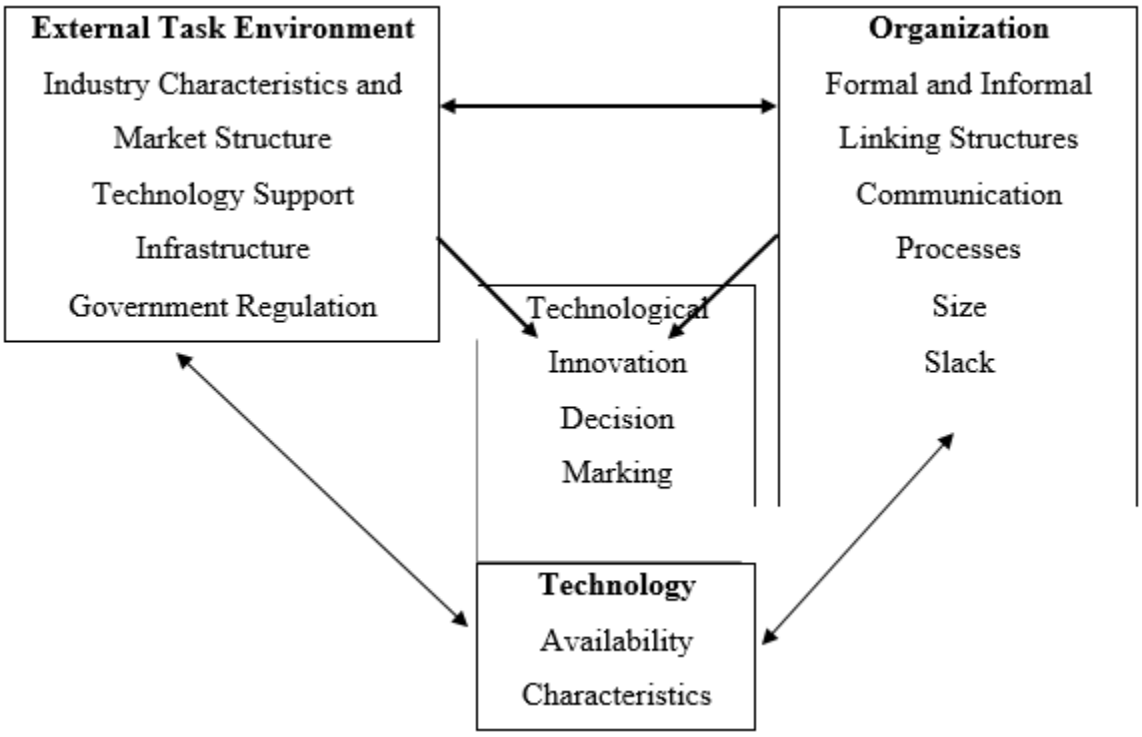


Figure III.1*: The Technology-Organization-Environment Framework*
Source: Tornatzky et al. (1990).

Literature demonstrated the efficacy of the TOE model in examining the acceptance and success of innovations, thereby enhancing organizational potential (Srivastava & Teo, 2007). However, Teo et al. (2009) highlighted that although the TOE framework is widely employed in literature, the unique internal factors applicable to individual aspect, namely technological, organizational, and environmental factors, are diverse in prior findings (Teo, et al. 2009).

III.2 The Technological Context

Technological dimension speaks to internal ICT infrastructure and the external technological tools and resource. Internal technologies are germane in the acceptance process as they are subjected to continuous change (Collins, Hage, & Hull, 1988). On the other hand, external innovations that have not been adopted by the organization can influence the scope and guidelines for innovation adoption, guiding the approach in utilizing technology (Baker, 2012). Innovation in the industry can be classified into three types: incremental, synthetic, and discontinuous changes, each carrying different levels of risk in terms of adoption (Tushman & Nadler, 1986). Access to internal technology tools in terms of infrastructure, expertise, manpower and resources are critical in firm's decision to embrace technology (Kwon & Zmud, 1987).

Innovation-dominated industries, characterized by continuous changes, present opportunities for measuring acceptance. Conversely, industries with non-continuous changes require organizations to be decisive in maintaining competitive potential. In the course of assessing technologies that bring non-continuous changes, organizations must also consider whether these technologies are value-adding or not (Tushman & Anderson, 1986). While innovation is capable of enhancing organizational expertise, innovation that destroys existing competencies can render current technologies obsolete. The research examines the technological context's impact on the utilization of technology-driven supply chains, focusing on various factors such as readiness, ICT capability level, compatibility and complexity.

1) Technology Readiness

Technology readiness speaks to how preparedness of an organization in terms to embrace new technologies (Finney & Corbett, 2007; Soja, 2006). Assessing organization's readiness for technology adoption, including the skills and ICT infrastructure available, is key (Somers &

Nelson, 2004; Tarafdar & Roy, 2003). ICT skill refers to the proficiency of ICT staff in utilizing and maintaining ICT to support business operations (Stratman & Roth, 2002). The organization's technological skills and readiness, along with robust training programs, are essential for enhancing the organization's core capabilities (Ravichandran, Lertwongsatien, & Lertwongsatien, 2005). Companies skilled and experienced in digital infrastructure are well-placed to harness technology in their operations and achieve greater efficiency compared to those with limited technical capabilities (Lee, Lee, & Lin, 2007). Readiness as regards technology adoption emerges as a significant factor influencing the acceptance of information and communication technology (Pan & Jang, 2008).

2) ICT Capability Level

According to Randeree, Mahal, and Narwani (2012), the Capability Maturity Model (CMM) suggests that goal setting in ICT systems occurs only after a certain level of processing has been achieved. Paulk (1999) outlines the different levels of CMM as follows: Level 1 (Initial) represents processes that are often complex and rely on individual intentions and skills. Level 2 (Repeatable) involves establishing basic infrastructure management processes that follow cost, schedule, and work functions based on previous successful projects. Level 3 (Defined) focuses on engineering activity management, documentation, and standardizing processes across the organization. At Level 4 (Managed), companies collect details around quality of products and efficiency of processes. Level 5 (Optimizing) entails continuous process improvement based on quantitative feedback, fostering innovative ideas and technologies. Companies operating at Level 5, particularly those utilizing new ERP systems, have shown greater success compared to those at lower levels (Schniederjans & Yadav, 2013). Previous research emphasizes the importance of

high-potential growth in supporting the creation, assessment, and continual improvement of ICT services aligned with strategic goals of the organization (Bowen, Cheung, & Rohde, 2007).

3) Compatibility

Compatibility speaks to how well a technology resource aptly fits the needs, experiences, and organizational operations (Schultz & Slevin, 1975). Organizational compatibility is evaluated based on the unique business functions of the organization, while technical compatibility is assessed in terms of the compatibility of existing information systems, hardware, and software (Schultz & Slevin, 1975). Assimilating ERP systems often involves changes in business processes and existing organizational cultures, underscoring the importance of organizational compatibility (Bradford & Florin, 2003). Additionally, technical compatibility is crucial as it involves integrating the new ERP system with available infrastructure, increasing the chances of successful ERP integration (DeLone & McLean, 1992; Tornatzky & Klein, 1982).

4) Complexity

Complexity is another attribute of ERP systems (Rogers, 1995). ERP service providers strive to develop modules that cater to specific industries, often adding complexity to enhance the data transformative capabilities of ERP systems (Poston & Grabski, 2001). The assimilation of ERP systems introduces additional complexity, resulting in significant changes at the departmental or organizational level (Poston & Grabski, 2001). When an ERP system becomes complicated, its usage within the organization diminishes. Complexity can lead to resistance and hinder adoption due to a lack of suitability with the needs of the company (Rogers, 1995). Furthermore, complexity impacts both the preliminary use of ERP systems but also inhibits adoption at higher levels within the organization (Vluggen, 2005). Consequently, complexity negatively impacts the integration of ERP systems.

III.3 The Organizational Context

The organizational context encompasses the characteristics of a company, including the strategic functions, processes, policies, manpower and available resources (Baker, 2012). Within the organizational context, various mechanisms can facilitate innovation, such as informal links between sub-units, crossline teams, and partners in the supply chain (Tushman & Nadler, 1986). These mechanisms, including sales representatives, evaluators, and users, contribute to the promotion and adoption of innovation within the organization.

Effective communication flow within organizational context can either foster or hinder innovation. Leadership dynamics are key in creating an organizational context that encourages and supports innovation aligned with the company's mandate. This includes communicating the potential benefits of technology innovation to the workforce, providing both official and unofficial rewards for innovation, emphasizing the company’s innovation culture, and assembling a competent management team with a compelling vision for the company's future.

Research has shown that organizational structure is a significant predictor of technology adoption (Ramdani, et al. 2013). In the TOE framework, organizational structure refers to the company's ability to support and manage new technologies at the high management and technical knowledge level (Chong & Chan, 2012). The support from top management is measured by their understanding of new technology and their willingness to support its adoption. High-level management are responsible for communicating the importance of new technologies to all units within an organization, influencing the firm's intention to embrace technology (Wang, Wang, & Yang, 2010). In literature, technology adoption in SCM, the organizational context is shaped by various factors such as need, business functions, resource capabilities and technical expertise.

These factors are pertinent in shaping the organizational context and influencing the successful integration of ERP systems into a company's operational activities.

1) Firm Size

Organizational size plays a key role in its technology management practices (Tornatzky et al., 1990; Yao, Xu, Liu, & Lu, 2003). Larger organizations tend to be more inclined to adopt innovations due to their greater adaptability and capacity to withhold systematic risks (Zhu, Kraemer, & Xu, 2003; Zhu & Kraemer, 2005). Implementing an ERP system could be a costly process. Studies by Shehab et al. (2004) and Huang et al. (2004) concurred that the adoption of ERP systems needs substantial financial resources and skilled personnel. However, contrasting perspectives exist, with some researchers arguing that organizational size and ICT adoption are not necessarily correlated (Armstrong & Sambamurthy, 1999; Iacovou, Benbasat, & Dexter, 1995).

2) Top Management Support

Support from top-level management entails prioritizing and actively supporting the adoption of new technologies (Martin, 1982). Previous research has not explicitly connected leadership commitment with management capabilities and the ability to overcome implementation barriers (Oliveira & Martins, 2011). Similarly, earlier studies have indicated that successful ERP implementation is positively influenced by an organizational culture that is supported by leaders (Al-Shamlan & Al-Mudimigh, 2011; Khattak, Yuanguan, Irfan, Khattak, & Khattak, 2012). However, it is essential for a company's leadership to provide support for the successful utilization of ERP systems (Moohebat, Jazi, & Asemi, 2011).

3) Type of Production

According to Raymond and Uwizeyemungu (2007), the acceptance of ERP systems is influenced by the types of production. The work of Verma, & Bhattacharyya (2017) categorizes production into four types based on product characteristics, production needs, and raw material requirements. The first type is unit or job production, where goods are produced according to consumer demand, with machines and equipment allocated based on the production plan. Batch production, the second type, involves producing similar products in groups or lots with specific characteristics. Machines are arranged based on the order of operations. Mass production or flow production, the third type, entails producing large quantities of identical items using dedicated machines for each production line. Continuous production or process production, the fourth type, involves the continuous production of a single product, typically involving the transformation of natural resources into raw materials for subsequent production steps. Unit or job production focuses on producing goods based on consumer demand, while batch production involves grouping products with specific characteristics. Mass production produces large quantities of identical items, and continuous production involves the continuous transformation of natural resources. These different types of production have implications for the acceptance and implementation of ERP systems (Raymond & Uwizeyemungu, 2007).

4) Perceived Barriers

Resistance from users while deploying ERP can limit acceptance. The perception of obstacles plays a significant role in this process. Leadership support is crucial in overcoming the difficulties and complexities associated with ICT adoption (Bajwa, Garcia, & Mooney, 2004; Nah & Delgado, 2006; Umble, Haft, & Umble, 2003). Companies with fewer obstacles in adopting ICT are more likely to accept and embrace technology compared to those with a higher perception of obstacles in its use.

III.4 The Environmental Context

The environmental context speaks to factors such as the industrial structure, nature of technology service providers, and regulations (Baker, 2012). The industrial structure, including factors like intense competition, can stimulate the acceptance of innovation (Mansfield, 1977). Dominant companies within the supply chain can influence their partners to create new innovations (Kamath & Liker, 1994). Highly competitive industries, the practice of innovation may not be readily apparent. Some firms seize the decline period of the industry as an opportunity to invent new innovations, while others may try to reduce costs by avoiding investment in innovation. The availability of basic infrastructure to support technology fosters innovation. Companies with face high labor costs are often compelled to innovate in order to optimize costs. Having a pool of professionals within the workforce, can also foster innovation.

Furthermore, government regulations and policies can either facilitate or hinder innovation. For instance, when the government introduces new policies, such as requiring energy companies to use specific operational control equipment, innovation becomes crucial. Conversely, stringent safety regulations and rigorous testing can slow down the development of innovation across industries. Examples include the construction sector, where new materials must undergo testing before use, and the agricultural sector, where the patenting and approval of new plants can be costly. Additionally, in the banking industry, personal data protection requirements may restrict the introduction of new methods for customer account access. Thus, government rules and regulations can either encourage or impede innovation (Baker, 2012). In the present study, the environmental factors influence technology usage through factors such as external support, competition, market position, industry dynamics and market uncertainty.

1) External Support

Having access to externally-induced support is crucial for users with potential, as it provides access to different data sources both at the country level and within specific regions. External support can be provided by technology distribution government and change agencies. Previous research has confirmed that external support is not only important for driving the success of ICT but also plays a key role in embracing technology (DeLone, 1988; Premkumar & Roberts, 1999). Li (2008) discovered that external support is a key determinant for adapting technological tools like electronic purchasing in the production sector, highlighting its importance for acceptance (Awa & Ojiabo, 2016).

2) Competitive Pressure

Competition is widely recognized an effective factor (Lin & Lin, 2008), with Zhu and Kraemer (2005) defining it as the level of pressure facing a particular company arising from competing companies. In general, competition has a positive impact on the acceptance of ICT, particularly when technology fuels rivalry among existing players and a company realized technology as a lever to outperform their competitors (Ramdani, Kawalek, & Lorenzo, 2009). Competition speaks volume in company's decision (Awa et al., 2016), as it enables companies to withhold competition in the industry and edge rivals through optimized efficiency.

3) Trading Partners' Readiness

Both operators and academics recognize the significance of the partner's collaboration as another key factor. This relationship extends beyond the buyer-seller dynamic and encompasses collaboration, which forms the foundation of Internet-based interorganizational systems (IIOS). Partner's responsiveness reflects their willingness to support firm's decision to embrace technology and plays a pivotal function in system planning and enhancing organizational capabilities (Lin & Lin, 2008). As companies become more interdependent, the understanding of

trader needs and the identification of risk opportunities from external sources become increasingly important.

4) Market Uncertainty

Uncertainty refers to unpredictable situations that can have significant impacts on individuals, organizations, and various aspects of life. Within organizational planning, market uncertainty holds particular importance. High levels of market uncertainty may lead to negative signals and cause companies to delay the release of official performance reports. Additionally, companies may be reluctant to provide guidance if their predictions are unreliable, further exacerbating market uncertainty (Libby & Rennekamp, 2012). Factors such as market competition, demand stability, and customer loyalty, which are beyond an organization's control, can significantly affect business operations. From an ICT perspective, management should seek greater responsiveness and flexibility in ICT support. Consequently, it is assumed that companies facing high market uncertainty are more likely to adopt open systems (Chau & Tam, 1997).

III.5 The TOE Framework and SMEs Adoption of Technology-Driven Supply Chain System

Finally, the constituents within the TOE framework have proven effectual in shaping the constraints and opportunities for innovation in organizations. These elements directly impact technological advancement within an organization. The TOE framework is widely used in research to understand the factors influencing adoption of technology and innovation within organizations. For technology-oriented supply chain adoption by SMEs, the TOE framework offers a holistic viewpoint to examine the key determinants and dynamics involved. The technology component of the TOE framework delves into factors such as technology readiness, ICT capability, compatibility, and complexity (Baker, 2012). These factors are crucial in assessing the SMEs'

preparedness to adopt and integrate technology-driven supply chain solutions. For example, the level of technology readiness and ICT infrastructure within SMEs shapes company decisions to embrace and utilize such solutions (Somers & Nelson, 2004; Tarafdar & Roy, 2003). The organizational component of the TOE framework explores the internal factors within SMEs that influence technology adoption. It encompasses aspects such as organizational context, structure, resources, and leadership support (Baker, 2012). For SMEs, firm size, leadership receptiveness and type of production are key considerations in determining deploying technology-driven supply chain solutions for business functions (Raymond & Uwizeyemungu, 2007). As described above, the support from senior leadership team is considered important in overcoming barriers and driving successful adoption (Moohebat, Jazi, & Asemi, 2011). The environmental component of the framework examines the external factors that impact the use of technology within SMEs. This includes the industry dynamics, presence of technology providers, and regulatory landscape (Baker, 2012). Factors such as competitive pressure and market uncertainty influence the decision-making process of SMEs when it comes to technology adoption (Awa et al., 2016). Additionally, external support, such as policy initiatives and collaborations with trading partners, can facilitate the adoption and integration of technology-driven supply chain solutions (Lin & Lin, 2008).

The current research on technology-driven supply chain adoption by SMEs assesses how TOE elements shapes firm's decisions to adopt and incorporate technology in their operational process. This comprehensive approach espouses valuable insights into the constraints, potential benefits and cost-effective approaches related to how technology tools can be better deployed within SME's supply chain.

Table III.1: ***Factors influencing the Degrees of Technology Use in Supply Chain Activities by SMEs in Nigeria***

Definitions	**Sophistication**		**Relevance to Local Context**			
Technology Category	Complexity	Novelty	Need		Applicability	
Hardware Example (Infrastructure Layer)						
Computers, Digital Communication Equipment, RFID Equipment, Sensors, Manufacturing equipment, Sorters, Automated Trucking			**Low:** Simple Computers Like Feature Phones (No Internet) **Medium:** Slightly sophisticated devices like Smartphones, Tablets and Personal Computers **High:** Large Complicated Enterprise Level Computers (Example)	**Low:** New to the Company **Medium:** New to the Industry **High:** New to the World (Krasadakis, 2020)	**Low:** Required only for peripheral operations without which business can still function **Medium:** Required only for key supporting functions without which business cannot function **High:** Required for the core value creation activities of the business (Liu et al, 2013)	**Low:** Requiring total redesign of business or industry to integrate **Medium:** Requiring some redesign to integrate **High:** Requiring little or no modification to integrate. (Liu et al, 2013)
Software Example						
AI, Data Analytics, PLM Software, ML			Low Medium High (To be determined case by case)	**Low:** New to the Company **Medium:** New to the Industry **High:** New to the World (Krasadakis, 2020)	**Low:** Required only for peripheral operations without which business can still function **Medium:** Required only for key supporting functions without which business cannot function **High:** Required for the core value creation activities of the business (Liu et al, 2013)	**Low:** Requiring total redesign of business or industry to integrate **Medium:** Requiring some redesign to integrate **High:** Requiring little or no modification to integrate. (Liu et al, 2013)

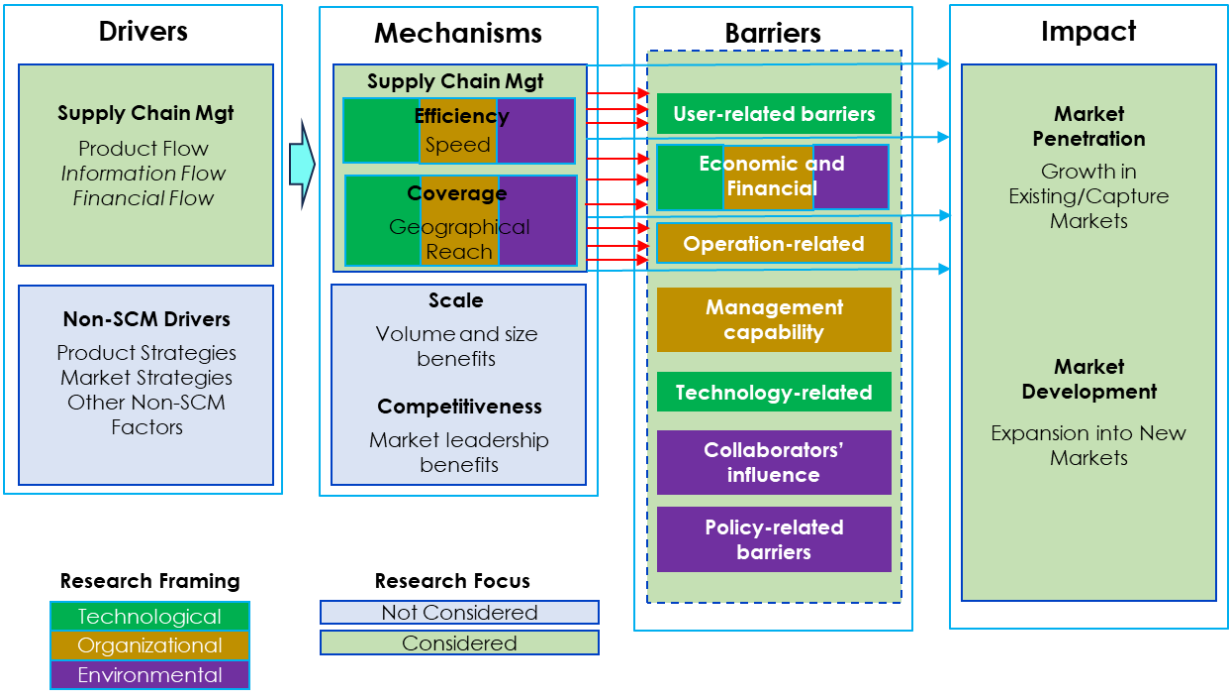


Figure III.2 Presentation of the Research within Technology-Organization-Environment Framework

IV CHAPTER FOUR: METHODOLOGY

IV.1 Introduction

This chapter focuses on the approach employed in the collection and analysis of data. Specifically, it touches on research design, data collection methods, and data analysis techniques. This chapter serves to establish the credibility and rigor of the research process with the aim of having robust and more generalizable findings.

IV.2 Research Design

The case study research design was adopted to assess the impact of technology-driven supply chain management on the market penetration (share) and market development (geopolitical presence) of Nigerian SMEs. The choice of case interview approach was necessitated by the need to provide detailed information and insights into the phenomenon under investigation. Mugenda and Mugenda (2009) suggest that a descriptive research design is effective when analyzing qualitative data, which aligns with the nature of the study. Yin (2017) and Stake (1995) also proposed this method because it is effective in illuminating intricate relationships, generating rich data, and providing a holistic perspective. Qualitative case interviews also emphasize the context in which the phenomenon occurs, which is ideal for understanding the dynamics of the complex subject of supply chains, especially in a market with limited structured data. Case interviews also leave room for exploration and discovery of new insights, considering that they are less regimented than surveys.

The descriptive research design was chosen because it allows for the systematic and accurate description of the facts and characteristics of the sample subjects in the population. By conducting case interviews, the researcher can source first-hand information directly from the respondents. This allows the researcher conducts a more in-depth study on the impact of

technology-driven supply chains on market penetration. The focus is on understanding the experiences, perspectives, and challenges faced by Nigerian SMEs in utilizing technology within their supply chains. The case interview method aptly suits this study as it allows for a thorough assessment of the relationships between technology-driven supply chains and market penetration and development. Through open-ended questions and probing, the researcher can gather rich qualitative data, capturing the nuances and complexities of the phenomenon. This approach facilitates discovery of in-depth findings as regards the factors driving market penetration, including the role of technology, operational challenges, and strategic implications.

With a sample size of 20 respondents, the case interview method offers a balance between depth and manageability. The selection of respondents was based on criteria that represent a diverse range of Nigerian SMEs involved in different industries and utilizing technology-driven supply chains to varying extents. This purposive sampling approach ensures that appropriate participants were recruited for the interviews. The study curated an interview guide that covers key themes and areas of interest. The guide was developed based on the objectives the study intends to achieve. Responses to interview questions were transcribed, cleaned and coded to allow for a detailed examination of the data and identification of key patterns and themes.

Data obtained from the case interviews was subjected to thematic analysis, which entails extracting similar patterns from the interview transcripts and grouping them into themes. Using thematic analysis made it possible to generate meaningful conclusions, identify key factors influencing market penetration, as well as market development and provide recommendations for Nigerian SMEs in leveraging technology-driven supply chains to enhance their market reach.

IV.3 Research Approach

Qualitative research approach was employed in the study. The choice of this approach is found suitable because it provides rich and detailed insights into the phenomenon under investigation. Utilizing qualitative approach will enable the researcher better understand and even appreciate diverse perspectives of participants on the topic. Qualitative research approach allows the researcher to understand the nuances on the impact of technology-driven supply chain on market development and penetration of SMEs across sectors; business functions and other parameters (Creswell, 2003). Methods such as interviews or focus groups allows the researcher to obtain rich and meaningful data that goes beyond simple numerical measurements. This approach enables better understanding of the subject matter, highlighting the underlying reasons, motivations, and interpretations of the participants. Qualitative research also allows for flexibility and adaptability during data collection, as it encourages open-ended questions and in-depth conversations. The interviews aimed to assess the level of technology adoption in specific areas of businesses, which are expected to contribute to market penetration. Additionally, financial indicators were examined to gauge the overall health of the businesses. The interviews were designed to measure key supply chain efficiency indicators, including the speed and scope of operations, with a focus on analyzing the impact of technology-driven supply chains on market penetration and market development.

To establish differences in technology usage between businesses within an industry and across various industries, the interviews were structured accordingly. This comparative analysis is crucial for understanding disparities in technology adoption between sectors. The interview design also incorporated replication logic by conducting multiple case interviews to determine which findings were consistent across cases. This research design facilitated the comparison and contrast of responses to further strengthen the external validity of the findings. By employing this approach,

valuable insights were unraveled to provide a holistic understanding of the topic under investigation.

IV.4 Selection of Respondents

Purposive sampling technique was employed in the process of selecting participants for the interview. The choice of this sampling approach was necessitated by the need to engage experienced as well as knowledgeable SME operators who could provide valuable insights into the subject matter. To select the firms for the case interviews, the study focused on organizations with an average of 70 employees and with at least two years of operational existence. This ensured that the selected businesses had sufficient experience to contribute to the study. Opportunistic sampling techniques were used to access a diverse range of SMEs across the manufacturing, trade, and services sectors with active supply chains.

The sample audience consisted of business owners who were assessed to understand their profiles and interest in the research. This allows for generation of concrete information during the interviews. A minimum of 20 businesses were selected for the interviews, which exceeded the recommended minimum of 6-10 aggregate cases suggested by Yin (2017). This ensured a sufficient number of cases to explore different replication patterns. However, strategy for data collection comprised of a systematic process in which a targeted 20 participants were selected (each representing a specific SME) and afterwards an extra of 5 participants were also approached in order to serve as possible replacement in the situation that any of the target participants provides less relevant information. In this process 18 of the targeted 20 participants responded more reasonably which necessitated a replacement of two participant from the extra five and the rest of the responses were discarded. This left the study with 20 participants considered suitable for the study.

The decision of the businesses to engage was guided by the need to represent a diverse range of attributes, including the level of technology use, their presence across regional markets and level of market penetration. An initial assessment of the businesses was conducted to identify where they fell on the spectrum of these attributes. This helped in shortlisting the businesses that adequately represented the range of attributes and would provide valuable insights for the research. By adopting purposive sampling and selecting a minimum of 20 participants with diverse attributes, the study aimed to ensure the collection of rich and varied data. The diversity of sampled businesses based on their sector of operation can be viewed in table 4.1 below. The selected sample was expected to provide deeper insights and a broad perspective on the influence of technology-driven supply chains on market penetration and market development of Nigerian SMEs, based respectively on their market shares and their level of presence across the country.

Table IV.1: ***Business Sector Counts Interviews***

Industry/Sector	**No of Interviews**
Trade	6
Technical and Professional Services	4
ICT	2
Hospitality	2
Fashion and Beauty	2
Engineering	1
Energy	1
Automobile	1
Real Estate	1

IV.5 Sources of Data

IV.5.1 *Primary and Secondary Data*

Primary data was used in the study. This type of data was sourced from structured interviews, following a specific protocol to ensure reliability. The use of structured interviews provided a systematic and standardized approach to gathering data, enhancing the quality and consistency of the information obtained. The interviews served as the primary means of obtaining firsthand insights and perspectives from the participants.

To further complement primary data source, the study made use of secondary sources. This involves reviewing company documentation and industry-related information. This approach further strengthened the reliability of the findings. Company documentation, such as financial reports, operational procedures, and marketing strategies, provided additional context and background information on the firms being studied.

However, it is acknowledged that in certain situations, limited executive availability due to scheduling conflicts, posed challenges in exploring specific information needed for the research. To address this, the interview questions were categorized into two sets. The first set comprised questions that could only be answered by the executives themselves, while the second set included questions that could be answered by alternate employees. As required later in the research, follow-up interviews were carried out to better understand the context of their market development efforts.

Overall, this approach allowed for flexibility in data collection, ensuring that valuable information was obtained even in cases where direct access to executives was limited.

By using structured interviews, reviewing company documentation, and incorporating industry-related information, the study maximized the depth and breadth of the primary data collected. This multi-faceted approach provided enriched the analysis by capturing diverse perspectives and multiple sources of information.

IV.6 Research Instrument

For data collection, an interview questionnaire was adopted for the study. This interview guide contained set of questions crafted to engage interview participants with the aim of obtaining information relevant to the research problem. According to Patton (2015), the interview questionnaire is a data collection tool that relies on asking questions in an orderly manner to collect information on a particular topic. An interview questionnaire ensures questions are arranged

systematically while also helping the researcher guide the direction of conversations with the participants. According to Rubin and Rubin (2012), an interview questionnaire usually contains an introductory section (that summarizes the study objectives and solicits participation), main questions to be asked (broader questions to more specific ones), probing responses (which depend on the participant's initial response to the major questions) and closing remarks.

The interview guide was organized in three parts. The first part is the introductory part, explaining in clear terms what the study seeks to achieve. The second section contained the direct questions and probing questions as regards the research objectives, which are (a) determining the level of adoption of ICT in the supply chain management of Nigerian SMEs; (b) identifying barriers to ICT adoption; (c) assessing market penetration and market development rate; and (d) examining the effect of ICT adoption in supply chain management on market penetration and market development. The last section featured further probing questions and closing remarks, with distinctions between market penetration and market development being based on market share and geographical presence across the 6 geopolitical regions respectively.

IV.7 Method of Data Analysis

The study employed the thematic analysis to generate valuable information from the raw data. NVivo software was utilized for conduct the thematic analysis. This type of analysis focuses on extracting key themes from the raw information. This approach enabled the researcher to conduct a deep dive into interview data, ensuring that key themes and patterns were identified and examined in detail.

The NVivo software provided a valuable tool for organizing, managing, and analyzing the qualitative data. It facilitated the coding and categorization of the interview transcripts. The

software also allowed for easy retrieval and comparison of data across different cases, enhancing the efficiency and accuracy of the analysis.

The process of data analysis involves careful examination of the interview transcript to understand to gain context. Initial codes were extracted based on commonality of key terms, concepts or statements that featured across the responses. The themes were further refined to ensure they fit into the research objectives.

To present the findings, the results were synthesized and summarized in figures and tables. Figures were used to visually represent patterns and relationships identified in the data, providing a clear and concise overview of the key themes. Tables were utilized to present supporting evidence, such as illustrative quotes or summarized data, enhancing the transparency and credibility of the findings.

Using NVivo for the thematic analysis ensured the responses were structured systematically. Incorporating tables and figures in the interpretation ensured the analysis was done in a way that everyone will understand what the findings entails. Overall, this approach facilitated a comprehensive exploration of the research questions and provided in-depth discoveries on the subject matter.

IV.8 Reliability and Validity

Data sourced were subjected to validity and reliability checks. This was done to ensure that the research instrument addresses the research questions and the findings can be adapted to the broader SME ecosystem in Nigeria. Conclusions were based on 20 interview transcripts from a total of 25 interviewed SMEs. This allowed for the substitution or removal of faulty data or incomplete information that can occur in interviews. In such instances, the additional five candidate companies were used as backup interviewees to replace any insufficient interviews. This

substitution was only required in two instances. These 5 backup companies met the same criteria by which the 20 other SMEs were selected.

Following Yin (2017), the study addressed the issue of reliability by

1) Arranging SME's information in similar format.

2) To ensure information accuracy and consistency, a second observer was enlisted to take notes during the interviews.

3) Creating a case interview database.

The study improved on construct validity by making use of diverse sources to assess the correctness of information provided by the participants. The use of multiple sources as well as the thematic analysis formed the basis for analytical generalizability as common for qualitative studies versus statistical generalizability in quantitative studies. By so doing, the findings were made more generalizable to entire SME ecosystem. This approach is supported by Yin (1994) to improve the relevance of the study. Samaddar and Kadiyala (2006) utilized a consensus approach to harmonize assessments and ensure reliability in studying the outsourcing of information systems.

Yin (1994) stresses that external validity, particularly in the context of single case studies, is essential for strengthening generalizability of findings. Unlike survey that anchors on statistical generalization, case studies make use of analytical generalization. This involves striving to generalize specific findings to broader theories. However, analytical generalization is not automatic and requires replication logic and the conduct of new case studies or experiments. As a result, this research presents causal relationships only on the basis of the interviewees' experiences, and not as categorical relationships. More research is proposed to establish such relationships, to

validate and generalize findings through replication logic supported by theoretical heterogeneity and diverse cultural contexts. (Samaddar and Kadiyala, 2006)

IV.9 Ethical Considerations

Compliance with ethical principles in qualitative research is imperative. This research paid attention to the principles of informed consent, voluntary participation, and confidentiality. To this end, the research completed an IRB certification to uphold adherence to ethical principles. Regarding informed consent, formal invitations were sent to participants to obtain their consent. Upon confirmation of participation, participants were briefed on the study objectives and expected outcomes from the interviews. For confidentiality, participants were informed that their responses and shared experiences would be used strictly for research purposes. Information obtained from the interviews were discarded after the completion of the study.

V CHAPTER FIVE: PRESENTATION AND ANALYSIS OF DATA

V.1 Preamble

This chapter examines the data collected on the effect of technology-driven supply chain systems on the market penetration and development of SMEs in developing nations, with the Nigerian SME ecosystem as case study. The data is analyzed thematically to identify patterns in SME behavior in technology adoption, limitations and impact. While this method provides rich insights into diverse viewpoints of participants, it inherently lacks the ability to establish causality. Instead, it offers a platform for exploring and presenting the self-reported claims of the respondents.

Therefore, statements indicating causality are intended, not to indicate such variable as the only factor, but as the expression of the respondents as perception of their experiences. Additionally, it is crucial to recognize that the sample size of 20 does not represent a statistically significant or representative sample of the entire population of Nigerian small businesses. Nonetheless, despite these limitations, the logical significance of insights gleaned contributed to valuable perspectives to the understanding of the impact of technology-driven supply chain systems on SMEs in Nigeria.

Descriptive tools such as charts and tables were employed to succinctly summarize key data characteristics, enhancing the clarity and comprehensibility of the findings.

V.2 Presentation of Data

Data sourced from the respondents is presented in four parts. The first section presents the company or industry profile. The second section elicited information on the technology adoption level in the supply chain management systems of selected SMEs. The third section espoused information on the barriers faced by selected SMEs in integrating technology into their supply

chain management systems and the efforts taken to address the identified barriers. The fourth section provides information on the market penetration and market development of selected SMEs as a result of supply chain technology, as well as alternative strategies for harnessing untapped opportunities in their respective markets. The last section offers valuable insights into the impact of technology adoption in supply chain on market development and market penetration of select SMEs.

V.2.1 *Industry Profile*

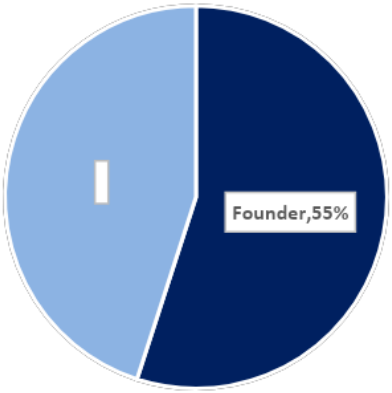


Figure V.1: Designation of Respondents

Of the 20 respondents interviewed, the majority (approximately 55%) are founders/owners of select businesses while the other 45 percent are senior executives (either as directors or managers) in their respective establishments. This distribution of respondents suggests that the study engaged individuals who hold company leadership positions and have direct involvement in the decision-making processes of their firms. Overall, respondents either as founders or senior executives are well-positioned to offer accurate information on the subject matter.

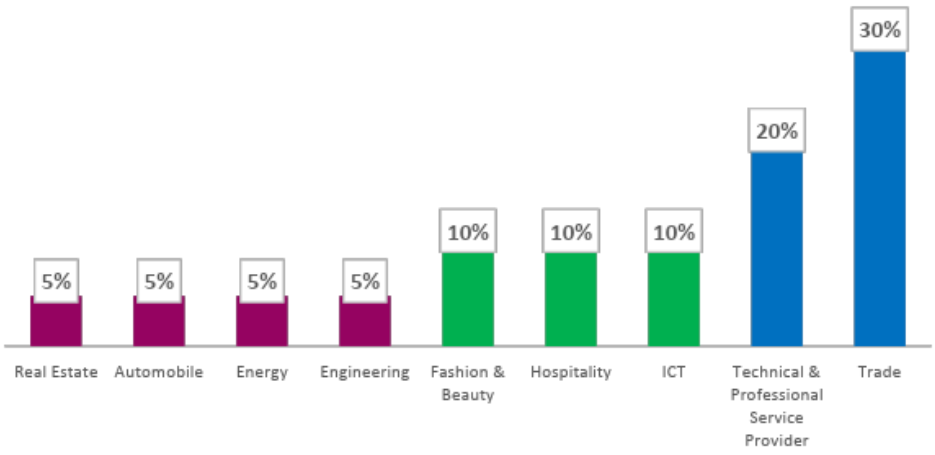


Figure V.2: Distribution by Economic Sector

Select SMEs covered a diverse range of economic sectors, representing significant portions of Nigerian SMEs. Majority operate in the trade sector, accounting for 30% of the sample. Other sectors included technical and professional services (20%), ICT (10%), hospitality (10%), and fashion and beauty (10%). The remaining sectors, including real estate, automobile, energy, and engineering, each accounted for 5% of the sampled SMEs.

These figures are largely in line with the distribution of sectors in Nigeria. The trade sector is one of the largest sectors in Nigeria, accounting for about 20% of GDP. The technical and professional services sector is also a major contributor to the economy, accounting for about 15% of GDP.

The study benefits from the heterogeneity of sectors, allowing a comprehensive analysis of technology-enabled supply chain systems' impact on market penetration in various industries. By examining specific sectors, comparing findings across industries, and understanding unique characteristics, challenges, and opportunities, the research gains richness and applicability, contributing valuable insights on the subject matter.

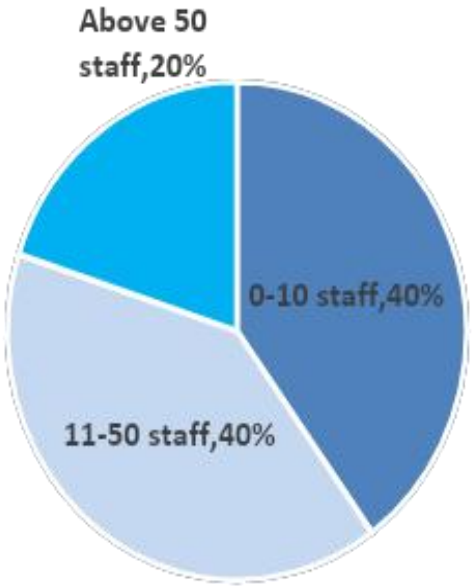


Figure V.3: Staff Strength

Figure 5.3 presents the staff strength of select businesses. The entities have an average staff size of 41 for a combined workforce of 807 employees, with individual businesses ranging from as few as three employees to as many as 200 employees. The distribution of employees among the selected SMEs shows that 40% of the businesses have between one and ten employees, another 40% have between 11 and 50 employees, and the remaining 20% have more than 50 employees. The analysis showed that SMEs with a higher level of maturity have larger staff size compared to younger SMEs.

According to Hitt et al. (2017), smaller SMEs face limitations, lacking financial resources to hire quality talents. Larger SMEs, with more resources, could invest in technology adoption, impacting market penetration strategies. Distribution by staff strength sheds light on the study's business scale, influencing SMEs' capacity to adopt technology in supply chain systems, with smaller businesses facing financing constraints, and larger ones dealing with departmental alignment and increased technology risks, citing fraud as a threat (Hitt et al., 2017).

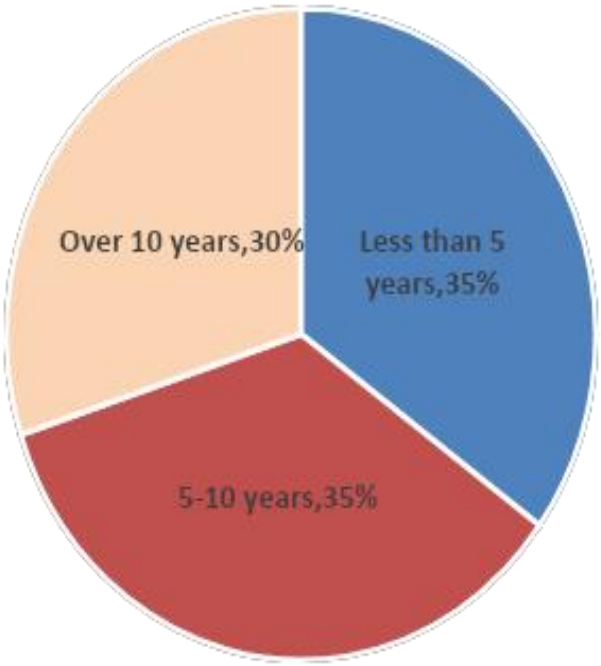


Figure V.4: Business Maturity

Data presented in Figure 5.4 showed that the selected SMEs are at varying maturity levels. Some 35% of the SMEs have been in existence for less than five years, another 35% have been operating for a period between five and ten years, and the remaining 30% have been in business for more than a decade. This distribution suggests a mix of new and mature businesses within the sample.

As Kotler & Keller (2016) earlier identified, newer businesses may face different challenges in terms of establishing their brand presence, attracting customers, and competing with established players in the industry. On the other hand, mature businesses may have had more time and experience to establish their market position and establish cordial relationship with vendors, suppliers and customers. Diversity in business maturity provides valuable insights into the range of experiences and potential differences in technology adoption and market penetration strategies.

Newer businesses may have different priorities and resource allocations compared to more established businesses, which can influence their commitment to adopting technology in their supply chain systems. Similarly, mature businesses may have a longer history of operations and customer base, potentially impacting their readiness and ability to adopt and leverage technology. This diversity in business maturity levels highlights the importance of considering the varying needs, challenges, and opportunities that SMEs of different ages may face when integrating technology into their supply chain systems and pursuing market penetration strategies.

The interviews revealed that younger businesses prioritize innovation and efficiency as they seek to differentiate from existing brands, while older businesses prioritize market expansion. Younger businesses indicated less aversion to innovation risk, while older businesses indicated a more conservative approach.

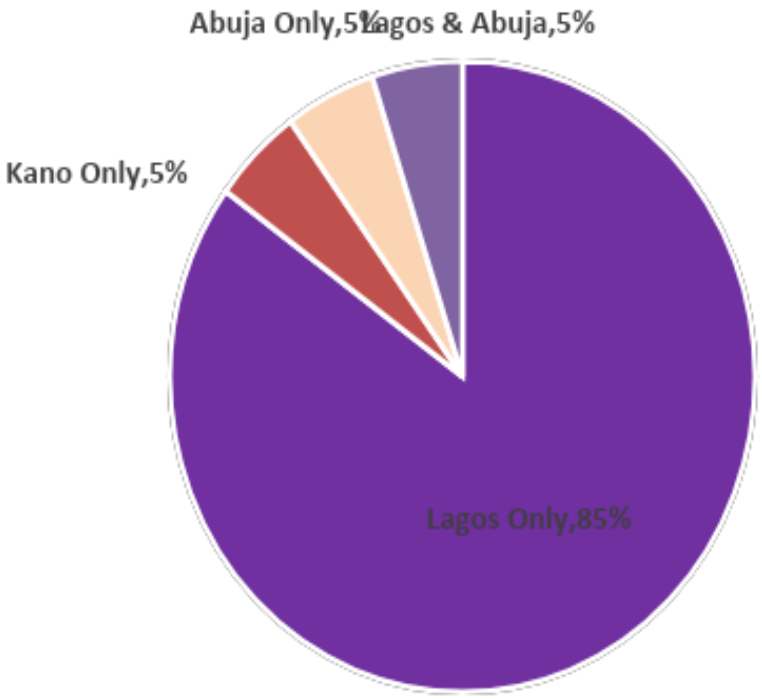


Figure V.5: Primary Location and Market Development Rate

Figure 5.5 shows the primary location/market of selected SMEs. Data shows a significant fraction of selected businesses (approximately 85%) are based in Lagos. This validates Lagos as the commercial nerve center of Nigeria. This also points to limited market development by the SMEs, most of whom have settled for regional operation. Only one of the businesses operates in more than one region with the other 19 limited to a single location.

Lagos is home to the highest number of informal and formal MSMEs in Nigeria, accounting for about 16% of the MSME ecosystem (SMEDAN, 2021), despite being home to less than 10% of the national population. Moreover, Lagos being the technology hub center in Nigeria indicates a pool of technological expertise, innovation and solutions available within the city. The high concentration of businesses and potential customers in Lagos means that SMEs need efficient supply chains to meet local demand. The insights from Lagos' role as technology hub and its importance as a market for SMEs can guide the adoption of technology in their supply chain processes.

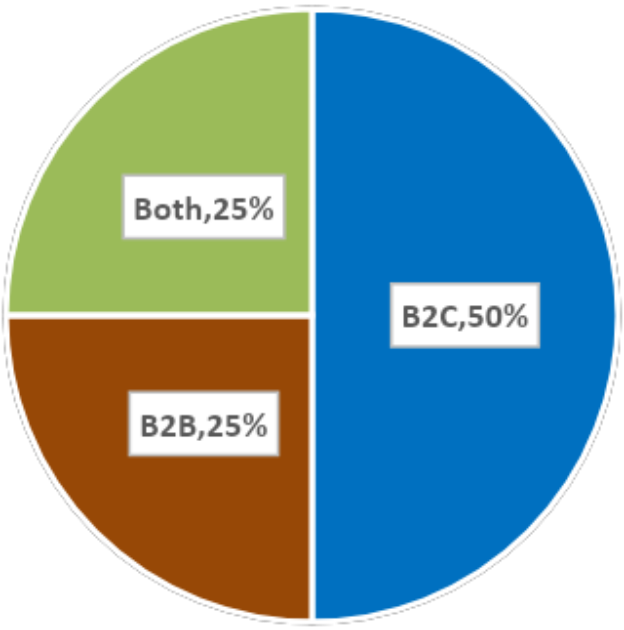


Figure V.6: Business Model

The findings presented in Figure 5.6 indicate the distribution of selected SMEs based on their business models. Half of the selected SMEs (50%) operate a business-to-customer (B2C) model, where they directly sell their products or services to the final consumers. This finding suggests that a significant proportion of the SMEs in the study focus on serving end consumers, potentially targeting a wide range of customers and catering to their specific needs.

Another quarter of the selected SMEs (25%) operate on a business-to-business (B2B) model. These businesses primarily engage in providing products or services to other businesses as their target customers. The B2B model often involves building relationships and offering solutions tailored to the specific requirements of business clients. This finding suggests that some SMEs may specialize in serving other businesses and operate within specific industry sectors.

Moreover, another quarter of the selected SMEs (25%) adopt a hybrid approach, combining both B2C and B2B models in their operations. These SMEs engage in serving both individual consumers and businesses, providing a diversified value offering. The adoption of a hybrid model allows these businesses to capture opportunities in different market segments and expand their customer base.

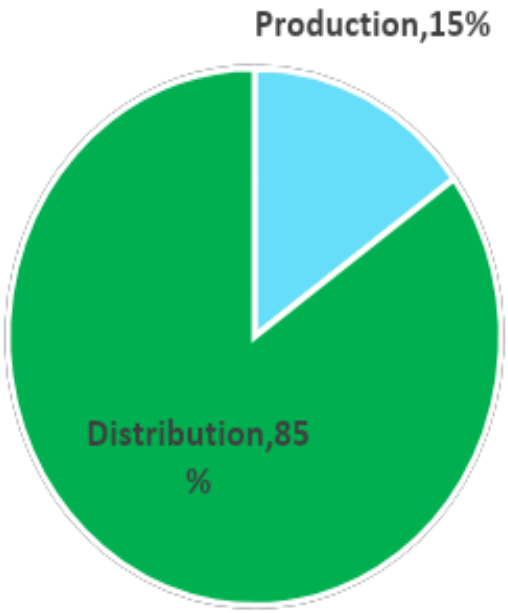


Figure V.7: Status in Supply Chain

The findings depicted in Figure 5.7 highlight the status of the selected SMEs within their respective supply chains. The data reveals that the majority of the selected businesses (85%) operate in the distribution or retail segment of the supply chain. These businesses primarily focus on activities such as purchasing, storing, and selling products to end consumers or other businesses. This finding suggests that a significant proportion of the selected SMEs operate in the distribution segment of the supply chain.

On the other hand, 15% of the selected SMEs operate in the production phase of the supply chain. These businesses are involved in manufacturing or producing goods, often serving as suppliers to other businesses or acting as key players in the production process. The presence of SMEs in the production phase reflects their contribution to the overall value chain, where they contribute to the creation and transformation of raw materials into finished products.

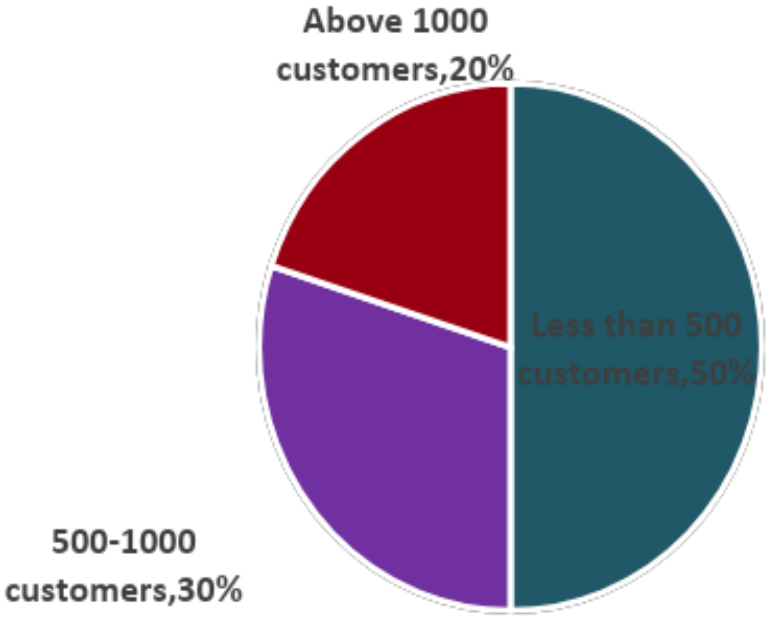


Figure V.8: Customer Base

Figure 5.8 indicates that the selected SMEs have a cumulative clientele base of 16,584 customers, with an average value of 848 customers per business. The customer base includes both corporate and individual customers. Half of the selected businesses have less than 500 customers, while 30% are serving between 500 and 1,000 customers. The remaining 20% of businesses have more than 1,000 customers. These findings reflect the varying customer sizes and levels of customer engagement among the selected SMEs. It demonstrates that there is a range of customer bases within the SME sector, with some businesses catering to a smaller number of customers

while others have a larger customer base. This variation in customer size aligns with the diversity of SMEs and their target markets that the study might be able to capture.

V.2.2 *Technology Adoption in Supply Chain Systems*

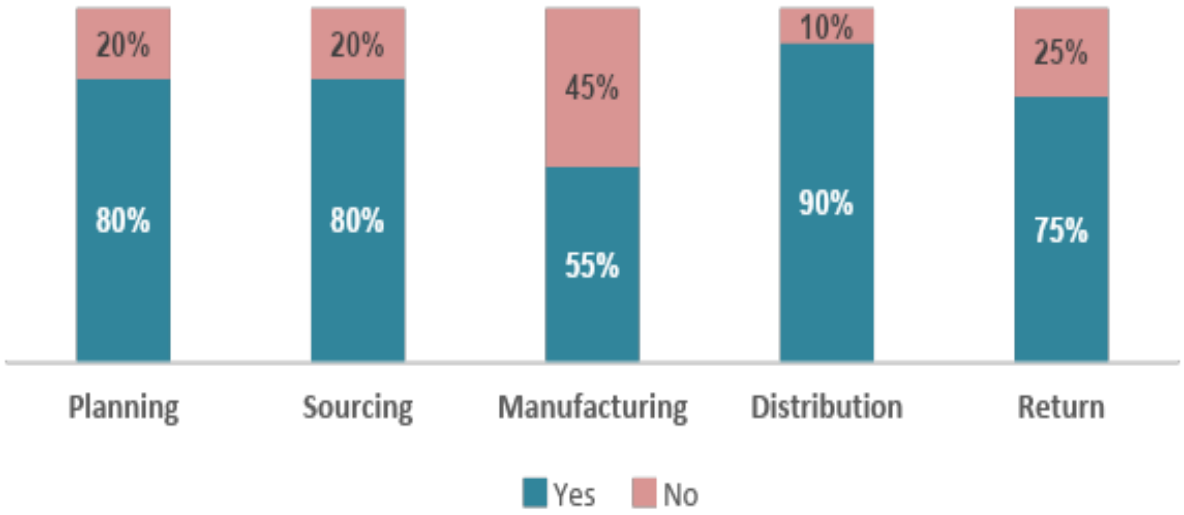


Figure V.9: Integration of SCM Element in Value Creation Process

Figure 5.9 indicates the extent to which selected SMEs have integrated different operational segments of their supply chain in their value creation process. According to the data, 80% of the selected SMEs incorporate planning in their value creation process, while the remaining 20% do not. Similarly, 80% of the SMEs have sourcing as part of their value creation process, while 20% do not. In terms of manufacturing, 55% of the respondents incorporate this element in their value creation process, while the remaining 45% do not. This aligns with our earlier discussions regarding the nature of SMEs, where many of them do not engage in core production activities involving the converting intermediate products and raw inputs into finished items. Additionally, 90% of the selected SMEs have the distribution element in their value creation process, indicating the importance of effectively delivering products or services to customers.

Furthermore, 75% of the SMEs incorporate the return element in their value creation process, reflecting the recognition of the need to address product returns and reverse logistics.

The findings demonstrate that selected SMEs incorporate various elements such as planning, sourcing, manufacturing, distribution, and return in their value creation process, although at varying levels. This highlights how essential a well-integrated and coordinated supply chain in the value creation process of SMEs.

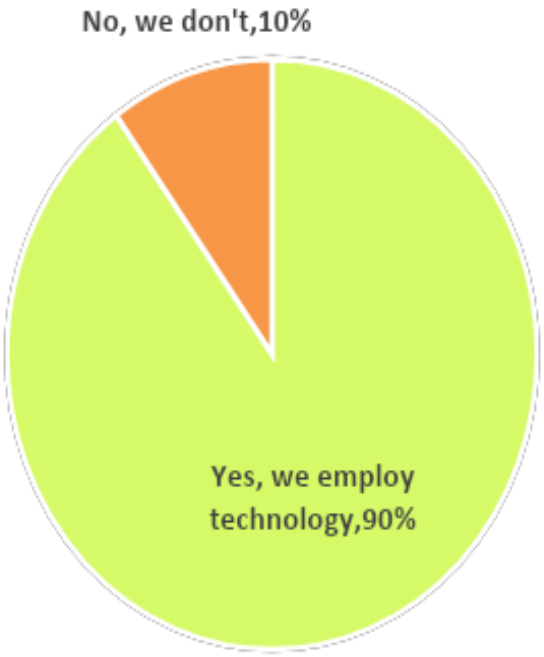


Figure V.10: Technology Adoption in Operations

According to data sourced, most (90 percent) enterprises adopt modern technologies in their operations while the other 10 percent do not. It can be inferred that technology adoption level is high among participating businesses. This reflects increased consciousness of the importance of technology in business given the ever-rising competitiveness of the Nigerian business landscape. One of the respondents alludes:

"We leverage cutting-edge technologies in all our operations to improve our supply chain visibility, transparency and customer satisfaction."

Another respondent also asserts:

"Absolutely, modern digital technology is an integral part of our operations, and we leverage it to enhance our competitiveness."

These statements further emphasize the significance of technology in their operations. One respondent stated that his business employs cutting-edge technologies for their functions within the supply chain while another emphasizes the integration of modern digital technology to enhance competitiveness. These assertions further underscore the importance of technology in bolstering supply chain performance, create positive customer experience and enhance overall productivity.

For businesses adopting technology, the researcher further inquired on the specific application of technology within the supply chain. Findings showed that 18 out of 20 selected businesses reported having incorporated modern technology in their operational activities. This aligns with the understanding that technology adoption is key for sustaining competitiveness in today's increasingly complex and dynamic business landscape.

The data underscores a strong inclination towards modern technology adoption in SMEs, with 90 percent embracing technology. This prevalence highlights the increasing recognition of technology's pivotal role in business operations, especially in the competitive Nigerian business landscape. The respondents' statements emphasize this trend, with one respondent confirming the application to reduce turnaround time. Another respondent emphasized its integration for enhanced competitiveness. In a broader context, this conveys that technology integration is no longer a mere choice but a fundamental strategy for sustained success in modern business environments (Adio, Bananda & Eluka, 2018).

Table V.1: Technology Adoption in Supply Chain Areas by the 18 out of 20 businesses using modern technology

Areas	Yes, Technology Adopted	No Technology Adopted
Planning	15	3
Sourcing	17	1
Manufacturing	11	7
Distribution	18	0
Return	11	7

Table 5.1 above shows the number of businesses adopting technology in each stage of the supply chain.

Planning: This stage involves making tactical decisions to determine overall supply chain design and operations. The result shows that only 15 SMEs adopt technologies in carrying out planning functions. The type of technologies used by some of the selected SMEs include advanced analytics, machine learning, forecasting software, inventory monitoring application, project management tools, RFID, and predictive analytics to perform a variety of functions. These technologies enable businesses in forecasting demand, understanding market dynamics, managing inventories and planning logistics. These technologies also help businesses stay abreast of market trends with the view of tweaking their business strategies in line with evolving trends. One respondent states:

"We use advanced analytics and machine learning algorithms to analyze data and forecast demand, allowing us to optimize our production schedules and minimize waste."

Another respondent operating in the ICT sector corroborates:

"We use cutting-edge technology to monitor and adjust our plans in real time".

Sourcing: Data in Table 5.1 shows 17 SMEs incorporate technology in their sourcing functions. These technologies include online market platforms, e-procurement platforms, automated warehousing systems, enterprise resource planning systems, and cloud-based sourcing. These technologies are primarily software applications. These tools are leveraged by selected

businesses in carrying out their sourcing functions from supplier prospecting to contracting. According to one of the respondents:

"*We leverage digital technologies to improve our sourcing activities, such as using e-procurement platforms to streamline our procurement process and reduce costs. We also use data analytics to identify the most suitable vendors for our needs and negotiate favorable pricing."*

More importantly, selected businesses leverage these technologies to secure favorable pricing deals from trusted suppliers that can deliver quality materials or components. Upholding this position, another respondent states:

"We make use of online marketplaces and platforms to identify and source the best materials and components at the best prices, ensuring that we can deliver high-quality products at competitive prices."

Manufacturing: Only 11 selected SMEs adopt technology at this stage. The kind of technology employed include advanced robotics, internet of things (IoT) sensors and computer-aided design (CAD) systems. These technologies perform multidimensional functions. One of the respondents into imports and export states:

"We use IoT sensors to monitor equipment performance and detect potential issues before they become major problems."

Generally, these tools are used for optimizing production and achieving efficiency. Another respondent operating in the automated manufacturing industry states:

"*We use advanced robotics and automation to streamline our manufacturing processes, reducing costs, improving quality, and enhancing efficiency."*

Distribution: Data shows that only 17 of selected SMEs incorporate technology such as GPS tracking, route optimization algorithms and real-time tracking and monitoring applications in fulfilling their distribution functions. These technologies are typically used to monitor shipments of products to final customers. One of the respondents stated:

"We use real-time tracking and monitoring technologies to optimize our delivery routes, ensure timely delivery, and provide customers with accurate and up-to-date information about their orders."

Returns: Data shows only 11 of the selected SMEs incorporate technology in fulfilling their return functions. Examples of these technologies include customer complaints system and online return management systems Feedback received from customers at the return stage are sometimes used by the business entity to improve its product quality towards achieving greater customer satisfaction and improving overall customer experience. A respondent that sells household equipment states:

"In our return process, we use AI algorithms to identify patterns and trends in customer returns, allowing us to improve our product quality and reduce the frequency of returns.

In addition, selected SMEs also use technology to receive, process and resolve customer complaints on defective products. One of the respondents corroborates this position.

"We use digital technologies to streamline our returns process and ensure that customers receive their refunds or replacements quickly and efficiently."

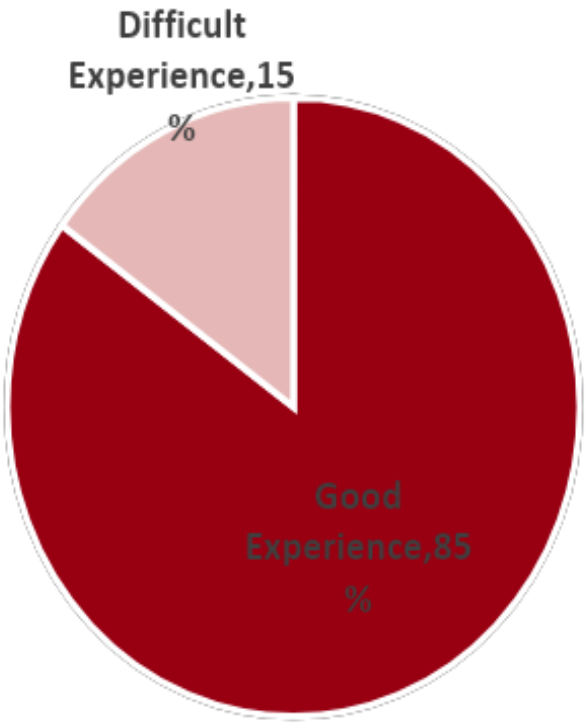


Figure V.11: Experience with Electronic Payment Channels

From figure 5.11 presented above, majority of the selected businesses (85%) reported having a positive experience with electronic payment channels, such as mobile transfers, compared to the traditional method of accepting written checks. This highlights the benefits of digital payment platforms in terms of convenience, improved cash flow, and reduced transaction costs. This further confirms high rate of technology adoption by SMEs in the supply chain. It further portrays the positive impact of technology adoption on operational efficiency. As Chopra and Meindl (2016) asserted, proper management of the financial flow ensures timely payment, cost control, and financial stability within the supply chain. The high percentage of businesses reporting a good experience with digital payment platforms suggests that SMEs in the study have recognized the advantages of transitioning from traditional payment methods to digital channels. This finding is in line with the growing global trend toward digital payment adoption, driven by technological

advancement in digital financial services. The positive feedback from selected businesses indicates that digital payment platforms have provided them with greater convenience, enabling faster and more efficient transactions. Improved cash flow, another reported benefit, can be attributed to the speed of digital transactions, which can facilitate quicker settlements and access to funds.

Additionally, the reduced transaction costs associated with digital payments compared to traditional check-based methods can contribute to cost savings for SMEs. A respondent assert:

"With mobile payments, we can easily track and reconcile payments, reducing the risk of errors and improving our financial management processes.

However, the study also found that 15% of the respondents reported having negative experiences with digital payment platforms due to network issues. This finding suggests that despite the overall positive feedback from the majority of businesses, there are still challenges and limitations associated with the use of these platforms. One of the respondents in this category adduced:

"It seems easy in theory, but the challenge is with the providers (the banks). Sometimes there can be no network for a whole 24 hours, which slows down transactions for that day."

The negative experiences reported by the respondents underscore the need for further innovation in digital infrastructure and efforts to address network issues. Improving network coverage, enhancing internet speeds, and ensuring reliable connectivity are crucial for maximizing the benefits of digital payment platforms and minimizing disruptions in business operations. While adoption of digital payment platforms is associated with several benefits, challenges still persist around network infrastructure. This issue has not been fully addressed by financial service providers in Nigeria. The challenge is even more prominent in remote areas characterized by poor network infrastructure and significantly lower bank presence.

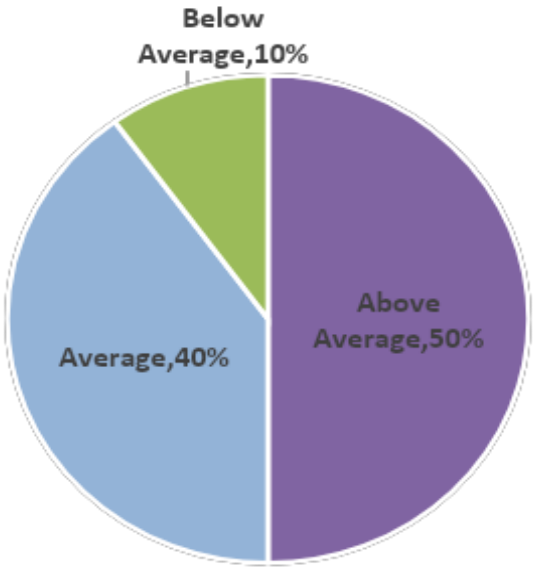


Figure V.12: Technology Adoption Level in SCM end-to-end

Figure 5.12 indicates that approximately 50% of the respondents consider their technology adoption level in supply chain management systems to be above average. Furthermore, 40% of the respondents rated their technology adoption in supply chain management as average, while 10% considered their adoption level to be below average.

This indicates that technology adoption in SCM varies among selected businesses. Few (about 15%) are early adopters and have advanced technology systems in place, while others are in the process of implementing or optimizing their technology solutions.

This variation in technology adoption levels could be influenced by factors such as resource availability, organizational size, industry characteristics, and individual business strategies. It is noteworthy that the specific reasons behind the respondents' perceptions of their technology adoption level as average or below average were not provided in the paragraph.

Most respondents recognize the benefits associated with incorporating technology into their supply chain processes, such as increased efficiency, better optimization of cost structures,

and the ability to provide superior solutions to customers. Technology-driven supply chain systems have been shown to improve operational efficiency, enhance visibility and coordination, enable real-time data analysis, and support decision-making processes. Adopting technologies in the supply chain allows for streamlined processes; reduced cost structures and strengthened competitiveness in the industry.

One of the respondents corroborated on this by stating:

"We harness cutting-edge technologies to enhance our supply chain visibility, transparency and sustainability. This is to make us a preferred partner for our customers and suppliers."

Upholding this position, another respondent that runs a digital marketing outfit also submits:

"Our supply chain technology adoption is above average, with technologies such as RFID, AI, and analytics tools utilized to improve visibility and optimize our processes."

While Ejem et al. (2021), Napitupulu et al., (2018) and Rahayu & Day (2017) noted that the adoption of technology in supply chains within emerging market economies remains low in Sub-Saharan African countries, data from the interviews indicates that this has improved.

This changing perspective among SMEs is possibly due to increasing level of awareness about the role of technology in enhancing supply chain efficiency, cost management, and customer satisfaction.

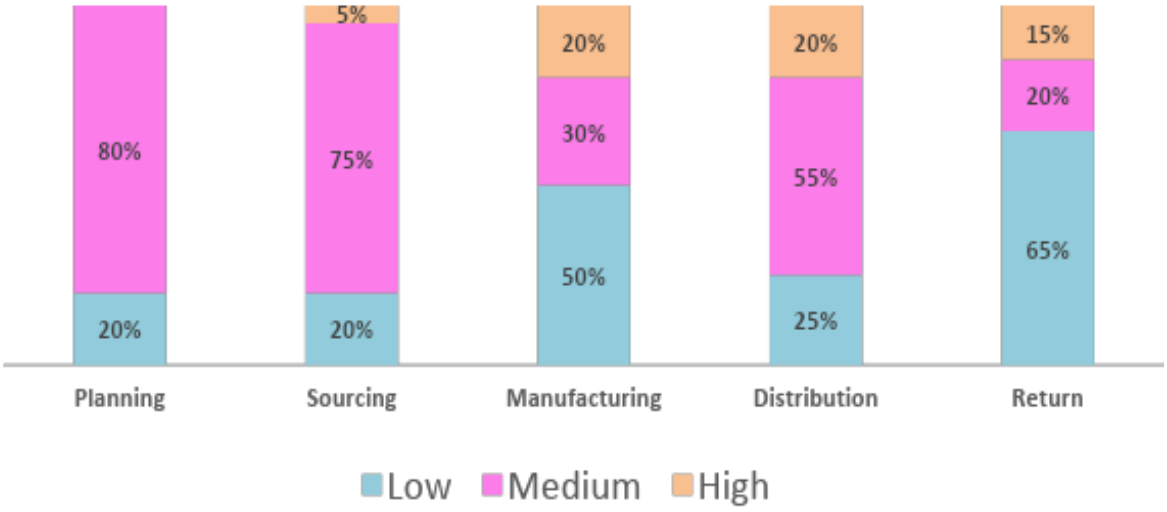


Figure V.13: Level of Hardware Technology Adoption

Figure 5.13 indicates the level of hardware technology adoption in the supply chain systems of the selected SMEs. The data shows that hardware technology adoption is moderate in the planning, sourcing, and distribution stages, while it is low in the manufacturing and return stages.

Usage of hardware technology in supply chain systems has been a topic of discussion in the literature. While the specific findings of hardware technology adoption at each stage of the value chain may not have been discussed in this result, there is agreement that technology adoption in supply chain management can contribute to improved performance and efficiency (Chopra & Meindl, 2021). The moderate adoption of hardware technology in planning, sourcing, and distribution stages aligns with the recognition of the importance of technology in these areas to enhance decision-making, optimize sourcing processes, and improve logistics and distribution activities.

However, the lower adoption of hardware technology in the manufacturing and return stages could indicate a potential area for improvement. Existing literature emphasizes the importance of technology integration in manufacturing processes to enhance productivity, quality control, and automation (Gunasekaran et al., 2018). Similarly, the adoption of technology in the return stage can facilitate effective reverse logistics processes and enable better management of product returns and after-sales services (Blumberg et al., 2021).

Relative Importance Index

To conduct an objective assessment on the level of hardware technology adoption, the study utilized the relative importance index (RII) as a statistical method. The RII helps in evaluating the relative contribution of hardware technology adoption in each element of the supply chain. By assigning weights to different levels of adoption based on perceived importance, the RII provides a standardized measure of hardware technology adoption in the supply chain. The RII is computed by assigning weights to each level of adoption (high=3; medium=2; and low=1) based on its perceived importance adjudged by respondents.

Table V.2: ***Relative Importance Index for Hardware Technology Adoption***

	High (A)	Medium (B)	Low (C)	Weighted High Adoption (A *3)	Weighted Medium Adoption (B*2)	Weighted Low Adoption (C*1)	Total	Highest Weight (3) * No of Respondents (20)	**RII**
Planning	0	15	4	0	30	4	34	57	**0.60**
Sourcing	1	14	4	3	28	4	35	57	**0.61**
Manufacturing	4	5	10	12	10	10	32	57	**0.56**
Distribution	4	10	5	12	20	5	37	57	**0.65**
Return	3	4	12	9	8	12	29	57	**0.51**

The findings presented in Table 5.2 indicate the adoption rate of hardware technologies at each stage of the supply chain systems of the selected SMEs. The results shows that hardware technology is mostly adopted at the distribution stage as it has the highest RII of 0.65. On the other hand, hardware technology is least used at the return stage.

The literature aligns with the findings regarding the adoption of hardware technology in the distribution stage. It is well-established that technology is critical in enhancing logistics and distribution activities, improving inventory management, and enabling efficient order fulfillment (Chopra & Meindl, 2021). The high adoption of hardware technology in the distribution stage among the selected SMEs reflects the recognition of its importance in streamlining these operations. In contrast, the lower adoption of hardware technology in the return stage may indicate a potential area for improvement. Effective return management is vital for supply chain efficiency and customer satisfaction (Blumberg et al., 2021). Therefore, the low level of adoption of hardware technology in the return stage suggests that selected SMEs may need to focus on integrating technology to enhance their capabilities in handling returns and managing the associated processes.

The findings, presented in Table 5.2, revealed varying levels of adoption. The distribution stage showed the highest adoption (RII of 0.78), reflecting its recognized importance in enhancing logistics and order fulfillment. On the other hand, the return stage exhibited the least adoption (RII of 0.48), signaling an area where technology integration could enhance reverse logistics and customer satisfaction.

The RII values not only aligned with existing literature on technology's role in distribution but also quantified the extent of adoption discrepancies across stages. This quantitative assessment informed strategic decision-making by highlighting stages requiring increased technology integration. Thus, RII served as a valuable tool for objectively evaluating hardware technology adoption's impact on different supply chain elements, allowing for targeted improvements and operational enhancements.

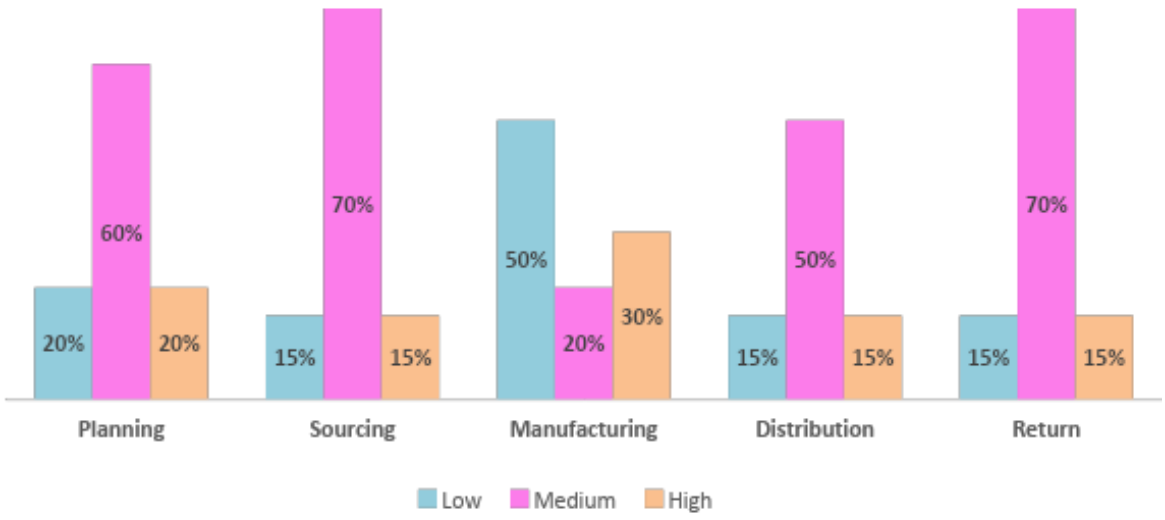


Figure V.14: Level of Software Technology Adoption

The findings presented in Figure 5.14 indicate the adoption of software technology at each stage of the supply chain systems of the selected SMEs. The data reveals that software technology adoption is moderate at the planning, sourcing, distribution, and return stages. However, in the manufacturing stage, software technology adoption is low. This is because selected SMEs in the study are not primarily involved in manufacturing activities.

The literature supports the findings regarding the adoption of software in the supply chain stages. Software technology is pivotal across various aspects of supply chain management, including planning, inventory management, order processing, and logistics (Chopra & Meindl, 2021). The moderate adoption of software technology in the planning, sourcing, distribution, and return stages aligns with the importance of these areas in optimizing supply chain operations and improving overall efficiency.

The lower adoption of software technology in the manufacturing stage is consistent with the fact that the selected SMEs are not predominantly engaged in manufacturing activities. This finding highlights the specific context of the study, where the focus is on SMEs operating in sectors

other than manufacturing. Therefore, it is expected that the adoption of software technology in the manufacturing stage would be relatively low among these SMEs.

Relative Importance Index

Table V.3: ***Relative Importance Index for Software Technology Adoption***

	High (A)	Med. (B)	Low (C)	Weighted High Adoption (A *3)	Weighted Medium Adoption (B*2)	Weighted Low Adoption (C*1)	Summation of weights	Highest Weight (3) * No of Respondents (20)	**RII**
Planning	4	12	4	12	24	4	40	60	**0.67**
Sourcing	3	14	3	9	28	3	40	60	**0.67**
Manufacturing	6	4	10	18	8	10	36	60	**0.60**
Distribution	7	10	3	21	20	3	44	60	**0.73**
Return	3	14	3	9	28	3	40	60	**0.67**

The data presented in Table 5.3 reveals the adoption of software technologies at each stage of the supply chain systems of the selected SMEs. The findings indicate that software technology adoption is widely adopted at the distribution stage. This aligns with the fact that a majority of the respondents operate as distributors or retailers within their supply chains. On the other hand, the manufacturing stage has the least level of software adoption.

The findings align with literature as discussed earlier. Software technologies are often leveraged in distribution activities to enhance order fulfillment, inventory management, and logistics coordination (Chopra & Meindl, 2021). Emphasis on software technology adoption at the distribution stage allows prompt product delivery to customers and timely responsiveness to customer requests.

In contrast, the relatively lower adoption of software technologies at the manufacturing stage aligns with the nature of the selected SMEs, as they are not primarily engaged in manufacturing activities. This finding reinforces the idea that technology adoption varies across various segments of the supply chain and is influenced by the specific operations and focus of the

businesses involved. The findings emphasize the need for SMEs to strategically align their needs as regards adopting technology with the specific requirements and characteristics of each stage within their supply chains.

The Relative Importance Index (RII) in Table 5.3, holds implications for the research findings. RII's quantification approach facilitates a nuanced understanding of software technology adoption across different supply chain stages among selected SMEs.

The presented RII values highlight significant patterns. Notably, the distribution stage stands out with the highest RII values (0.73), indicating substantial adoption of software technology. This aligns with the predominant role of distributors and retailers in the respondent pool. The emphasis on software technology adoption at this stage corresponds with its pivotal role in optimizing logistics, inventory, and order fulfillment, aligning with existing literature.

Conversely, the manufacturing stage showcases the lowest software technology adoption (RII of 0.60). This finding resonates with the nature of the SMEs, primarily non-manufacturers. It underscores that technology adoption is context-driven and influenced by the operational focus of the businesses. The RII's application in software technology adoption research reveals a distribution-focused technology adoption trend among SMEs and underscores the nuanced nature of technology integration across various supply chain stages.

V.2.3 *Barriers to ICT Adoption in Supply Chain Management*

Analysis of respondents' position on barriers to ICT adoption in supply chain management unveiled four critical challenges.

Barrier 1 (Complexity): The first barrier speaks to the evolving nature of technology.

One of the respondents submits

"Technology is too dynamic and always changing. For us, in view of complex nature, we are careful when sourcing for which technology or digital tool to adopt".

The constant and ever-changing nature of technology has made it increasingly difficult for SMEs to keep pace with the latest technology. Moreover, adapting new technologies on a regular basis tend to bring changes to existing business processes which can be difficult to manage.

Barrier 2 (Technical Expertise): Another prominent challenge facing SMEs is lack of technical expertise in the use of technology.

One of the respondents posits:

"Getting IT experts to handle the process is problematic. Bringing these experts to lead our technology drive is expensive and we cannot afford that."

Respondents facing this challenge attributed this to lack of technical personnel on their team, making it difficult for them to adapt modern technology in their supply chain. Technical experts are too expensive for small business owners to hire. The finding that SMEs face a challenge in terms of lack of technical expertise in utilizing technology is a common issue discussed in the literature (Smith, 2020; Egbetokun et al., 2014). SMEs often lack the necessary technical personnel with the expertise to effectively integrate and leverage technology within their operations, including their supply chain management systems. This challenge arises from several factors, such as limited financial resources, which make it difficult for small business owners to afford hiring technical experts.

The lack of technical expertise poses a barrier for SMEs in adopting and effectively utilizing modern technologies, including those in their supply chain management. This corroborates prior empirical studies that underscored the importance of human resource capabilities and technical knowledge in implementing and managing technology-driven initiatives

within SMEs. Small businesses may struggle to keep up with the rapidly evolving technological landscape and face difficulties in identifying, implementing, and maximizing the benefits of appropriate technology solutions (Smith, 2020; Egbetokun et al., 2014).

The inability to access or afford technical expertise limits SMEs' ability to fully leverage the power of technology to optimize their supply chain. SMEs can consider other options such as partnering with technology service providers, outsourcing certain technical tasks, or investing in training and upskilling programs for their existing workforce. These strategies can help bridge the gap in technical expertise and enable SMEs to overcome the barriers associated with technology adoption in their supply chain management systems.

Barrier 3 (Financial Requirements): Technology is not cheap as it comes with huge financial implications. From procuring to maintaining active subscription, modern technologies are costly and beyond the financial capabilities of an average SME operator. Most SMEs in Nigeria have a lean financial buffer. As such, acquiring and managing technology can depress their bottom-line, thereby limiting technology use in the SME ecosystem. One of the respondents highlights:

"Implementing new technology can be very expensive and finding the necessary funding as SME is a challenge."

The finding that the cost of modern technologies poses a financial challenge for SMEs aligns with the literature we have discussed. Research by Egbetokun et al. (2014) highlights the financial constraints faced by SMEs in adopting and managing technology-driven initiatives. SMEs often operate with limited financial resources, and the high costs associated with acquiring and maintaining modern technologies can strain their financial capabilities. This makes it challenging for SMEs to invest in technology and limits their ability to fully utilize technology in their operations, including their supply chain management systems.

The financial implications of technology adoption have been identified as a significant barrier for SMEs in various studies (Egbetokun et al., 2014; Smith, 2020). The costs involved in procuring technology solutions, such as hardware, software, and subscriptions, can be substantial and may exceed the financial capacity of many SME operators. This limitation restricts their access to advanced technologies and hinders their ability to leverage technology for improved supply chain efficiency and market penetration.

To address this challenge, SMEs may need to explore cost-effective alternatives such as cloud-based solutions, open-source software, or shared technology infrastructure. Collaborative partnerships with technology providers or seeking government support for technology adoption programs could also help alleviate the financial burden on SMEs (Egbetokun et al., 2014). By overcoming financial constraints, SMEs can unlock the power of technology in their supply chain management and enhance their competitiveness in the market.

Barrier 4 (Security Attack): SMEs face challenges related to digital attacks, which aligns with the literature as discussed. Cybersecurity concerns is identified as a significant barrier (Egbetokun et al., 2014; Smith, 2020). SME owners lack adequate data protection knowledge. They also do not have the resources to effectively protect their critical systems and sensitive information against digital attacks. This vulnerability to cyber threats creates fear and reluctance among SMEs in adopting technology solutions, including those related to supply chain management. One of the respondents posits:

"Sometimes technology is complex. I do not want the stress that comes with it. Also, the fear of being double crossed by criminal elements is scary."

The assertion emphasizes the perception of complexity and the fear of being targeted by cybercriminals as factors that discourage SMEs from embracing technology. This highlights the

need for SMEs to enhance their cybersecurity awareness and capabilities to mitigate risks associated with technology adoption.

The strategies employed by selected SMEs to address the challenges are in line with recommendations from the literature. Staff training and upskilling initiatives, as mentioned by one of the respondents, can help bridge the knowledge gap and improve the technical expertise of employees in managing technology adoption (Egbetokun et al., 2014). Consulting IT experts, attracting IT professionals, and collaborating with industry players are also effective approaches for SMEs to access specialized knowledge and ensure the adoption of appropriate technology solutions (Egbetokun et al., 2014; Smith, 2020).

Additionally, collating and analyzing supply chain data, staying updated on technological trends, and fostering flexibility in business processes align with the literature's emphasis on leveraging data-driven insights, continuous learning, and adaptability to harness the power of technology in supply chain management (Egbetokun et al., 2014; Smith, 2020).

To overcome these challenges, SMEs can consider several strategies. Staff training and upskilling initiatives can enhance the technical capabilities of existing employees. Collaborating with industry experts and IT professionals can provide specialized knowledge without the need for costly full-time hires.

Exploring cost-effective alternatives such as cloud-based solutions and open-source software can mitigate financial constraints (Björkdahl, 2020). Fostering a cybersecurity-aware culture and implementing robust security measures can alleviate concerns related to security attacks (Akamoh, 2015). Embracing data-driven decision-making, staying updated on technological trends, and maintaining business process flexibility align with the literature's recommendations. These strategies can empower SMEs to navigate the dynamic technology

landscape, effectively integrate technology into supply chain management, and capitalize on its potential benefits. By addressing these barriers and implementing proactive solutions, SMEs can enhance their competitiveness and adaptability in today's technology-driven business environment.

V.2.4 *Market Penetration and Development Strategies of Selected SMEs*

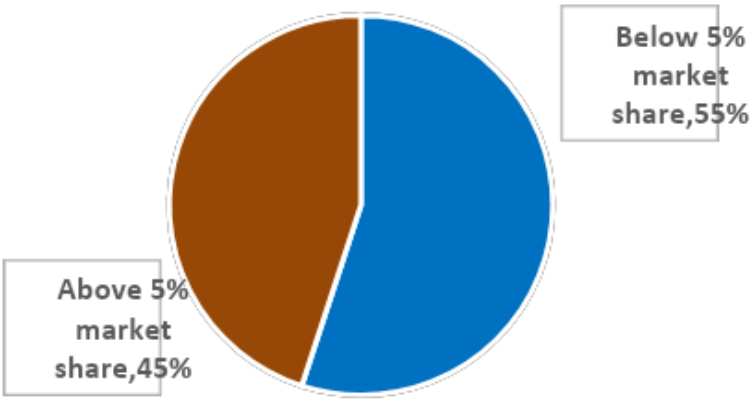


Figure V.15: Market Penetration Rate of Selected SMEs

Data in Figure 5.15 shows the market penetration rate of selected SMEs. Result shows that over 50% of select businesses have less than five percent share in their respective markets. This is not surprising given that small businesses are known to have limited influence within the industry they operate. On the other hand, 45 percent of selected small businesses control more than five percent share of their market.

With majority of selected SMEs owning less than 5% market share aligns with the literature as reviewed. Small businesses typically face challenges in achieving significant market penetration due to their limited resources and competitive disadvantages compared to larger firms (Boso et al., 2016; O'Cass et al., 2017). Extremely low level of market share among selected SMEs can be attributed to factors such as constrained marketing budgets, less brand recognition, and difficulty in reaching a wide customer base.

On the other hand, the finding that 45 percent of selected SMEs own more than five percent market share indicates that a notable portion of small businesses have managed to establish a stronger presence in their respective markets. This suggests that despite the inherent challenges, some SMEs are able to overcome barriers and gain a more substantial market share through effective strategies and value propositions.

The disparity in market penetration rates among SMEs reflects the diverse nature of the small business landscape, with variations in industry, competitive positioning, and growth trajectories. While some SMEs may face difficulty in expanding their market presence, others may have successfully differentiated themselves and captured a larger share of their target markets.

The findings highlight the importance for SMEs to develop effective marketing strategies, leverage their unique strengths, and differentiate themselves to enhance their market penetration. It also underscores the need for continuous adaptation and innovation to overcome the inherent challenges of limited resources and competition in the marketplace.

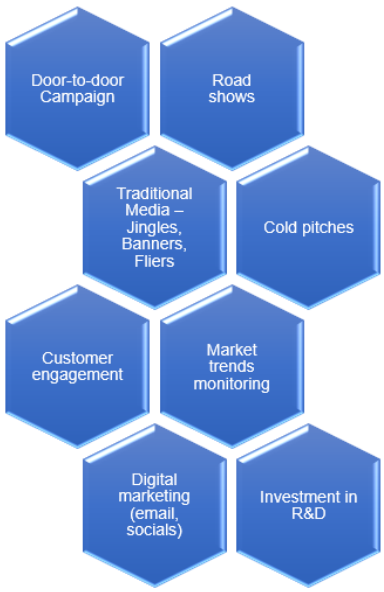


Figure V.16: Market Penetration Strategies Employed by Selected SMEs

This pattern of limited market influence can be attributed to several factors. SMEs often contend with budgetary constraints that hinder their ability to execute robust marketing campaigns. Moreover, their brand recognition might be dwarfed by that of more established competitors, making it difficult to capture consumers' attention. Additionally, the struggle to reach a broad customer base due to logistical limitations can further impede their market penetration efforts.

However, the intriguing finding that 45% of the selected SMEs own more than five percent market share introduces a counter-narrative that underscores the potential for strategic success despite these obstacles. This subset of SMEs has evidently transcended the conventional constraints, suggesting that they have successfully implemented effective strategies and compelling value propositions. This might involve innovative approaches to marketing, leveraging niche markets, fostering strong customer relationships, or delivering unique products or services that resonate with consumers.

In essence, the data underscores the duality of the SME landscape. While a majority grapple with limited market influence due to inherent challenges, a notable fraction has demonstrated their capacity to thrive and secure a more substantial foothold in their markets. This bifurcation highlights the dynamic interplay between the constraints faced by SMEs and the strategic approach that some employ to overcome these barriers. Ultimately, this analysis not only aligns with existing literature but also emphasizes the strategic significance of effective market penetration strategies for SMEs aiming to carve out a meaningful share in their industries.

Market-based Strategies

The main objective of market-based strategies (market penetration and market development) is to increase sales volume, which can be achieved by selling more products or services in existing markets while entering into new markets to attract new customers. There is no

one-size-fits-all approach when it comes to deepening market penetration and increasing market share. Indeed, most businesses combine a mix of technology-driven SCM solutions with other traditional approaches to growing their markets.

Several strategies are being utilized by selected businesses to penetrate new markets and hold a grasp of existing customers. Engagement with the respondents showed that these strategies proved effective in enabling them to improve market share. The strategies are highlighted as follows:

- **Door-to-door campaigns**: 10 percent of the respondents are using this strategy. This involves door-to-door visits and directly interfacing with potential customers directly. Interaction during door-to-door campaigns provides a human way of engaging potential customers to establish trust and create a positive brand image.
- **Road shows:** Another 10 percent of respondents use this strategy. Roadshows are a series of promotional events held in different locations with the objective of showcasing a company's products or services to potential customers. Roadshows present businesses with the opportunity of engaging their target audience directly.
- **Traditional Media:** Only five percent of respondents utilize traditional media such as banners, posters and fliers to create awareness for their offerings.
- **Cold Pitching:** 15 percent of respondents use cold pitching in the process of increasing their market share. Cold pitching entails reaching out to potential customers without prior relationship. It typically involves initiating conversation through emails, phone calls or social media messages with the aim of getting attention of potential customers.
- **Customer Engagement:** 30 percent of respondents deepen their market penetration by relating with existing customers periodically to know their level of satisfaction; and other

pain points and how SMEs can adjust offerings to meet customer needs. This customer-centric approach is used to build confidence in a company's brand.

- **Market Trend Monitoring:** Five percent of respondents make use of this approach. This involves understudying the market to identify potential opportunities in each segment of the market.
- **Digital marketing:** 10 percent of respondents utilize digital platforms such as websites, emails, mobile apps and social media platforms to create awareness for their products or services.
- **Investment in Research & Development:** Only five percent of respondents consider investment in research and development as strategy for increasing market penetration. This typically involves conducting thorough market research studies to identify untapped opportunities across markets. It could also be in form of investing in product quality to make it more attractive to potential and new customers.

Engagement with selected businesses pointed to how technology is adapted to harness untapped opportunities in the marketplace, serving in many instances as a complementary tool to alternative approaches. Most SMEs employs business strategy frameworks such as SWOT (strengths, weaknesses, opportunities and threat) analysis; PEST (political, economic, social and technological analysis); and market analysis in determining untapped opportunities in the market. These tools provide in-depth assessment of the business environment both internally and externally. It also provides small businesses with insights on current and future market conditions and how they should be positioned to harness opportunities in the market. These insights help business owners make informed and strategic business decisions. A respondent states:

"What we do is we use technology to do SWOT analysis and feasibility study. We then process the data to make informed decisions."

Another strategy adopted by selected SMEs in identifying untapped opportunities using technology is to conduct product review sessions with stakeholders including customers, investors and distributors to identify areas where the market is being underserved. One of the respondents affirms this:

"We understand that the market is highly competitive. We are constantly looking for how to innovate and improve our strategy to gain competitive edge."

With this strategy, small businesses have an evidence-based information at their disposal on areas they need to improve on to drive competitiveness in the market.

Market penetration strategies play a pivotal role in a business's quest to expand its sales volume and market share. The discussed strategies showcase the dynamic approaches that selected businesses employ to deepen their market penetration and retain their existing customer base.

In essence, these strategies underscore the multifaceted nature of market penetration. Businesses must craft a tailored approach that aligns with their strengths, target audience, and market conditions (Baird & Raghu, 2015). The amalgamation of traditional approaches, digital tools, customer engagement, and innovation showcases the intricate web of strategies that contribute to a business's sustained growth and competitiveness in a dynamic marketplace.

V.2.5 *Impact of Technology-enabled Supply Chain System on Market Penetration and Market Development of Selected SMEs*

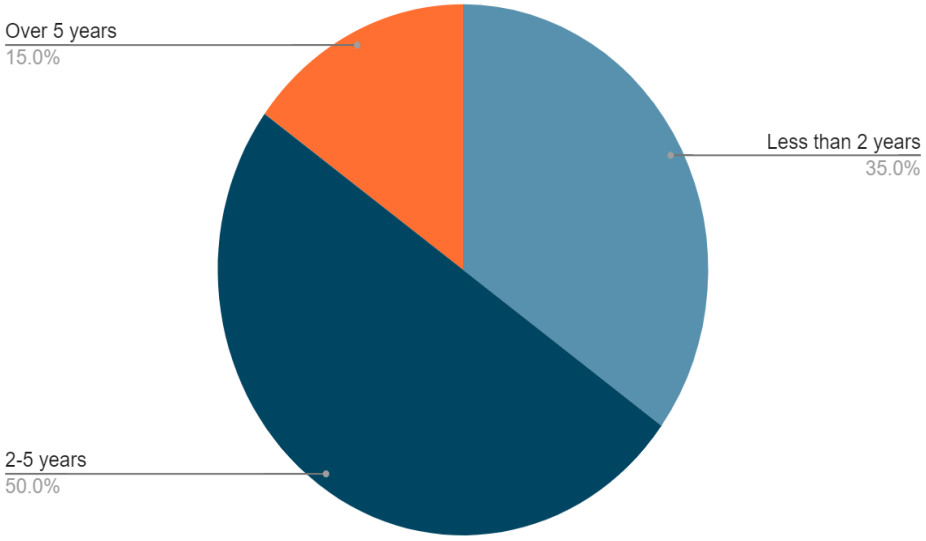


Figure V.17: Commencement of Technology Adoption

Figure 5.17 indicates that a significant portion of selected SMEs (65%) started integrating technology into their operations within the past two years, aligning with the literature reviewed. The adoption of technology in SMEs has gained increased prominence in the business environment, which is considered complex and competitive (Aragón-Correa et al., 2020; Sarpong et al., 2019). SMEs now have a better understanding of the power of technology to achieve positive business outcomes within the supply chain (Aragón-Correa et al., 2020).

Results show that half of selected SMEs (50%) began adopting technology between two and five years ago. This finding suggests that technology adoption among SMEs has been an ongoing process, with a considerable number of businesses recognizing the benefits and initiating their integration of technology in their operations during this time frame. It is worth noting that a smaller percentage of selected SMEs (15%) had been utilizing technology for more than five years. These SMEs can be considered early adopters of technology, and their longer history of technology

integration may indicate their proactive approach in leveraging technological advancements to maintain competitiveness in their markets.

Integrating technology into the operations of SMEs has gained substantial traction, as evidenced by both the data and the referenced literature. Approximately 65% of the surveyed SMEs have embarked on the journey of technological integration in their supply chain systems within the past two years.

This trend is in line with the progressive nature of contemporary business practices, where the utilization of digital solutions has become imperative for remaining competitive in a swiftly evolving market landscape. Scholars like Aragón-Correa et al. (2020) and Sarpong et al. (2019) underscores this shift, highlighting how advancements in digital technologies have spurred SMEs to embrace technology to enhance their operational efficiency and enrich customer experiences.

The data also paints a broader picture of technology adoption among SMEs. Notably, about 50% of the SMEs in the sample began adopting technology between two and five years ago. This suggests that the transition towards technology-driven operations has been an ongoing and gradual process, with numerous SMEs recognizing the advantages and subsequently integrating technology to bolster their operational prowess.

Remarkably, a smaller yet significant proportion (15%) of the SMEs have been pioneers in this movement, having harnessed technology for over five years. These early adopters stand as testament to the strategic leverage of technology in gaining a competitive edge. Their extended history of technological integration signifies a proactive approach, demonstrating how technology can be wielded as a potent tool to secure a vantage point in the market.

The combination of recent data and corroborative literature affirms the rising trend of technology incorporation within SME operations. This transition aligns with the competitive

demands of the contemporary business sphere, where technology facilitates efficiency, customer engagement, and competitive advantage (Christopher, Peck & Towill, 2020). The data showcases both gradual integration and early adopters. Collectively, these insights underline the pervasive influence of technology as a transformative force in the SME landscape.

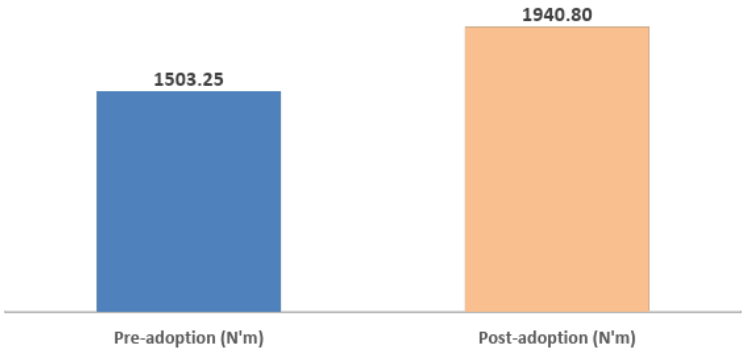


Figure V.18: Impact of Technology-Driven Supply Chain on Revenue

The findings presented in Figure 5.18 indicate a significant increase in the cumulative annual revenue of selected SMEs after the adoption of technology-enabled supply chain systems, both from their existing markets and new markets. The data shows that the combined annual revenue of the SMEs rose by 29% from N1.53 billion to N1.94 billion within two years following the integration of ICT into their supply chain operations.

This finding aligns with the literature as reviewed, which highlights the positive, albeit non-exclusive, impact of technology adoption on the performance of SMEs. Implementing technology-enabled supply chain systems results in improved operational efficiency, cost optimization, and betterment in customer service delivery, all of which contribute to increased revenue generation (Lee et al., 2017; Tippins et al., 2018). One of the respondents posits:

"Since we started using supply chain systems in our business, our annual revenue has increased significantly. The efficiency and effectiveness of technology in our supply chain played a crucial role in this growth."

Another respondent shared similar position:

"We have seen substantial increase in our revenue since we started using technological solutions in our operations."

According to the respondents, the increase in annual revenue observed in the study can be attributed, albeit non-exclusively, to the various benefits associated with technology adoption, such as streamlined processes, better inventory management, faster order fulfillment, and improved decision-making enabled by data analytics (Lee et al., 2017). These have knock-on effects on the more traditional approaches to growing market penetration. By leveraging technology in their supply chain operations, SMEs can respond more proactively to market demands, deliver faster on customer orders, and seize business opportunities to establish in new markets, ultimately leading to revenue growth.

Adopting technology in supply chain systems often helps businesses to generate increased revenue. This is substantiated by the cited studies by Lee et al. (2017) and Tippins et al. (2018), both of which highlight the transformative outcome of such systems. By embracing technology, SMEs stand to unlock enhanced operational efficiency, optimize costs, and elevate customer satisfaction levels. These dynamics collectively act as drivers of revenue growth, amplifying the overall financial trajectory.

The qualitative perspectives of the respondents further illuminate the discourse. One respondent pointed out how the implementation of a supply chain system has catalyzed a marked

expansion in annual revenue. Another respondent echoed this sentiment, emphasizing their growth in new markets following the infusion of technological solutions across operations.

The observed growth in revenue can be attributed to a mix of technology-driven factors. The systematic streamlining of processes, adept inventory management, swifter order fulfillment, and evidence-based decision-making process, as highlighted by Lee et al. (2017), collectively engineer an environment conducive to seizing business prospects, aligning with market demands, and exceeding customer expectations.

While the findings indicate a positive correlation between technology adoption and revenue growth, other factors may also contribute to changes in annual revenue, such as market conditions, competitive landscape, and business strategies. However, the increase in revenue observed in the study, combined with the statements of the interviewees, suggests that technology-enabled supply chain systems play a role in driving financial performance for selected SMEs.

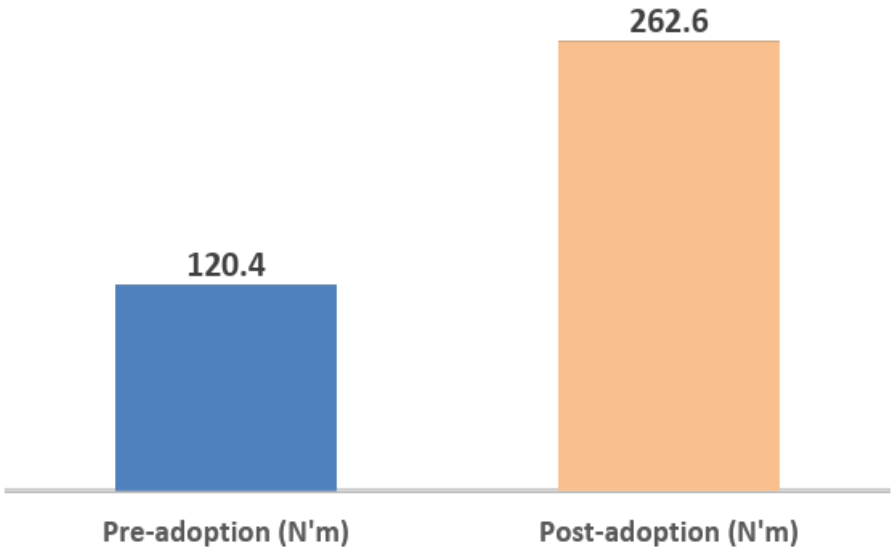


Figure V.19: Impact of Technology-Driven Supply Chain on Profit

The findings presented in Figure 5.19 demonstrate a significant improvement in the profit levels of selected SMEs following the integration of ICT into their supply chain operations. Prior to ICT adoption, the combined annual profit of the businesses amounted to N120.4 million. However, after integrating technology, their joint annual profit increased by 10% to N262.6 million a year later. This finding aligns with the literature, which alludes to the benefits offered by technology on the SMEs performance. By incorporating technology into their supply chain systems, SMEs can achieve cost savings, operational efficiency, and enhanced decision-making, leading to improved profitability (Chung et al., 2019; Kaur et al., 2021).

The increase in profit margin observed in the study further confirms the assertation that technology integration in supply chain enhances financial performance as seen for selected SMEs. Average profit margin of the businesses rose from eight percent to 13.5 percent during the post-adoption period. This suggests that technology-enabled supply chain systems have facilitated better cost management, increased productivity, and higher returns on investment.

"Since we enabled technology in our supply chain, our revenue has grown by about 30 percent annually and our profit margin has increased from seven percent to 12.5 percent of revenue," says one of the respondents.

Another respondent shared similar position:

"Before we invested in technology, our profits were limited due to high overhead costs and poor inventory management. But now, we now earn profit equivalent to 10 percent of our revenue, from some six percent earlier."

The position of the respondents reflects the benefits of deploying technology in business operations. Technology enables businesses to digitize processes, optimize inventory levels and streamline operations. By addressing these areas, errors are reduced and wastage are minimized,

and companies can significantly reduce their operational costs. For instance, automating order processing and fulfilment systems help to reduce personnel costs while advanced predictive analytics optimizes procurement and stock management. The massive costs that are saved will therefore translate to improvement in profit margins.

While the findings show a positive relationship between technology integration in supply chain and profitability, other factors can also influence profit levels, including market dynamics, competition, and business strategies. Nonetheless, the increase in profit observed in the study suggests that integrating technology into supply chain operations can contribute to the financial success of SMEs.

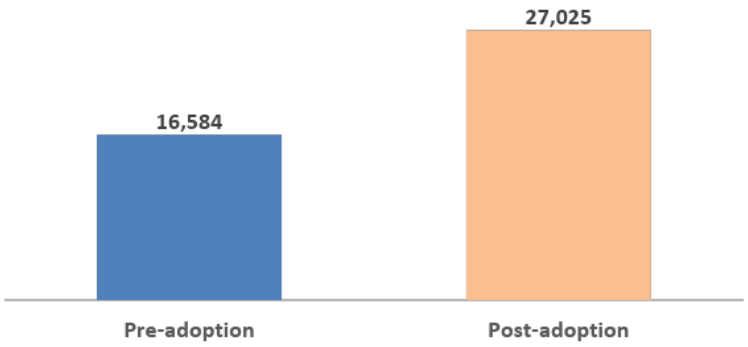


Figure V.20: Impact of Technology-driven Supply Chain on Customer Base

These findings presented in the paragraph indicate a substantial increase in the customer base of selected SMEs after incorporating technology into their supply chain systems. Prior to technology integration, the businesses were serving a total of 16,584 customers. However, after technology adoption, their cumulative customer base experienced a significant growth of 63 percent, reaching 27,025 customers.

This finding aligns with the literature we have discussed, which highlights the effectiveness of technology in widening market reach for SMEs. By leveraging technology-enabled supply chain

systems, SMEs can overcome geographical barriers, reach a larger audience, and tap into new market segments (Schniederjans et al., 2020; Wahab et al., 2021).

The increase in the customer base of selected SMEs is particularly beneficial as it allows them to generate more revenue and maximize profit. Prior to technology adoption, the limited customer base constrained their capacity to generate sufficient income. However, with the integration of technology, these businesses have gained access to a wider audience, enabling them to capture more market share and strengthen their presence in their respective industries. One of the respondents recounted his experience as regards customer growth:

"Before we started making use of technology in our operations, our customer base was limited to the local market. We had a few repeat customers. Technology has helped us reach a larger audience than we can ever imagined. Our customer base has grown rapidly and we can now compete with larger companies in our industry."

Another respondent shared similar experience:

"Our customer catchment was just the immediate vicinity of our shop. We have more than doubled our clientele base since we started using technology. We are now able to provide quality services to our clients. This has helped us retain and acquire more clients."

Technology has indeed enabled businesses to improve customer service delivery, which is key to attracting and retaining customers. Higher level of satisfaction motivates customers to maintain patronage and make referrals to their friends, families and associates. For example, technological solutions such as customer relationship management system help businesses to better manage their customers. It covers areas around information management, complaints management and inquiry response. These features drive customer satisfaction and retention; they also help businesses understand customer behavior and preferences, and use insights derived to sharpen

quality of service delivery to customers. This collectively enables businesses to retain their customers and penetrate new markets to acquire customers from competitors.

Comments by the business owners show how technology made a big difference. One person mentioned that technology allowed them to reach a larger audience and compete with bigger companies. Another shared how their customer base doubled after using technology, and they were able to improve the services they offered.

It is not just about getting more customers. Technology also helps businesses improve how they serve their customers. For example, tools like customer management systems help businesses keep track of customer information, respond to their questions, and identify customer preferences. This makes customers undertake repeat business and even recommend the business to others.

Technology is a key factor in helping small businesses attract more customers. Not only does it mean more money, but it also helps businesses become better at what they do, creating a cycle of growth and success.

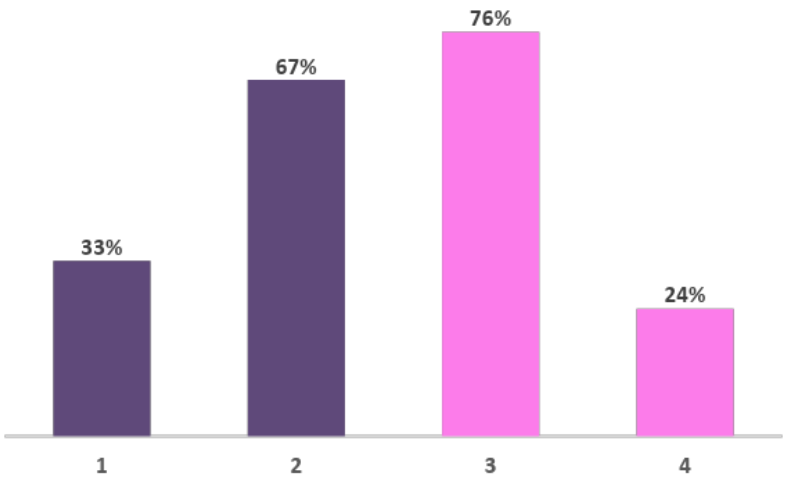


Figure V.21: Impact of Technology-Driven Supply Chain on Order Fulfillment (Supply Chain Speed)

These findings presented in the paragraph demonstrate the impact of technology adoption on the turnaround time for fulfilling customer orders in selected SMEs. Prior to the integration of technology, the majority of the businesses (67%) took between three and seven days to fulfill customer orders, while 33 percent were able to fulfill orders within two days. However, with the introduction of technology in their supply chain systems, a significant improvement was noticed in the turnaround time for order fulfillment.

This finding aligns with previous empirical studies that emphasized the role of technology in streamlining and expediting order fulfillment processes. Technology solutions such as inventory management systems automate various activities related to order processing, including order entry and tracking, leading to a reduction in errors and a quicker processing time (Wahab et al., 2021). Additionally, tools such as route optimization algorithms contribute to efficient product shipment by considering factors such as delivery locations and traffic situations to determine the most optimal routes for speedy product delivery to customers.

By leveraging technology-enabled supply chain systems, the selected SMEs improved on their order fulfillment processes and reduced the time it takes to fulfill customer requests. This enhances customer satisfaction and contributes to the overall efficiency and competitiveness of the businesses. It is important to note that the specific improvements in turnaround time mentioned in the paragraph are not directly attributed to any specific literature discussed earlier. However, the general agreement lies in the positive impact of technology.

The data underscores the transformative influence of technology integration on order fulfillment timelines within a subset of SMEs. The research showcases a remarkable evolution in the turnaround time following the infusion of technology into the supply chain systems of these SMEs. Prior to this integration, a significant proportion (67%) of these enterprises necessitated

between three and seven days to complete customer orders. In contrast, 33% managed to achieve order fulfillment within a two-day window. The integration of technology has precipitated a noteworthy enhancement in the efficiency of order fulfillment processes.

These findings align with the empirical literature explored, accentuating the pivotal role of technology in rationalizing and expediting order fulfillment operations. Technological solutions, exemplified by inventory management systems, have automated various facets of order processing – encompassing order input and tracking. This mechanization has been instrumental in curbing errors and expediting processing times (Wahab et al., 2021). Furthermore, the incorporation of tools such as route optimization algorithms has facilitated streamlined product shipment, leveraging variables such as delivery points and traffic scenarios to chart the most optimal routes for swift customer deliveries.

By harnessing technology-driven supply chain systems, the selected SMEs have attained commendable enhancements in their order fulfillment protocols, substantially diminishing the temporal requisites for meeting customer demands. This augmentation extends beyond the realms of customer satisfaction, permeating the broader dimensions of operational efficiency and competitive edge. The data spotlights how technology has revolutionized order fulfillment processes in a cluster of SMEs. The migration from manual to technology-assisted operations has yielded remarkable reductions in order processing times, resonating with the tenets of existing literature. The implications of this shift encompass heightened customer contentment, streamlined operations, and fortified competitiveness.

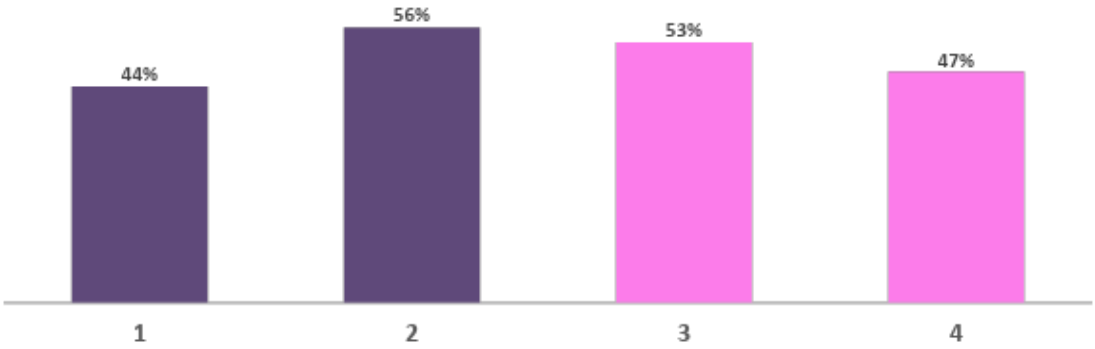


Figure V.22: Impact of Technology-Driven Supply Chain on Supplies

The findings presented in the paragraph highlight the impact of technology adoption on the turnaround time for receiving supplies from vendors in selected SMEs. Prior to the integration of technology, the majority of the businesses (56%) received supplies between three and seven days, while 44% were able to receive supplies within two days. However, with the introduction of technology in their supply chain systems, there has been an improvement in the turnaround time for receiving supplies.

This finding aligns with the literature we have discussed, which emphasizes the role of technology in optimizing supply chain and improving communication with suppliers. Technology-driven tools such as supplier portals enable real-time information sharing between businesses and suppliers, facilitating better coordination and expediting the delivery of supplies (Wahab et al., 2021). By leveraging such technology-enabled supply chain systems, selected SMEs have experienced a nine percent improvement in receiving supplies within two days, indicating the positive impact of technology adoption.

The results show the impact of technology adoption on the turnaround time for procuring supplies from vendors within a sample of SMEs. Preceding the integration of technology, a majority of these enterprises (56%) encountered supply arrival times spanning from three to seven days, while 44% managed to receive their supplies within a more expedited two-day timeframe.

However, the introduction of technology into their supply chain mechanisms has elicited a noteworthy enhancement in the promptness of supply reception.

V.3 Discussion of Findings

V.3.1 *Objective 1: Determine the Level of ICT adoption in Supply Chain Management Systems*

Findings showed that the level of ICT adoption in supply chain management systems among the selected SMEs. The data presented in various figures and tables shed light on the extent to which technology is integrated into different stages of the supply chain, including planning, sourcing, manufacturing, distribution, and return. The provided in the findings illustrate the adoption rates of hardware and software technologies in each stage, highlighting the areas where technology is more or less implemented. From the findings, it is evident that the selected SMEs have embraced technology to varying degrees in their supply chain management systems. The data indicate moderate to high adoption of technology in planning, sourcing, and distribution stages, while manufacturing and return stages show lower levels of technology adoption. This information addresses the research objective of determining the level of ICT adoption in supply chain management systems among the selected SMEs. Some of these technologies include machine learning, AI algorithms, enterprise resource planning tool, project management tool, customer relationship management tool, online return tool, e-warehousing, e-procurement platforms, etc. Further analysis showed software technologies have a higher level of adoption in the supply chain compared to hardware tools. Hardware technologies are mostly to execute distribution functions and least used at the return stage. On the other hand, software technologies are mostly used for distribution functions, and least used at the manufacturing stage. The fact that hardware and software technologies are mostly used for distribution functions is linked to the fact that virtually

all the respondents operate as either medium-scale distributor or retailer in their respective supply chain.

Findings showed that the scale of technology adoption is average from an end-to-end perspective. This can be linked to the growing consciousness among small business owners on the importance of technology adoption in the modern business environment considered complex and highly competitive. Following the aftermath of covid-19 pandemic experience, Nigerian SMEs have come to appreciate the usefulness of technology in their operations. Business owners have realized that with the help of technology, they can optimize costs, serve customers better and compete favorably in the marketplace (Lagos Chamber of Commerce, 2021).

Relating these findings to extant literature further upheld these assertions. Findings are consistent with Li, et al, (2006) whose study provided evidence of the positive impact of technology in terms of streamlining processes, reducing costs and enhancing performance. Li, et al, (2006)'s findings also showed that implementing effective supply chain management practices, which involve technology adoption, can lead to competitive advantage. Similarly, the study agreed with the submission of Gunasekaran and Ngai (2004), who found that information systems and technology play is critical in integrating and managing supply chain. Their study emphasizes the positive benefits of technology-enabled supply chain systems in terms of such as real-time information sharing among supply chain players. The study also concurred the posture of Christopher and Towill (2001) whose findings showed that implementing technology-driven supply chain systems help businesses to better adapt in a dynamic business environment and respond quickly to market changes.

V.3.2 *Objective 2: Identify Barriers to ICT Adoption in Supply Chain System*

Findings revealed four barriers to ICT adoption in the supply chain system. These include lack of technical expertise, high financial implications, concerns about digital attacks, and limited knowledge on protecting critical systems and sensitive information. According to the results, most SME owners lack the necessary technical competence to adapt technology in their supply chain processes. Additionally, the financial constraints faced by SMEs make it difficult for them to invest in expensive technologies. Moreover, the fear of digital attacks and the complexity associated with technology adoption also act as deterrents for SMEs.

The identification of these barriers and the strategies employed to address them provided first-hand information on the challenges facing SMEs in this regard. The findings on the barriers faced by SMEs as regards integrating in supply chain systems align with most empirical findings. For instance, Olatokun and Bankole (2011) highlighted inadequate technical manpower as a major barrier to adoption and use of e-business technologies by SMEs. Their position supports this study's findings that due to the limited financial resource at the disposal of SMEs, they lack the capability to hire competent and qualified technical resource persons.

Other barriers identified in Olatokun and Bankole's (2011) study include poor power supply, high cost of implementation, lack of push from supply chain and lack of adequate resources. More importantly, their study established that internal factors tend to pose greater barriers in technology adoption among SMEs compared to external factors. This also aligns with the findings which shows that internal factors such as funding shortage and inadequate manpower, poses significant barriers to technology adoption by SMEs.

The study concurs with Ladokun, Osunwole and Olaoye (2013) that SMEs in Nigeria are slow in adopting technology as they face major constraints such as poor infrastructure, limited

digital literacy, high cost of technology equipment, legal and regulatory issues and weak digital technology strategies. Similarly, the study Irefin, Abdul-Azeez and Tijani (2012) whose findings reveal that procuring technology equipment comes with huge cost implications beyond the financial capacity of SMEs in Nigeria, while identifying other factors such as availability of technology infrastructure, government support and business size.

V.3.3 *Objective 3: Determine Market Penetration Rate of Selected SMEs*

The findings directly address the research objective of determining the market penetration rate of interviewed SMEs. Result showed that most SMEs control less than five percent of their market. This suggests that small businesses often have limited influence within the industries they operate in, resulting in relatively smaller market shares. This is however not surprising due to a number of reasons. Firstly, SMEs often have fewer financial and human resources compared to bigger organizations. This limits their ability to invest in marketing, research and development and expansion efforts, which affects their market share. SMEs often struggle to gain visibility and brand recognition due to their limited marketing budget. Moreover, many industries are dominated by bigger players with strong market positions. Entering these markets can be challenging for SMEs as they face intense competition from established brands that have already captured significant market share (Agwu, 2018). As pointed by Ojala and Tryvainen (2007), SMEs have little or no budget for research and development, thereby limiting their ability to improve on their product offerings through innovation. This also impact their ability to grow their market share.

Findings also showed that selected business owners adopt several strategies to increase their market share and deepen their penetration level. These strategies include conducting door-to-door campaigns; complementing traditional and digital marketing; cold pitching; monitoring market trends and responding quickly and direct customer engagement. Despite implementation

of these strategies, the level of market share of selected SMEs remains insignificant compared to the entire market.

The study agrees with Malesev and Cherry (2021) as regards the market penetration level of SMEs. Providing evidence from the construction sector in Finland, their findings confirmed widespread recognition of the value of digital marketing strategies among SMEs but reveal that uptake and effective use of digital marketing is undermined by lack of up-to-date marketing mixes.

V.3.4 *Objective 4: Determine the Impact of Technology-Driven Supply Chain on Market Penetration and Market Development*

The data and information presented shed light on how the adoption of technology in supply chain systems has influenced the market penetration of the selected SMEs.

Findings showed the positive contribution of technology-driven supply chain to market penetration and development. Firstly, the adoption of technology was observed to contribute to the increase in the cumulative customer base of the selected SMEs. Prior to technology adoption, the SMEs were serving 16,584 customers, but after technology integration, the customer base increased by 63% to 27,025 customers. Based on the comments of the interviewed businesses, they leveraged technology to optimize their supply chain systems for the goal of expanding their reach. Secondly, the findings indicate that technology adoption has contributed to the revenue and profitability of the selected SMEs. The combined annual revenue increased by 29% after technology adoption, and the average profit margin also improved from 8% to 13.5%. These improvements result from other growth efforts as well as technology-driven supply chain systems, as stated by the interviewed businesses. The combined efforts proved effective in enhancing the financial performance of SMEs, which can lead to a higher market.

With a focus on the processes of the businesses, the data show improvements in the turnaround time for fulfilling customer orders and receiving supplies from vendors after the

integration of technology. While not being the only change the businesses made, findings show adoption of technology in supply chain systems has a positive impact on the market penetration of SMEs through increased efficiency in supply chain operations enhancing customer satisfaction, building a positive reputation, and attracting more customers, thereby aiding in market penetration. These findings support existing literature that emphasizes the role of technology in enabling market expansion and growth for businesses.

VI CHAPTER SIX: INSIGHTS AND RECOMMENDATIONS

VI.1 Introduction

SMEs are the most important business component in an economy. Their operations present tremendous opportunities for strengthening commerce, creating wealth and employment opportunities for the labor force. The business environment has increasingly become competitive, and this has reinforced the importance of technology adoption in business operations. Scholars have maintained that integrating technology into business operations bring numerous benefits in terms of streamlining processes, enhancing efficiency, quickening turnaround time and improving quality of service delivery to customers. Inspite of the increased awareness of the importance of technology in supply chain systems, SMEs have been slow in integrating digital tools into their supply chain management practices. Rather, several small businesses still adopt manual approach in managing their supply chain system.

The importance of supply chain management is reinforced by rapid digital adoption in commerce as well as the increased integration of Nigeria into the global economy. This therefore implies that the potential benefits and opportunities presented by technology have not been fully tapped by small businesses as a result of myriad of factors such as huge cost requirements and poor technical expertise amongst others. It is against this backdrop that the study investigated the effect of technology-driven supply chain management on market penetration of SMEs in Nigeria. The study specifically focused on the following:

- The nature of ICT adoption in SCM systems by Nigerian SMEs.
- Barriers to technology adoption in in the supply chain system of Nigerian SMEs.
- The supply chain strength of Nigerian SMEs, based on their market penetration and market development.

- Impact of ICT-driven supply chain system on market penetration and market development of Nigerian SMEs.

A qualitative research approach was utilized for collecting data. Purposive sampling technique was used to select 20 SMEs across different sectors within the country. With reference to data sourced, these small businesses operate across seven factors including trade, energy, real estate, automobile, hospitality, ICT and technical and professional service sectors. Interviews were conducted with selected businesses to harvest diverse perspectives and gather valuable insights on the subject matter. Data sourced was analyzed using descriptive (charts, tables) and thematic analysis.

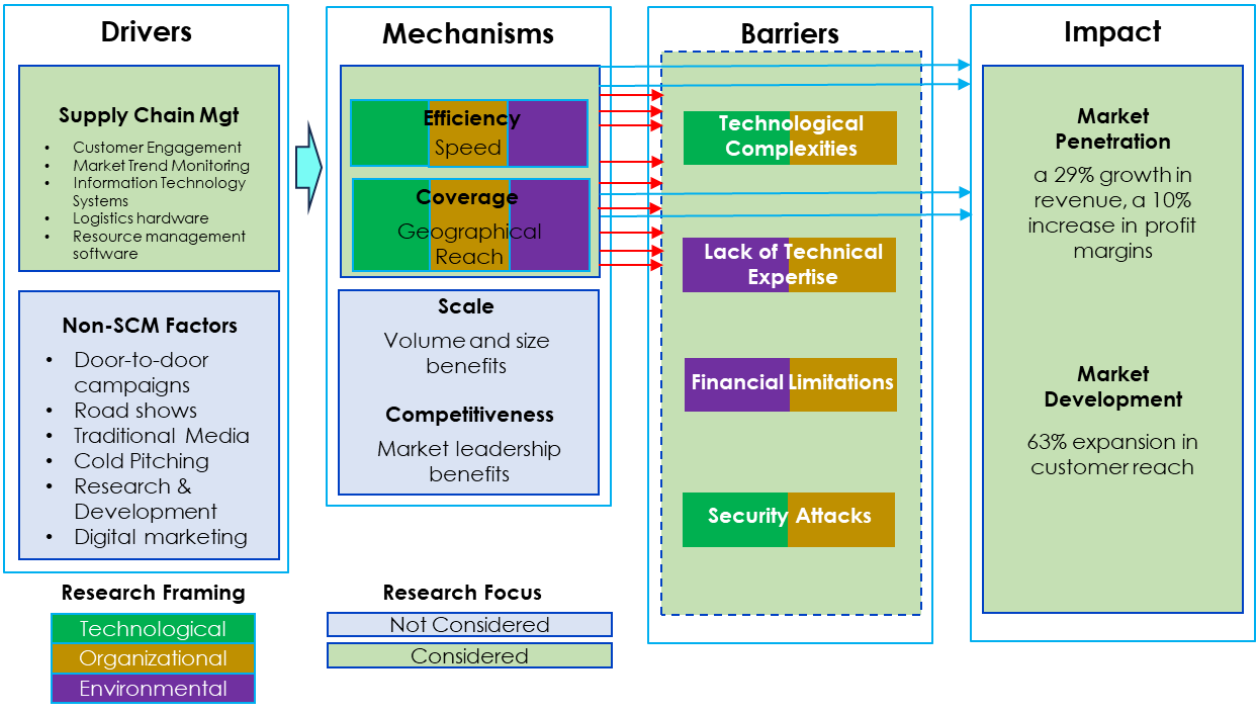


Figure VI.1: Presentation of Research Insights within the Technology-Organization-Environment Framework

VI.2 Insights from Research

Most businesses engaged are mature enterprises in terms of their years of existence. Almost all the businesses have Lagos as their primary location and market. Thus, there is heavy concentration of their presence in Lagos. More importantly, a large number of these businesses operate at the distribution segment (either wholesale/retailer) in their respective supply chain with just a few operating in the manufacturing segment within the supply chain. These businesses have a combined staff strength of 807 employees and a customer base of 16,584.

VI.2.1 *Level of ICT Adoption in Supply Chain System of SMEs*

Adoption of ICT by selected businesses is ranked moderate (not too high nor low). This aligns with the position of Ejem, *et al,* (2021) that functions executed through the use of technology by SMEs could be insourced and/or outsourced. Selected businesses integrate technology in various segments of their supply chain. These technologies are both hardware and software technologies but more of the latter. Some of the technological solutions utilized by these businesses include AI algorithms, enterprise resource planning tool, customer relationship tool, return tool, e-warehousing, e-procurement platforms, RFID, internet of things (IoT) inventory management tools. These tools are used by businesses to carry out different functions within the supply chain ranging from planning, supplier sourcing, logistics and delivery. A deep dive into the data sourced revealed that hardware and software technologies are mostly used for distribution functions. This is connected to the fact that most of selected SMEs operate in the distribution segment within their supply chain. The distribution function entails transporting finished goods from the manufacturer to final consumers. Hardware and software technology are least utilized at the return and manufacturing stage respectively.

From an end-to-end standpoint, technology adoption in SCM by these businesses is not entirely perfect. The key areas identified for improvement in the supply chain management system are better use of technology for logistics and delivery; procurement; inventory management and return management. There was consensus in respondents' position that improvement is a continuous process within the supply chain. This requires small business owners to continuously review their supply chain and adjust their models accordingly in line with the dynamics.

VI.2.2 *Barriers to ICT Adoption in Supply Chain Systems*

Selected SMEs face few barriers in the process of integrating technology in their supply chain system. These barriers are combination of factors within and beyond their control. The major barriers are complexities associated with technology; lack or dearth of technical expertise in using the technology; inability to meet the cost requirements for procuring and managing digital technological solutions and susceptibility to cyber-attacks. These challenges fall within the seven barriers (user, financial, technology, management capability, etc.) identified by Harris, *et al,* (2015). For these businesses, the challenges are more tilted to user-related challenges which speaks to low level of knowledge and understanding of technology by business owners thereby limiting the implementation of technology in daily operational activities within the supply chain. Another pertinent challenge is financial-related. Most SMEs have limited access to funding opportunities amid lean financial buffers. This also often limits their capacity in acquiring technology solutions relevant to their business. Feedback from respondents showed that these challenges have been at the fore over the past two years, albeit efforts are being made to address the gaps. Some of the measures taken in solving the problem include – training employees on digital solutions relevant to business needs; adopting agile philosophy; outsourcing to IT professionals and seeking counsel from IT experts.

VI.2.3 *Market Penetration and Development Level of SMEs and Strategies for Competitiveness*

Market penetration level of selected businesses is relatively low. More than half of selected businesses have less than five percent share of their respective market. This supports evidence that small businesses tend to have limited influence within their industry. Market development is even more limited given that only one of the 20 SMEs operates in more than one region. Acknowledging the low level of market reach, efforts are being made by selected business owners in growing their market share. Some of the strategies include door-to-door campaigns, roadshows, cold pitching, digital marketing campaigns amongst others. These approaches, according to them, have been impactful in deepening their visibility in the marketplace.

VI.2.4 *Impact of Technology-driven Supply chain on market penetration*

Findings showed that technology adoption has had a considerable impact on selected businesses. By integrating technology in their supply chain, selected businesses are able to grow revenue and profit margin; expand market research; quicken order processing and deliveries to customers. On the back of improved efficiencies in supply chain operations courtesy of technology, selected SMEs grew their revenue by 29 percent; improved profit by 10 percent and expanded their customer reach by 63 percent, mostly in existing markets. Incorporating technology into supply chain operations enabled these businesses access a wider range of customers, with one business succeeding in penetrating new markets. Additionally, businesses improved their turnaround time in settling deliveries to customers and receiving supplies from vendors. Overall, incorporation of technology has had a profound effect on the capacity of small businesses to increase their market share by optimizing their supply chain operations to drive customer retention, satisfaction and acquisition (in case of new customers).

While technology provides numerous benefits, specific impact on key business performance indicators differs based on the industry; business size and scale at which technology is applied. This supports Aryapadi, *et al,* (2020) that technology drives topline sales growth resulting from market penetration. With technology incorporation in SCM enables companies can improve their capacity to reach and serve more customers, establish presence in new markets and create new sales channels. Similarly, the findings corroborate with Rowland (2008) whose study found that technology-oriented supply chain fosters productivity and enhances customer satisfaction, leading to favorable performance outcomes.

VI.3 Contributions to Theory

Findings can be contextualized within the framework of the technology-organization-environment model. The TOE model assesses the interconnectedness between technology, organizational (internal) factors and external environmental factors that could influence the adoption and implementation of technology by an organization. The findings contribute to the framework in the following:

- ***Technology factors***: According to the findings, technology adoption level in the supply chain operations of selected businesses is moderate. For some businesses, it was below average and for others, it was above average. However, generally, the level of technology adoption is moderate. This points to the presence of a few technological challenges impeding ICT adoption by SME owners. These barriers anchor on affordability and accessibility to technology solutions; gap in technical expertise and dearth of customized solutions for SMEs. By providing evidence-based information on technology-related factors, the TOE framework helps to better understand specific challenges faced by small businesses in adopting technology solutions in their business operations.

- ***Organizational Factors***: The findings suggest that internal factors such as availability of financial resources, firm size and level of technological knowledge and expertise influence decisions bothering on technology adoption. By providing evidence-based information on these factors, the TOE framework offers valuable insights into the internal dynamics and capabilities that need to be addressed to enhance technology adoption in supply chain operations.
- ***External Environment Factors***: The research findings highlight the significance of external factors in shaping SMEs' decision on technology adoption. These factors are externally induced, and are outside the control of selected businesses. The external component of the TOE framework speaks captures industry characteristics, market competition and policies of government. The relatively moderate case of technology adoption within the supply chain systems of Nigerian SMEs reflects the impact of persisting external factors (poor broadband connectivity, poor power infrastructure, etc.) limiting technology adoption.

The application of TOE framework to the research findings pinpoints the complex interplay among technology, organization and external environment. This framework highlights critical areas that should be addressed by SME operators. Some of these areas include development of customized solutions for SMEs, improvement in SMEs' internal capabilities and addressing external barriers. Addressing these areas through the collaborative efforts of SME owners, industry associations, regulatory institutions and the Nigerian government. This is key in deepening market penetration for SMEs while strengthening their competitiveness in the marketplace.

VI.4 Contribution to Practice

The research findings do not only contribute to practical implications but also provide guidance on necessary measures aimed at improving technology in the supply chain system of Nigerian SMEs for deeper market penetration. Firstly, the research points to the need to develop skills and capacity of SMEs owners and their team in the use of modern technology solutions. The capacity building sessions can be facilitated externally by IT professionals to ensure SMEs are equipped with appropriate technical competences required for effective technology adoption in supply chain operations.

Secondly, a large number of digital solutions in the business landscape do not appropriately meet the unique needs and challenges of SMEs. As such, technology developers need to start thinking of building tailored solutions that uniquely align with the specific business characteristics applicable to Nigerian SMEs. These solutions should be made affordable to Nigerian SMEs with flexible payment options that will be convenient for small businesses. Thirdly, the research findings highlight low adoption of technology in few of the selected SMEs engaged during face-to-face interviews. This presents a case for stakeholders in the Nigerian MSMEs ecosystem to intensify efforts towards promoting awareness for technology adoption particularly among SMEs in the informal sector, who are yet to recognize the value-adding characteristics of technology. In addition, the findings highlighted that collaboration between SMEs, technology providers, logistics service providers and e-commerce platforms could play an instrumental role in fostering technology adoption and market penetration. Leveraging these platforms helps small businesses to connect to a broader range of audience, potentially increase market share.

Nonetheless, some aspects of the supply chain still need improvement as highlighted. The findings presented in Figure 6.1 highlight the improvement areas identified by the selected SMEs in their SCM systems. These areas include logistics and delivery, procurement and production,

inventory management, and return. The data shows that these improvement areas are not uniform across businesses, with some identifying a single area for improvement while others recognize the need to improve their entire supply chain system.

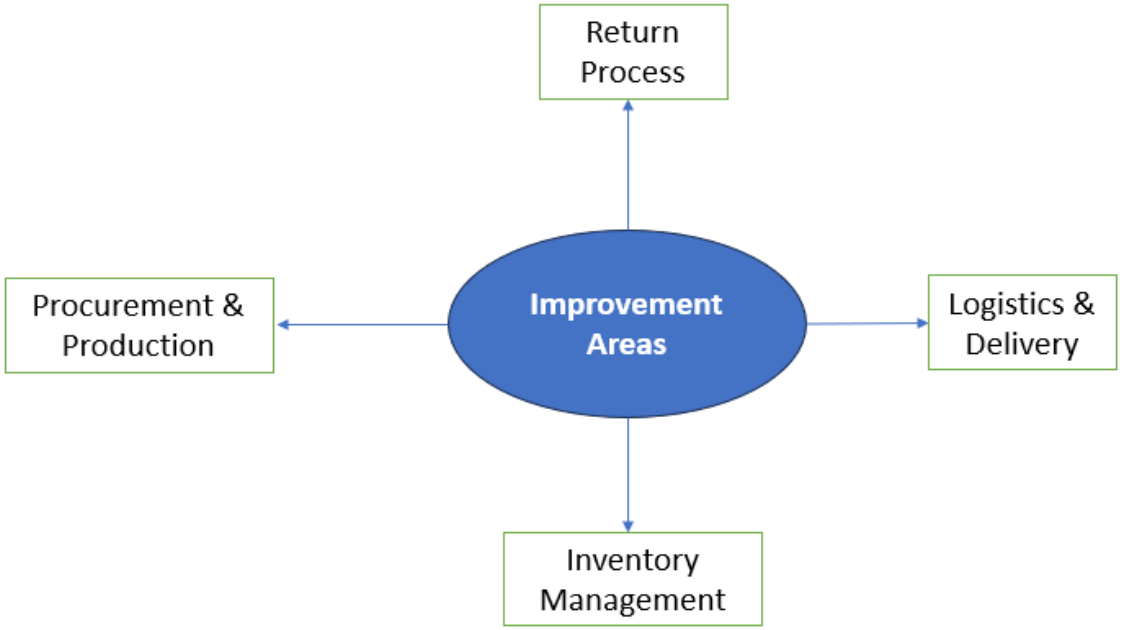


Figure VI.2 Major Segments in the Supply Chain That Need Improvement

As highlighted in literature, SCM involves multiple interconnected elements, and improvements in these areas can contribute to enhanced overall performance (Christopher, 2016). Logistics and delivery, procurement and production, inventory management, and return are recognized as key components of SCM that require attention and continuous improvement (Chopra & Meindl, 2021). Given the evolving nature of technology, respondents believed that improving the use of technology in business operations is an endless process, but that they are making efforts to address identified gaps. One respondent maintains:

"We prioritize continuous improvement in our supply chain with a focus on enhancing our procurement, logistics, and delivery operations to enable us drive maximum customer satisfaction."

Another respondent holds a similar position:

"For us, we continuously assess our supply chain processes to identify areas that require improvement to enhance our supply chain efficiency."

The acknowledgement by the respondents that improving the use of technology in business operations is an ongoing process aligns with the notion that technology adoption in SCM is dynamic and ever-evolving (Gunasekaran et al., 2018). Businesses need to continuously assess their technology capabilities and make efforts to address identified gaps to leverage the potential benefits of technology-driven supply chain systems. Findings showed the recognition of the need for improvement and the acknowledgement that technology plays a crucial role in addressing these gaps in SCM systems.

Improving supply chain systems is an endless process. It requires businesses to constantly assess their systems, identify gaps impeding efficiency, and leverage technology to bridge these gaps. This would help small businesses stay relevant in an increasingly competitive business environment while providing customers with optimal satisfaction.

VI.5 Recommendations

VI.5.1 *General Recommendations*

The study offered valuable recommendations that SMEs could explore in adopting technology in their supply chain systems. These recommendations aim to address the barriers identified in the research and maximize the benefits of technology-driven supply chains for SMEs.

1. Enhancing Financial Accessibility:

- Governments and financial institutions should develop specialized funding programs and initiatives for SMEs. This will provide access to loans and grants specifically for technology adoption in supply chain management.

- Collaborations with technology providers and industry associations can help negotiate favorable pricing and financing options for SMEs, making technology solutions more accessible and affordable.

2. Promoting Technical Expertise:

- Capacity-building programs, workshops, and training sessions should be organized periodically to enhance the technical skills and knowledge of SME owners and employees in managing technology-driven supply chain systems.

- Collaboration between SMEs and academic institutions can facilitate knowledge exchange and spring up novel research ideas in the area of technology application

3. Strengthening Cybersecurity Measures:

- SMEs should be more conscious of digital protection on their by putting in simple measures such as firewalls, encryption protocols, and employee awareness programs.

- Government agencies and industry bodies should support and resources to help SMEs understand and mitigate cybersecurity risks associated with technology adoption.

4. Facilitating Collaboration and Knowledge Sharing:

- Industry associations, chambers of commerce, and technology providers should establish platforms for SMEs to share best practices, success stories, and lessons learned in technology adoption for supply chain management.

- Collaborative partnerships between SMEs and larger organizations can provide mentorship, guidance, and technical support to facilitate technology integration in supply chain systems.

5. Supporting Research and Development:

- Research institutions and government agencies should prioritize research and development efforts to pinpoint potential opportunities offered by technology within the supply chain.

- Research funding should be made available to support studies on emerging technologies, their potential applications, and their impact on SME supply chains.

6. Encouraging Policy Support:

- Governments should develop policies and regulations that encourage technology adoption in supply chain management, including incentives, tax breaks, and simplified regulatory processes for SMEs.

- Policy frameworks should be designed to promote collaboration between SMEs, technology providers, and other stakeholders, fostering an ecosystem that supports innovation and technological advancement.

7. Promoting Industry Collaboration:

- SMEs should actively engage in partnerships and collaborations with technology providers, logistics companies, and other SMEs to leverage economies of scale, share resources, and jointly develop innovative supply chain solutions.

- Industry forums and events should be organized to promote networking opportunities and collaboration within the SME ecosystem in adopting and optimizing technology in their supply chains.

8. Continuous Monitoring and Evaluation:

- SMEs should regularly assess their technology adoption efforts and impact on supply chain. This will spotlight gaps in processes and performance, measure ROI, and ensure evidence-based decisions are made as regards making investments in technology.

- Research institutions and industry associations can provide support in monitoring and evaluating the effectiveness of technology-driven supply chains through surveys, case studies, and benchmarking initiatives.

With these recommendations, SMEs can address barriers to technology adoption to enhance their market reach. The collective efforts of governments, industry stakeholders, and SMEs themselves are crucial in creating an enabling environment for technology-driven supply chain systems, fostering growth, competitiveness, and resilience in the SME sector. The dynamic nature of technology and supply chain management requires continuous learning, adaptation, and innovation. Therefore, the recommendations provided should be viewed as a starting point for further exploration and refinement as technology and business landscapes evolve. By embracing technology and leveraging its potential, SMEs can navigate the challenges of today's global markets and thrive in an increasingly digital and interconnected world.

VI.5.2 *Recommendations for Future Studies*

1. Longitudinal Studies: Utilizing longitudinal research approach is a step in the right direction in improving on the findings. By collecting data over an extended period, researchers can capture the evolving nature of technology use and its impact on various supply chain performance metrics. The order of adoption of technology along the different activities and flows of the supply chain also provides an interesting area of study, especially in understand which order proves most common or beneficial amongst SMEs.

2. Comparative Studies: Comparative analysis from geographical and sectoral perspective will also be helpful in broadening literature on the subject matter. Comparing SMEs of different sizes and sectors can help identify industry-specific challenges and opportunities.

3. Technological Innovations: Further investigation is still required to determine how SMEs can leverage evolving technologies in strengthening their supply chain systems and expanding their reach. Investigating the feasibility, opportunities and potential risks of implementing these technologies can pave the way for future advancements in SME supply chains.

5. Collaboration and Ecosystems: Investigating the role of collaboration and ecosystem development in supporting SMEs' technology adoption and market penetration can provide valuable insights. Future studies can explore the dynamics of partnerships, industry clusters, and collaborative networks in fostering technology-driven growth for SMEs.

6. Impact on Sustainability: Examining the intersection of technology adoption in SME supply chains and sustainability can be an important area of future research. Investigating how technology-driven supply chain systems can contribute to environmental sustainability, such

as carbon footprint emission and supporting sustainable sourcing of raw materials, aligns with the drive of Sustainable Development Goals to utilizing technology to promote socioeconomic prosperity for everyone.

These recommendations aim to expand the knowledge base surrounding technology adoption in SME supply chains and its impact on market penetration. Putting focus on these suggested areas will shed more light on the opportunities, challenges, and implications of technology-driven supply chain management for SMEs, ultimately supporting their growth and competitiveness in the global marketplace.

VI.6 Limitations of the Study

This study is not without its own limitations. Firstly, the study is dominated by SMEs with an active presence in Lagos State. While this concentration is understandable given Lagos's economic significance, it does introduce a limitation as the findings may not fully represent the experiences and challenges faced by SMEs operating in other states. Geographical factors play a significant role in influencing technology adoption in supply chain systems, and the unique dynamics of other regions could lead to differing outcomes. The findings may not be an adequate reflection of SMEs operating in other states due to the influence of geographical factors influencing technology adoption in supply chain systems. Future studies could address this limitation by incorporating a more geographically diverse sample, encompassing SMEs from various states across Nigeria.

Secondly, the study's sectoral representation is another notable limitation. While it encompasses SMEs across seven sectors, certain industries with substantial SME presence, such as agriculture and education, are notably absent from the sample distribution. Consequently, the generalizability of the findings to other sectors is restricted. To mitigate this limitation in future

research, a more comprehensive sampling strategy could be employed to ensure a more adequate representation from a broader range of industries, thereby enhancing the applicability of the findings across diverse business sectors.

Furthermore, the qualitative approach adopted in data collection, involving face-to-face interviews with selected SME owners, presents inherent limitations. Respondent bias and the limited depth of information provided on supply chain and technology-related issues may impact the authenticity of the findings. Additionally, the rapidly evolving nature of technology solutions and their application underscores the need for continual reassessment of the findings against new developments. To address these concerns, future studies could incorporate other analytical techniques to enhance the robustness of the findings.

APPENDICES

Appendix A: Interview Questionnaire

Introduction

My name is **Olawale Temowo**, a postgraduate student at the Mack Robinson C, United States. I am currently carrying out a study titled "***Impact of Technology Supply-Chain Systems on Market Penetration of SMEs in Nigeria."*** The study seeks to better understand how tech-enabled supply chain helps Nigerian small businesses enter new markets and maintain a presence in existing markets. This study is a partial fulfillment for the award of a Doctor of Business Administration degree in Supply Chain Management.

All data collected for this research shall remain confidential and will be used anonymously. All data collected shall be stored and handled on secured databases and physical storage devices.

Section A: Business Information

1. **General: This section seeks to understand your business model and supply chain.**

a. Please tell us your name and designation.

b. What is the name of your organization?

c. Kindly talk about your organization – talking about your principal activities, staff strength, and product/service offerings.

- Type of business
- Industry
- Number of employees
- Years of Existence
- Partners, Suppliers, and Service Providers
- Customer Base and Segment
- Primary Location and Primary Market Base (within and outside Nigeria)

d. How long has your business been in existence?

e. What are your major products and services?

f. How is your business structured? At what stage do you operate in your supply chain?

- Who are your suppliers and target market?

Section B: ICT Adoption in Supply Chain Management

2. Technology Use

a. Does your business have each of the following operations as part of its value creation process?

- Planning
- Sourcing
- Manufacturing
- Delivery
- Return

b. Do you employ modern digital technology in any of your operations?

c. If yes, select all that apply.

- Planning
- Sourcing
- Manufacturing
- Delivery
- Return

d. How would you rate the technology adoption in your business processes?

- Follow up – procurement, logistics, production, etc.

e. Looking at your supply chain from an end-to-end perspective, how would you rate the level of technology adoption?

f. What segment of the supply chain needs to be improved on?

g. Please specify which categories of technology you employ and to what degree (Low. Medium or High) in each part of your business

Hardware	Low	Medium	High
- Planning	-	-	-
- Sourcing	-	-	-
- Manufacturing	-	-	-
- Delivery	-	-	-
- Return	-	-	-

Software	Low	Medium	High
- Planning	-	-	-
- Sourcing	-	-	-
- Manufacturing	-	-	-
- Delivery	-	-	-
- Return	-	-	-

h. Please list examples of technology use in each category

Hardware	Low	Medium	High
- Planning	-	-	-
- Sourcing	-	-	-
- Manufacturing	-	-	-
- Delivery	-	-	-
- Return	-	-	-

Software	Low	Medium	High
- Planning	-	-	-
- Sourcing	-	-	-
- Manufacturing	-	-	-
- Delivery	-	-	-
- Return	-	-	-

i. To what extent is technology used in each aspect of your operations

Hardware	Low	Medium	High
- Planning	-	-	-
- Sourcing	-	-	-
- Manufacturing	-	-	-
- Delivery	-	-	-
- Return	-	-	-

Software			
-	Low	Medium	High
- Planning	-	-	-
- Sourcing	-	-	-
- Manufacturing	-	-	-
- Delivery	-	-	-
- Return	-	-	-

Section C: Barriers to ICT Adoption in Supply Chain Management

3. Barriers to ICT Adoption

a. What are the challenges faced in adopting technology in your supply chain?

- *Follow-up question: Are these challenges within or beyond your control as an entrepreneur in the MSME ecosystem?*

b. For how long have these challenges been at the fore?

c. What efforts are you taking in addressing these challenges?

Section D: Market Penetration and Market Development

Market penetration, also referred to as distribution intensity, is defined as the number of intermediaries used by a manufacturer within its trade areas (Stern et al., 2006). In this context, market penetration refers to the robustness of the supply chain of the SME within Nigeria, used as a comprehensive indicator of the quality of the supply chain.

How has the adoption of technology in your supply chain helped your business as far as market penetration is concerned?

Follow-up question – how significant is the impact?

Please share any supporting documentation to support this.

4. Technology Impact

a. When did you start using technology in your supply chain?

b. Before the use of supply chain technology in your business, how much did you make annually in

- Revenues

- Profits

You can provide a range for these figures if exact numbers are either unavailable or confidential.

c. Since you started using supply chain technology in your business, how much did you make annually in

- Revenues

- Profits

You can provide a range for these figures if exact numbers are either unavailable or confidential.

d. What was the size of your customer base before you started using technology in your business?

e. What is the size of your customer base since you started using technology in your business?

f. How has the number of collaborators in the categories changed before and after you started using technology?

-	Before	After
- Planning	-	-
- Sourcing	-	-
- Manufacturing	-	-
- Delivery	-	-
- Return	-	-

g. How have your operating costs in the categories below evolved before and after you started using technology?

-	Before	After
- Planning	-	-
- Sourcing	-	-
- Manufacturing	-	-
- Delivery	-	-
- Return	-	-

5. Market Penetration and Market Development

- What percentage of the market does your firm presently control?
- What strategy does your firm adopt in entering new markets and maintaining a presence in existing ones?
    - *Follow-up question: Is this strategy competitive enough to gain market share?*
- It is often said that competitiveness engenders sustainability in the business environment. How does your firm leverage technology to identify untapped opportunities in the market?

Before the Deployment of Technology

Market Development:

a. Which of the following regions did your business operate in?

- Southwest
- Southeast
- South South
- Middle Belt
- North Central
- Northeast
- Northwest

b. How much of your revenue came from the regions below?

-	Naira	%
- Southwest	-	-
- Southeast	-	-
- South South	-	-
- Middle Belt	-	-
- North Central	-	-
- Northeast	-	-
- Northwest	-	-

c. How much of your customer base were the regions below?

-	Number	%
- Southwest	-	-
- Southeast	-	-
- South South	-	-
- Middle Belt	-	-
- North Central	-	-
- Northeast	-	-
- Northwest	-	-

d. How long did it take you to deliver goods and services in the regions below?

-	0-2 days	3-7 days	More than 7 days
- Southwest	-	-	-
- Southeast	-	-	-
- South South	-	-	-
- Middle Belt	-	-	-
- North Central	-	-	-
- Northeast	-	-	-
- Northwest	-	-	-

e. How long did it take you to receive supplies in the regions below?

-	0-2 days	3-7 days	More than 7 days
- Southwest	-	-	-
- Southeast	-	-	-
- South South	-	-	-
- Middle Belt	-	-	-
- North Central	-	-	-
- Northeast	-	-	-
- Northwest	-	-	-

After the Deployment of Technology

f. Which of the following regions does your business operate in?

- Southwest
- Southeast
- South South
- Middle Belt
- North Central
- Northeast
- Northwest

g. How much of your revenue comes from the regions below?

- Southwest
- Southeast
- South South
- Middle Belt
- North Central
- Northeast
- Northwest
-

h. How much of your customer base is in the regions below?

- Southwest
- Southeast
- South South
- Middle Belt

- North Central
- Northeast
- Northwest

i. How long does it take you to deliver goods and services in the regions below?

-	0-2 days	3-7 days	More than 7 days
- Southwest	-	-	-
- Southeast	-	-	-
- South South	-	-	-
- Middle Belt	-	-	-
- North Central	-	-	-
- Northeast	-	-	-
- Northwest	-	-	-

j. How long does it take you to receive supplies in the regions below?

-	0-2 days	3-7 days	More than 7 days
- Southwest	-	-	-
- Southeast	-	-	-
- South South	-	-	-
- Middle Belt	-	-	-
- North Central	-	-	-
- Northeast	-	-	-
- Northwest	-	-	-

A. Sample Answers

Section A: Business Information

1. General: This section seeks to understand your business model and supply chain.

a. Please tell us your name and designation.

Owner	Manager B	Manager C

b. What is the name of your organization?

Company A	Company B	Company C

c. Kindly talk about your organization – talking about your principal activities, staff strength, and product/service offerings.

- Type of business

Trade in packaged consumer goods	Office supplies, stationery, and basic office set-up	Livestock feed/Agricultural supplies

- Industry

FMCG	Office supplies and services	Agriculture

- Number of employees

200+	40-50	300+ (200 Auxiliary)

- Years of Existence

10	6	7

- Partners, Suppliers, and Service Providers

FMCG Manufacturers, Distributors, Medium Scale Retailers, Neighborhood Stores	Office supply distributors, publishers, and furniture suppliers	Agricultural supply importers, manufacturers, and distributors

- Customer Base and Segment

Retailers, FMCG Manufacturers	Small businesses, Large Organizations, Schools, and Government Offices	Farmers, Resellers

- Primary Location and Primary Market Base (within and outside Nigeria)

Lagos Nigeria	Lagos Nigeria	Kwara Nigeria

d. How long has your business been in existence?

16	9	12

e. What are your major products and services?

Trade in packaged consumer goods	Office supplies, stationery, and basic office set-up	Livestock feed/Agricultural supplies

f. How is your business structured? At what stage do you operate in your supply chain?

- Who are your suppliers and target market?

FMCG Manufacturers, Distributors, Medium Scale Retailers, Neighborhood Stores	Office supply distributors, publishers, and furniture suppliers	Agricultural supply importers, manufacturers, and distributors

Retailers, FMCG Manufacturers	Small businesses, Large Organizations, Schools, and Government Offices	Farmers, Resellers

Section B: ICT Adoption in Supply Chain Management

2. Technology Use

j. Does your business have each of the following operations as part of its value creation process?

- Planning	Yes	Yes	Yes
- Sourcing	Yes	Yes	Yes
- Manufacturing	No	No	Yes
- Delivery	Yes	Yes	Yes
- Return	Yes	No	No

k. Do you employ modern digital technology in any of your operations?

Yes	Yes	Sometimes

l. If yes, select all that apply.

- Planning	Yes	No	Yes
- Sourcing	Yes	No	Yes
- Manufacturing	No	No	No
- Delivery	Yes	No	No
- Return	No	No	No

m. How would you rate the technology adoption in your business processes?

High	Low	Medium

- Follow up – procurement, logistics, production, etc.

n. Looking at your supply chain from an end-to-end perspective, how would you rate the level of technology adoption?

High with our suppliers, low with our customers	Low with our suppliers, high with our customers	Medium with our suppliers, low with our customers

o. What segment of the supply chain needs to be improved on?

Retailers and middlemen	Suppliers are too manual	Suppliers do not see value in technology because customers don't use it

p. Please specify to which categories of technology you employ and to what degree (Low. Medium or High) in each part of your business

Hardware			
- Planning	Low	Low	Low
- Sourcing	High	Medium	Low
- Manufacturing	Low	Low	High
- Delivery	High	High	High
- Return	High	Low	Low

Software			
- Planning	High	Low	High
- Sourcing	High	Medium	High
- Manufacturing	Low	Low	Low
- Delivery	High	Low	Low
- Return	High	Low	Low

q. Please list examples of technology use in each category

Hardware			
- Planning	-	-	-
- Sourcing	Tracked Vehicles	Computers	-
- Manufacturing	-	-	Feed Mixers, Controlled Temp Storage
- Delivery	Tracked Vehicles, Salesforce Automation (SFA) Devices	Vehicles	Tracked Packages
- Return	Tracked Vehicles, Salesforce Automation (SFA) Devices	-	-

Software			
- Planning	Inventory Monitoring Software	-	Spreadsheets and Email
- Sourcing	Salesforce Automation Software	Email and Internet Service	Spreadsheets and Email
- Manufacturing	-	-	-
- Delivery	Tracking Software, Salesforce Automation (SFA) Software	-	-
- Return	Tracking Software	-	-

r. To what extent is technology used in each aspect of your operations?

Hardware			
- Planning	Low	Low	Low
- Sourcing	High	Medium	Low
- Manufacturing	Low	Low	High
- Delivery	High	High	High
- Return	High	Low	Low

Software			
- Planning	High	Low	High
- Sourcing	High	Medium	High
- Manufacturing	Low	Low	Low
- Delivery	High	Low	Low
- Return	High	Low	Low

Section C: Barriers to ICT Adoption in Supply Chain Management

3. Barriers to ICT Adoption

d. What are the challenges faced in adopting technology in your supply chain?

Skills to use modern. Market acceptance Expensive equipment for SFA Sometimes technology is complex	No need for it, our operations works fine without it	Skills gap Poor integration with existing hardware systems Low adoption/interest by customers

- *Follow-up question: Are these challenges within or beyond your control as an entrepreneur in the MSME ecosystem?*

Some	No	Some

e. For how long have these challenges been at the fore?

Always	Always	Always

f. What efforts are you making in addressing these challenges?

Skills to use modern software – User education. Market acceptance - User education Expensive equipment for SFA - None Sometimes technology is complex – Feedback to software companies	No need for it, our operations works fine without it - None	Skills gap – Training for staff Poor integration with existing hardware systems – Replacing older hardware systems with new ones after permanent failure. Low adoption/interest by customers – Customer Education

Section D: Market Penetration and Impact

Market penetration, also referred to as distribution intensity, is defined as the number of intermediaries used by a manufacturer within its trade areas (Stern et al., 2006). In this context, market penetration refers to the robustness of the supply chain of the SME within Nigeria, used as a comprehensive indicator of the quality of the supply chain.

How has the adoption of technology in your supply chain helped your business as far as market penetration is concerned?

It has helped us reach more distributors, especially in remote locations	No impact	We can now manufacture our feed

Follow-up question – how significant is the impact?

High	Low	High

Please share any supporting documentation to support this.

4. Technology Impact

h. When did you start using technology in your supply chain?

Always	Never	2018

i. Before the use of supply chain technology in your business, how much did you make annually in

- Revenues

N120 million	N38 million	N162 million

- Profits

N70 million	N10 million	N100 million

You can provide a range for these figures if exact numbers are either unavailable or confidential.

j. Since you started using supply chain technology in your business, how much did you make annually in

Revenues

N120 million	N38 million	N210 million

Profits

N70 million	N10 million	N130 million

You can provide a range for these figures if exact numbers are either unavailable or confidential.

k. What was the size of your customer base before you started using technology in your business?

300	48	136

l. What is the size of your customer base since you started using technology in your business?

300	48	215

m. How has the number of collaborators in the categories changed before and after you started using technology?

-	Before			After		
- Planning	15	5	30	20	5	30
- Sourcing	15	5	30	20	5	30
- Manufacturing	0	0	5	0	0	12
- Delivery	15	5	30	20	5	30
- Return	15	5	30	20	5	30

n. How have your operating costs in the categories below evolved before and after you started using technology?

-	Before	After
- Planning	-	-
- Sourcing	-	-
- Manufacturing	-	-
- Delivery	-	-
- Return	-	-

5. Market Penetration

- What percentage of the market does your firm presently control?

Less than 1%	Less than 3%	Less than 1%

Before Deployment of Technology

k. Which of the following regions did your business operate in?

Southwest	Yes	Yes	Yes
Southeast	Yes	Yes	Yes
South South	Yes	No	No
Middle Belt	Yes	No	Yes
North Central	Yes	No	Yes
Northeast	No	No	Yes
Northwest	No	No	Yes

APPENDIX B: IRB Certification

Informed Consent

Title: *The Impact of Technology-Driven Supply Chain Systems on Market Penetration of SMEs in Nigeria*

Principal Investigator: Subhashish Samaddar

Co-Investigator: Wale Temowo

Student Principal Investigator: Wale Temowo

Introduction and Key Information

You are invited to take part in a research study. It is up to you to decide if you would like to take part in the study.

The purpose of this study is to Despite the tangible value of ICT adoption in supply chains, specifically for SMEs and the further importance of SMEs in the Nigerian economy, the literature exploring ICT adoption in SCM by SMEs in Nigeria and its impact on their market penetration has been limited. As such, this current research aims to reduce this research gap by exploring the impact of ICT-driven SCM on the market penetration of Nigerian SMEs.

Your role in the study will last 2 months October 2022 – December 2022
You will be asked to do the following:

- Provide data/information through:

  - Initial interview session conducted virtually or in-person between 30 mins and 2 hrs.

  - If necessary, 1-5 follow-up interactions by email, video conference, or phone calls that will last between 15-30 mins each at a maximum total of 2 hrs.

Participating in this study will not expose you to any more risks than you would experience on a typical day.

This study is not designed to benefit you. Overall, we hope to gain information about your business and technology use in your supply chain activities.

Purpose

The purpose of this study is to Despite the tangible value of ICT adoption in supply chains, specifically for SMEs, and the further importance of SMEs in the Nigerian economy, the literature exploring ICT adoption in SCM by SMEs in Nigeria and its impact on their market penetration has been limited. As such, this current research aims to reduce this research gap by exploring the

impact of ICT-driven SCM on the market penetration of Nigerian SMEs. A total of 10-50 people will be invited to take part in this study.

Procedures

If you decide to take part, you will provide information on the impact of technology-driven supply chain systems on the market penetration of Small & Medium Scale Enterprises (SMEs)

- You will be interviewed to provide qualitative data about your business for a duration of 30 minutes to 2 hours. The interview may be conducted face-to-face or via video conference.
- You will be required to fill in a survey to provide quantitative data about your business. The survey will be distributed primarily through digital media.
- You may be required to provide additional information in a shorter follow-up interview lasting for a total of 30 minutes to 1 hour.
- You may be required to provide supporting documentation showing data relevant to the research. These can be shared electronically.

Future Research

Researchers will remove information that may identify you and may use your data for future research. If we do this, we will not ask for any additional consent from you.

Risks

In this study, you will not have any more risks than you would on a normal day of life. No injury is expected from this study, but if you believe you have been harmed, contact the research team as soon as possible. Georgia State University and the research team have not set aside funds to compensate for any injury.

Benefits

This study is not designed to benefit you personally. Overall, we hope to gain information about the use of technology in the supply chains of Nigerian SMEs

Alternatives

The alternative to taking part in this study is to not take part in the study.

Voluntary Participation and Withdrawal

You do not have to be in this study. If you decide to be in the study and change your mind, you have the right to drop out at any time. You may skip questions or stop participating at any time.

You may refuse to take part in the study or stop at any time. This will not cause you to lose any benefits to which you are otherwise entitled.

Confidentiality

We will keep your records private to the extent allowed by law. The following people and entities will have access to the information you provide:

- Subhashish Samaddar and Wale Temowo
- GSU Institutional Review Board
- Office for Human Research Protection (OHRP)

When we present or publish the results of this study, we will not use your name or other information that may identify you. We will use interviewee code numbers rather than your name on study records. The information you provide shall remain confidential and will be used anonymously. All data collected shall be stored and handled on secured and encrypted databases and physical storage devices. When we present or publish the results of this study, we will not use your name or other information that may identify you.

For any follow-up information exchange using email, you should be aware that data sent over the Internet may not be secure, therefore you should use encryption and other mechanisms to exchange any sensitive information with the researchers. On our end, we will use encrypted emails to request, comment or clarify information with you.

Contact Information

Contact Subhashish Samaddar (Principal Investigator) at e-mail address s-samaddar@gsu.edu or phone number (678)612-4517

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- If you have questions about the study or your part in it
- If you have questions, concerns, or complaints about the study.

The IRB at Georgia State University reviews all research that involves human participants. You can contact the IRB if you would like to speak to someone who is not involved directly with the study. You can contact the IRB for questions, concerns, problems, information, input, or questions about your rights as a research participant. Contact the IRB at 404-413-3500 or irb@gsu.edu.

Consent

We will give you a copy of this consent form to keep.

If you are willing to volunteer for this research, please sign below.

_____

Printed Name of Participant

_____ _____

Signature of Participant Date

_____ _____

Principal Investigator or Researcher Obtaining Consent Date

REFERENCES

Aaker, D. A. (2014). Aaker on branding: 20 principles that drive success. Morgan James Publishing.

Adio, A. I., Bananda, R. A., Eluka, J. C. (2018) Product Differentiation and Competitive Advantage: Evidence from the Nigerian Telecommunication Sector. Department of Management, University of Nigeria, Enugu Campus. Department of Marketing, University of Jos

Akamoh, A. A. (2015) Using Market Penetration Strategy to Improve Market Share of MCN. Business School Netherlands.

Alicke, K., Rachor, J., & Seyfert, A. (2003). Supply Chain 4.0 - The next-generation digital supply chain.

Apulu, I. & Latham, A. & Moreton, R. (2011) Factors affecting the effective utilisation and adoption of sophisticated ICT solutions: Case studies of SMEs in Lagos, Nigeria. Journal of Systems and Information Technology, 13, 125-143

Abdallah, A. B., & Al-Ghwayeen, W. S. (2020). Green supply chain management and business performance: The mediating roles of environmental and operational performances. Business Process Management Journal, 26(2), 489–512.

Ahn, H., Ryu, S., & Han, I. (2014). The impact of supply chain agility on business performance: Focusing on the role of IT capability. Transportation Research Part E: Logistics and Transportation Review, 67, 39-51.

Awa, H. O., & Ojiabo, O. U. (2016). A model of adoption determinants of ERP within TOE framework. Information Technology & People, 29(4), 901-930.

Allen, R. S., & Helms, M. M. (2006). Linking strategic practices and organizational performance to Porter's generic strategies. Business Process Management, 12(4), 433–454.

Ansoff, H. I. (1957). Strategies for Diversification. Harvard Business Review, 35(5), 113–124.

Apulu, I. & Latham, A. (2011) An Evaluation of the Impact of Information and Communication Technologies: Two Case Study Examples. International Business Research,

Aryapadi, M., Dekhne, A., Fleischer, W., Graf, C., & Lange, T. (2020). Supply chain of the future: Key principles in building an omnichannel distribution network.

Asian Development Bank. (2018). SMEs in Asia: Their Importance and Ways to Support Them. Retrieved from https://www.adb.org/publications/smaller-enterprises-bigger-role-smes-asia

Avasilicai (coord.), 2009. "Entrepreneurship: applied research," Cluj-Napoca: Tedosco

Ajzen, I. (1991). The theory of planned behavior. Organizational Behavior and Human Decision Processes, 50(2), 179–211.

Ajzen, I., & Fishbein, M. (1975). A Bayesian analysis of attribution processes. Psychological Bulletin, 82(2), 261–277.

Al-Shamlan, H. M., & Al-Mudimigh, A. S. (2011). The change management strategies and processes for successful ERP implementation: a case study of MADAR. International Journal of Computer Science Issues (IJCSI), 8(2), 399-407.

Armstrong, C. P., & Sambamurthy, V. (1999). Information technology assimilation in firms: The influence of senior leadership and IT infrastructures. Information Systems Research, 10(4), 304-327.

Bartolini, C., Dumas, M., & La Rosa, M. (2012). Process model reuse: feasibility, benefits, and challenges. IEEE Transactions on Software Engineering, 38(2), 449-462.

Bowen, P. L., Cheung, M.-Y. D., & Rohde, F. H. (2007). Enhancing IT governance practices: A model and case study of an organization's efforts. International Journal of Accounting Information Systems, 8(3), 191-221.

Baird, A., & Raghu, T. (2015). Associating consumer perceived value with business models for digital services. European Journal of Information Systems, 24(1), 4–22.

Barreto, L., Amaral, A., & Pereira, T. (2017). Industry 4.0 implications in logistics: An overview. Procedia Manufacturing, 13, 1245–1252.

Bajwa, D. S., Garcia, J. E., & Mooney, T. (2004). An integrative framework for the assimilation of enterprise resource planning systems: Phases, antecedents, and outcomes. Journal of Computer Information Systems, 44(3), 81-90.

Bowen, P. L., Cheung, M.-Y. D., & Rohde, F. H. (2007). Enhancing IT governance practices: A model and case study of an organization's efforts. International Journal of Accounting Information Systems, 8(3), 191-221.

Bradford, M., & Florin, J. (2003). Examining the role of innovation diffusion factors on the implementation success of enterprise resource planning systems. International Journal of Accounting Information Systems, 4(3), 205-225.

Björkdahl, J. (2020). Strategies for digitalization in manufacturing firms. California Management Review, 62(4), 17–36.

Barua, A., Konana, P., Whinston, A. B., and Yin, F. “An Empirical Investigation of Netenabled Business Value,” MIS Quarterly (28:4), 2004, pp. 585 – 620

Bharati, P., & Chaudhury, A. (2006). A technology adoption lifecycle model for service-oriented architecture. European Journal of Information Systems, 15(5), 541-559.

BIAC, B20 China, World SME Forum, SME Finance Forum (2016), Financing Growth; SMEs in Global Value Chains, http://biac.org/wp-content/uploads/2016/06/Financing-Growth-SMEs-in-GlobalValue-Chains.pdf.'

Bi, Rui, Robert Davidson, Booi Kam, and Kosmas Smyrnios. 2013. Developing Organizational Agility through IT and Supply Chain Capability. Journal of Global Information Management 21: 38–55.

Büyüközkan, Gülçin, and Fethullah Göçer. 2018. Digital Supply Chain: Literature review and a proposed framework for future research. Computers in Industry 97: 157–77.

Blumberg, D., Cooper, D. R., & Schindler, P. S. (2021). Business research methods. McGraw-Hill Education.

Bourlier, A., & Gomez, G. (2016). Strategies for Expanding into Emerging Markets with E-Commerce. Euromonitor International

Braun V, Clarke V. 2006. Using thematic analysis in psychology. Qual Res Psychol. 3(2):77–101.

Cao, M., Zhang, Q., & Sarkis, J. (2000). Supply chain collaboration: A conceptual model and empirical evidence. International Journal of Physical Distribution & Logistics Management, 30(4), 334-356.

Chatfield, A. T. and Yetton, P. "Strategic Payoff from EDI as a Function of EDI Embeddedness," Journal of Management Information Systems (16:4), Spring 2000, pp. 195 – 224.

Chen, J., Zhou, R., Chen, H., & Pan, L. (2020). Sustainable fashion and the value chain. In Handbook of Sustainable Luxury Textiles and Fashion (pp. 113-136). Springer.

Choi, T.Y., Dooley, K.J., Rungtusanatham, M., 2001. Supply networks and complex adaptive systems: Control versus emergence Journal of Operations Management 19 (3), 351–366.

Chopra, S., & Meindl, P. (2021). Supply chain management: Strategy, planning, and operation. Pearson.

Chopra, S., Meindl, P., & Kalra, D. (2022). Supply chain management: Strategy, planning, and operation. Pearson.

Christopher, M. (2016). Logistics & supply chain management. Pearson.

Christopher, M., Peck, H., & Towill, D. (2020). Creating agile supply chains in the fashion industry. International Journal of Retail & Distribution Management, 48(7), 753-768.

Cegielski, C. G., Hall, D. J., & Yager, C. (2012). The impact of IT capability on firm performance: The mediating roles of absorptive capacity and supply chain agility. Information & Management, 49(3-4), 178-186.

Chau, P. Y., & Tam, K. Y. (1997). Factors affecting the adoption of open systems: An exploratory study. MIS Quarterly, 21(1), 1-24.

Christopher, M. (2016). Logistics & supply chain management. Pearson UK.

Creswell, J. (2003). Research Design: Qualitative, Quantitative and Mixed Method Approaches. 3rd ed. Thousand Oaks, CA: Sage Publications.

Chen, Chih-Jou. 2019. Developing a model for supply chain agility and innovativeness to enhance firms' competitive advantage. Management Decision 57: 1511–34.

Chong, A. Y.-L., & Chan, F. T. (2012). Structural equation modeling for multi-stage analysis on Radio Frequency Identification (RFID) diffusion in the healthcare industry. Expert Systems with Applications, 39(10), 8645-8654.

Collins, P. D., Hage, J., & Hull, F. M. (1988). Organizational and technological predictors of change in automaticity. Academy of Management Journal, 31(3), 512-543.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly: Management Information Systems, 13(3), 319–339.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User Acceptance of Computer Technology: A Comparison of Two Theoretical Models. Management Science, 35(8), 982–1003.

DePietro, R., Wiarda, E., & Fleischer, M. (1990). The context for change: organization, technology and environment. In L. G. Tornatzky & M. Fleischer (Eds.), The Process of Technological Innovation (pp. 151–175). Lexington, MA: Lexington Books.

Deepu, T. S., & Ravi, V. (2021). Supply chain digitalization: An integrated MCDM approach for interorganizational information systems selection in an electronic supply chain. International Journal of Information Management Data Insights, 1(2), 100038.

DeLone, W. H., & McLean, E. R. (1992). Information systems success: The quest for the dependent variable. Information systems research, 3(1), 60-95.

Dopson, E. (2022, May 26). How to Increase Market Penetration: 9 Strategies for Retailers. Marketing. Retrieved from https://www.shopify.com/retail/market-penetration

Ehie, Ike, and Luis Miguel D. F. Ferreira. 2019. Conceptual Development of Supply Chain Digitalization Framework. IFAC-PapersOnLine 52: 2338–42.

Ejem, Ejem & M., Uka & N. Dike, Declan & Chris, Ikeogu & Igboanusi, Chinemerem & Chukwu, Oluchi. (2021). Evaluation and Selection of Nigerian Third-Party Logistics Service Providers Using Multi-Criteria Decision Models.

Etokudoh, E. P., Boolaky, M., Gungaphul, M. (2017) Third Party Logistics Outsourcing: An Exploratory Study of the Oil and Gas Industry in Nigeria. First Published October 11, 2017, Research Article. https://doi.org/10.1177/2158244017735566

European Commission. (2019). Small and Medium-sized Enterprises (SMEs). Retrieved from https://ec.europa.eu/growth/smes_en

European Commission. (2019). SME growth monitor: Annual report 2019. Brussels: European Commission. DOI: 10.2826/603707

Fasanghari, M., Dolatabadi, H. R., & Rezaei, F. (2008). Radio frequency identification (RFID) applications: A brief introduction. In 2008 1st International Conference on Recent Advances in Information Technology (pp. 462-465). IEEE.

Fasanghari, M., Roudsari, F. H., Chaharsooghi, S. K (2008) Assessing the Impact of Information Technology on Supply Chain Management. World Applied Sciences Journal 4 (1): 87-93, 2008 ISSN 1818-4952 © IDOSI Publications, 2008

Fawcett, S. E., Ellinger, A. E., & Ogden, J. A. (2019). Supply chain management: From vision to implementation. Pearson.

Fernie, J., & Sparks, L. (2021). Logistics and retail management: Emerging issues and new challenges in the retail supply chain. Routledge.

Finney, S., & Corbett, M. (2007). ERP implementation: A compilation and analysis of critical success factors. Business Process Management Journal, 13(3), 329-347.

Germain, R., & Iyer, K. N. S. (2006). The interaction of internal and downstream integration and its association with performance. Journal of Business Logistics, 27(2), 29-52.

Gautr, R. (2020, February 29). Digitization in supply chain: Digital technologies in chemical industries. Chemical Industry Digest.

Gangwar, H., Date, H., & Ramaswamy, R. (2015). Understanding determinants of cloud computing adoption using an integrated TAM-TOE model. Journal of Enterprise Information Management, 28(1), 107–130.

Germain, R., & Iyer, K. N. S. (2006). The interaction of internal and downstream integration and its association with performance. Journal of Business Logistics, 27(2), 29–52.

Gorbach, G. (2017). The great digitization of industry. Supply Chain Management Review, (September–October), 24–29.

Guest, G., MacQueen, K. M., & Namey, E. E. (2012). Applied thematic analysis. Sage.

Gunasekaran, A., & Ngai, E. W. (2004). Information systems in supply chain integration and management. European Journal of Operational Research, 159(2), 269-295.

Gupta, S., & Arora, S. (2018). Retailer-manufacturer supply chain coordination and innovation: A literature review. International Journal of Retail & Distribution Management, 46(7), 648-669.

Haksöz, Ç. (2013). Risk Intelligent Supply Chains: How Leading Turkish Companies Thrive in the Age of Fragility (1st ed.). Boca Raton: CRC Press. https://doi.org/10.4324/9781315300368

Harindranath, G., Dyerson, R. & Barnes, D. (2008) ICT in small firms: factors affecting the adoption and use of ICT in Southeast England SMEs. European Conference on Information Systems (ECIS). Galway, Ireland.

Harris, I., Wang, Y. & Wang, H. (2015) ICT in multimodal transport and technological trends: Unleashing potential for the future. Int. J. Production Economics, 159, 88-103.

Harvard Business School. (2017). The market penetration playbook. Boston, MA: Harvard Business School Publishing. ISBN: 978-1-63369-053-5

Han, C., Dong, Y., & Dresner, M. (2013). Emerging Market Penetration, Inventory Supply, and Financial Performance. Production and Operations Management, 22(2), 335–347.

Hsu, C. W., & Yeh, C. C. (2017). Understanding the factors affecting the adoption of the Internet of Things. Technology Analysis and Strategic Management, 29(9), 1089–1102.

Hughes, P., Hughes, M., & Morgan, R. E. (2010). Why Do Product-Market Strategies Fail? A Sociostructural Examination under Conditions of Adherence. Group & Organization Management, 35(5), 606–635.

Hutzschenreuter, T., Kleindienst, I., Groene, F., & Verbeke, A. (2014). Corporate strategic responses to foreign entry: insights from prospect theory. The Multinational Business Review, 22(3), 294–323.

Hennink, M. M., Hutter, I., & Bailey, A. (2020). Qualitative research methods. Sage Publications.

Hinterhuber, A., & Liozu, S. (2014). Innovation in pricing: Contemporary theories and best practices. Routledge.

Hitt, M. A., Ireland, R. D., & Hoskisson, R. E. (2017). Strategic management: Concepts and cases: Competitiveness and globalization. Cengage Learning.

Hollensen, S. (2015). Marketing management: A relationship approach. Pearson Education.

Hollenstein, H. (2004) Determinants of the adoption of information and communication technologies (ICT): an empirical analysis based on firm-level data for the Swiss business sector. Struct. Change Econ. Dyn, 15, 315-342.

Huckridge, J., Bigot, S. & Naim, M. (2010) ICT in multimodal transport operations: a framework for future research. 17th International Annual EuroMA Conference. Portugal.

Huq, Z., & Gilbert, D. (2014). Adoption of information and communication technologies by microentrepreneurs in developing countries: Evidence from rural Bangladesh. Journal of Global Information Technology Management, 17(2), 105-132.

Huang, S.-M., Hung, Y.-C., Chen, H.-G., & Ku, C.-Y. (2004). Transplanting the best practice for implementation of an ERP system: A structured inductive study of an international company. Journal of Computer information systems, 44(4), 101-110.

Iacovou, C. L., Benbasat, I., & Dexter, A. S. (1995). Electronic data interchange and small organizations: Adoption and impact of technology. MIS quarterly, 19(1), 465-485.

Jacobs, F. R., Chase, R. B., & Lummus, R. R. (2014). Operations and supply chain management: The core. McGraw-Hill Education.

Jones, A. (2019). Fashion design. In The Bloomsbury Encyclopedia of Design (pp. 261-264). Bloomsbury Publishing.

Kable. (2014) 'ICT investment trends in the retail industry'. [Online] Available at: https://www.kable.co.uk/media-centre/ict-investment-trends-in-the-retailindustry.html (Accessed 15 July 2018).

Kalogiannidis, Stavros, Dimitrios Kalfas, Fotios Chatzitheodoridis, and Stamatis Kontsas. 2022. The Impact of Digitalization in Supporting the Performance of Circular Economy: A Case Study of Greece. Journal of Risk and Financial Management 15: 349. [Google Scholar] [CrossRef]

Kapoor, S. (2020) Consumer and the Market. Publisher: IIPAISBN: 81-86641-53X. Project: Consumer Law and Protection

Keegan, W. J., Green, M. C., Keegan, P. D., & Hoopes, C. R. (2019). Global marketing. Pearson.

Khanna, A., Fore, V., Tomar, R. (2016) Intelligent Supply Chain Management System. Conference: 3rd International Conference on Advances in Computing & Communication EngineeringAt: Durban, South Africa DOI:10.1109/ICACCE.2016.8073764

Khajavi, S. H., & Holmström, J. (2015, September). Manufacturing digitalization and its effects on production planning and control practices. IFIP International Conference on Advances in Production Management Systems, 179–185.

Korpela, Kari, Jukka Hallikas, and Tomi Dahlberg. 2017. Digital supply chain transformation toward blockchain integration. Paper presented at the 50th Hawaii International Conference on System Sciences, Hilton Waikoloa Village, HI, USA.

Kotler, P., & Keller, K. L. (2016). Marketing management. Pearson.

Kotler, P., Kartajaya, H., & Setiawan, I. (2016). Marketing 4.0: Moving from traditional to digital. John Wiley & Sons.

Kumar, A., & Shukla, V. (2019). Supply chain information integration: A review and synthesis. Benchmarking: An International Journal, 26(2), 633-656.

Krasadakis, G. (2020) The Importance of Novelty for Innovation. Retrieved from: https://medium.com/innovation-machine/how-important-is-novelty-for-innovation-f29ecf665a2b

Kuan, K. & Chau, P. (2001) A perception-based model for EDI adoption in small businesses using a technology-organization-environment framework. Inform. Manag, 38, 507– 521.

Kumar, V., Loonam, J., Kumari, A., Garza-Reyes, J., A., & Ngo, V., H. (2018) Supply integration through e-business-enabled enterprise systems: the case of the UK automobile sector. In: BAK, O. (ed.) E-business and supply chain integration: strategies and case studies from industry. London: Kogan page.

Khattak, M. A. O., Yuanguan, S., Irfan, M., Khattak, R. A., & Khattak, M. S. M. (2012). Examining critical success factors affecting ERP implementations in enterprises of Pakistan. Interdisciplinary Journal of Contemporary Research in Business, 3(10), 606-632.

Kwon, T. H., & Zmud, R. W. (1987). Unifying the fragmented models of information systems implementation. New York: ACM Digital Library.

Lee, C.-P., Lee, G.-G., & Lin, H.-F. (2007). The role of organizational capabilities in successful e-business implementation. Business Process Management Journal, 13(5), 677-693.

Lambert, D. M., & Cooper, M. C. (2000). Issues in supply chain management. Industrial Marketing Management, 29(1), 65-83.

Lambert, D. M., Knemeyer, A. M., & Pagh, J. D. (2018). An overview of supply chain management: A resource for research and practice. Sage Publications.

Laudon, K. C., & Laudon, J. P. (2016). Management information systems: Managing the digital firm (14th ed.). Pearson.

Li, N., & Dimitratos, P. (2014). How do business-level strategies affect multiple market servicing modes in the foreign country? International Marketing Review, 31(5), 526–546.

Liu, L., Chen, D. Q., Bosec, I., Hua, N., Brutond, G. D. (2013) Core versus peripheral information technology employees and their impact on firm performance. https://doi.org/10.1016/j.dss.2013.01.018

London Business School. (2013). The importance of learning and adaptation for SMEs in emerging markets. London: London Business School. ISBN: 978-1-909409-20-3

Loske, D., & Klumpp, M. (2020). Verifying the effects of digitalisation in retail logistics: An efficiency-centered approach. International Journal of Logistics Research and Applications, 25(2), 203–227.

Lyytinen, K., Newman, M. & Al-Muharfi, A. (2009) Institutionalizing enterprise resource planning in the Saudi steel industry: A punctuated socio-technical analysis. Journal of Information Technology, 24, 286-304.

Libby, R., & Rennekamp, K. (2012). Self-serving attribution bias, overconfidence, and the issuance of management forecasts. Journal of Accounting Research, 50(1), 197-231.

Lin, H.-F., & Lin, S.-M. (2008). Determinants of e-business diffusion: A test of the technology diffusion perspective. Technovation, 28(3), 135-145.

Mansfield, E. (1977). The production and application of new industrial technology. New York: Norton.

Moohebat, M. R., Jazi, M. D., & Asemi, A. (2011). Evaluation of the ERP implementation at Esfahan steel company based on five critical success factors: A case study. International Journal of Business and Management, 6(5), 236.

Martin, J. (1982). Strategic Data-Planning Methodologies Prentice Hall. New Jersey: Englewood Cliffs.

Malhotra, N. K. (2017). Marketing research: An applied orientation. Pearson Education.

Manzoor, F., Wei, L., Sahito, N., Hussain, A. (2021) The role of SMEs in rural development: Access of SMEs to finance as a mediator. https://doi.org/10.1371/journal.pone.0247598

Mathiassen, L. (2017). Engaged scholarship in information systems: Rigor and relevance in the information systems discipline. Journal of Information Technology, 32(1), 1-5.

Mentzer, J. T., DeWitt, W., Keebler, J. S., Min, S., Nix, N. W., Smith, C. D., & Zacharia, Z. G. (2001). Defining supply chain management. Journal of Business Logistics, 22(2), 1-25.

Meyer, J. W. & Rowan, B. (1977) Institutionalized organizations: formal structure as myth and ceremony. American Journal of Sociology, 83

Miles, M. B., Huberman, A. M., & Saldaña, J. (2020). Qualitative data analysis: A methods sourcebook. Sage Publications.

MIT Sloan School of Management. (2015). How to gain a competitive advantage through market penetration. Cambridge, MA: MIT Sloan School of Management. ISBN: 978-0-262-03435-3

Mordor Intelligence (2021) Nigeria Third-Party Logistics (Outsourcing) Market - Growth, Trends, Covid-19 Impact, and Forecasts. https://www.mordorintelligence.com/industry-reports/nigeria-outsourcing-market

Muga, L., & Santamaria, R. (2010). Market penetration strategies and the fee–performance relationship: the case of Spanish money mutual funds. The Service Industries Journal, 30(9), 1529–1547.

Mugenda, O. and Mugenda, A. (2009). Research Methods: Quantitative and Qualitative Approaches. 2nd ed. Nairobi: Acts Press.

Mukhopadhyay, T., & Kekre, S. (2002). Strategic and operational benefits of electronic integration in B2B procurement processes. Management Science, 48(10), 1301–1313.

Nandi, Madhavi Latha, Santosh Nandi, Hiram Moya, and Hale Kaynak. 2020. Blockchain technology-enabled supply chain systems and supply chain performance: A resource-based view. Supply Chain Management: An International Journal 25: 841–62.

Nah, F. F.-H., & Delgado, S. (2006). Critical success factors for enterprise resource planning implementation and upgrade. Journal of Computer Information Systems, 46(5), 99-113.

Nowell, L. S., Norris, J. M., White, D. E., & Moules, N. J. (2017). Thematic analysis: Striving to meet the trustworthiness criteria. International Journal of Qualitative Methods, 16(1), 1-13.

Nwafor, A., Samuels, S., Ojetunde, D. (2021) Nigeria, South Africa, Egypt constitute half of Africa's $2.7trn economy. International Center for Investigative Reporting. Retrieved

from: https://www.icirnigeria.org/nigeria-south-africa-egypt-constitute-half-of-africas-2-7trn-economy/Perego, A., Perotti, S. & Mangiaracina, R. (2011) ICT for logistics and freight transportation: a literature review and research agenda. Int. J. Phys. Distrib. Logist. Manag, 41, 457-483.

OECD. (2019). Enhancing the Contributions of SMEs in a Global and Digitalised Economy. Retrieved from https://www.oecd.org/cfe/smes/Okon, E. O. (2018) MSMEs Performance in Nigeria: A Review of Supply Chain Collaboration Challenges Department of Economics, Kogi State University, Anyigba, Kogi State, Nigeria

OECD (2022) Digital upskilling, reskilling & finding talent: The role of SME ecosystems. A joint webinar of the OECD "Digital for SMEs" (D4SME) & EECOLE (Entrepreneurship Education, Collaboration, and Engagement) Initiatives

Oh, Soojung, Young U. Ryu, and Hongsuk Yang. 2019. Interaction effects between supply chain capabilities and information technology on firm performance. Information Technology and Management 20: 91–106.

Opdenakker, R. (2006). Advantages and disadvantages of four interview techniques in qualitative research. Forum Qualitative Sozialforschung/Forum Qualitative Social Research, 7(4):122-186.

Opresnik, D., & Taisch, M. (2015). The value of big data in servitization. International Journal of Production Economics, 165, 174–184.

Oyelaran-Oyeyinka, B. (2020) SME: Issues, Challenges, and Prospects. FSS 2020 International Conference. Director Monitoring &Research Division (UN-HABITAT) Nigeria.Tob-Ogu, A., Kumar, N. & Cullen, J. (2018) ICT adoption in road freight in Nigeria - A case study

of the petroleum downstream sector. Technological forecasting & social change, 131, 240-252

Oliveira, T., & Martins, M. F. (2011). Literature review of information technology adoption models at the firm level. Electronic Journal of Information Systems Evaluation, 14(1), 110-119.

Pan, M.-J., & Jang, W.-Y. (2008). Determinants of the adoption of enterprise resource planning within the technology-organization-environment framework: Taiwan's communications industry. Journal of Computer Information Systems, 48(3), 94-102.

Poston, R., & Grabski, S. (2001). Financial impacts of enterprise resource planning implementations. International Journal of Accounting Information Systems, 2(4), 271-294.

Pakurár, Miklós, Muhammad Asif Khan, Attila Benedek, and Judit Oláh. 2020. The impact of green practices, cooperation and innovation on the performance of supply chains using the statistical method of meta-analysis. Journal of International Studies 13: 111–28.

Patton, M. (2015). Qualitative research and evaluation methods: Integrating theory and practice (4th ed.). Thousand Oaks, CA: Sage.

Paulk, M. C. (1999). Analyzing the conceptual relationship between ISO/IEC 15504 (Software Process Assessment) and the capability maturity model for software. In Proceedings of the Ninth International Conference on Software Quality: Vol. 9 (pp. 293-303). USA: American Society for Quality.

Porter, M. E. (1985). Competitive advantage: Creating and sustaining superior performance. Simon and Schuster.

Premkumar, G., & Roberts, M. (1999). Adoption of new information technologies in rural small businesses. Omega, 27(4), 467-484.

Peng, M. W. (2014). Global strategy. Cengage Learning.

Pokharel, S. (2005) Perception on information and communication technology perspectives in logistics - A study of transportation and warehouses sectors in Singapore. The Journal of Enterprise Information Management, 18, 136-149.

Porter, M. E. (2008). Competitive strategy: Techniques for analyzing industries and competitors. Simon and Schuster.

Premkumar, G., & Roberts, M. (1999). Adoption of new information technologies in rural small businesses. Omega, 27(4), 467-484.

Rai, A., Patnayakuni, R., & Nainika, S. (2006). Firm performance impacts of digitally enabled supply chain integration capabilities. Management Information Systems Quarterly, 30(2), 225–246.

Reddy, S. (2021) Supply Chain Technologies for Better Supply Chain Management. Propel: https://www.propelplm.com/blog/supply-chain-technologies-better-supply-chain-management

Richardson, M., & Evans, C. (2007). Strategy in Action Applying Ansoff's Matrix. Manager: British Journal of Administrative Management, (59), i-iii.

Roberts, C., & Fletcher, K. (2019). Fashioning the future: Sustainability and the fashion industry. Routledge.

Rosenbloom, B. (2017). Marketing channels: A management view. Cengage Learning.

Rubin, H. & Rubin, I. (2012). Qualitative interviewing: The art of hearing data (3rd ed.). Los Angeles, CA: Sage.

Ravichandran, T., Lertwongsatien, C., & Williams, A. (2005). Effect of information systems resources and capabilities on firm performance: A resource-based perspective. Journal of management information systems, 21(4), 237-276.

Rogers, E. M. (1995). Diffusion of Innovations: Modifications of a model for telecommunications. Berlin: Springer.

Randeree, K., Mahal, A., & Narwani, A. (2012). A business continuity management maturity model for the UAE banking sector. Business Process Management Journal, 18(3), 472-492.

Raymond, L., & Uwizeyemungu, S. (2007). A profile of ERP adoption in manufacturing SMEs. Journal of Enterprise Information Management, 20(4), 487-502.

Schonberger, R. J. (2008). Operations management. Pearson Prentice Hall.

Schniederjans, D., & Yadav, S. (2013). Successful ERP implementation: An integrative model. Business Process Management Journal, 19(2), 364-398.

Schultz, R. L., & Slevin, D. P. (1975). Implementing operations research/management science. Amsterdam: American Elsevier.

Schneiderjans, D., & Yadav, S. (2013). Successful ERP implementation: An integrative model. Business Process Management Journal, 19(2), 364-398.

Somers, T. M., & Nelson, K. G. (2004). A taxonomy of players and activities across the ERP project life cycle. Information & Management, 41(3), 257-278.

Stratman, J. K., & Roth, A. V. (2002). Enterprise resource planning (ERP) competence constructs: Two-stage multi-item scale development and validation. Decision Sciences, 33(4), 601-628.

Saldaña, J. (2016). The coding manual for qualitative researchers. Sage Publications.

Saldanha, J. P., Mello, J. E., Knemeyer, A. M., & Vijayaraghavan, T. A. S. (2015). Implementing Supply Chain Technologies in Emerging Markets: An Institutional Theory Perspective. Journal of Supply Chain Management, 51(1). https://doi.org/10.1111/jscm.12065

Samaddar, S., Kadiyala, S. (2006) Information systems outsourcing: Replicating an existing framework in a different cultural context. Journal of Operations Management 24 (2006) 910–931

Samaddar, S., Nargundkar, S., Daley, M. (2005) Inter-organizational information sharing: The role of supply network configuration and partner goal congruence. Department of Managerial Sciences, J. Mack Robinson College of Business, Georgia State University.

Saraf, N., Langdon, C., and Gosain, S. "IS Application capabilities and relational value in interfirm partnerships," Information Systems Research (18:3) 2007, pp 320-339.

Sharma, M., Gupta, R., & Acharya, P. (2020). Prioritizing the Critical Factors of Cloud Computing Adoption Using Multi-Criteria Decision-making Techniques. Article Global Business Review, 21(1), 142–161.

Ślusarczyk, Beata, Manuela Tvaronavičienė, Adnan Ul Haque, and Oláh Judit. 2020. Predictors of Industry 4.0 technologies affecting logistic enterprises' performance: An international perspective from an economic lens. Technological and Economic Development of Economy 26: 1263–83.

Simchi-Levi, D., Kaminsky, P., & Simchi-Levi, E. (2008). Designing and managing the supply chain: Concepts, strategies, and case studies (3rd ed.). McGraw-Hill.

Smith, G. (2020). Fashion industry. In The SAGE Encyclopedia of Economics and Society (pp. 617-618). SAGE Publications.

Smith, P., & Johnson, M. (2021). Strategic management in the international fashion retail industry. In The Routledge Companion to Strategic Management in the Retail Sector (pp. 173-192). Routledge.

Stefansson, G. (2002) Business-to-business data sharing: a source for integration of supply chains. International Journal of Production Economics, 75, 135-146.

Stern W.L., El-Ansary A., Andersso E., Couglan, A. (2006) Marketing Channels (7th ed.), Upper Saddle Creek, NJ: Prentice-Hall

Stank, T., Esper, T., Goldsby, T. J., Zinn, W., & Autry, C. (2019). Toward a digitally dominant paradigm for twenty-first century supply chain scholarship. International Journal of Physical Distribution & Logistics Management, 49(10), 956–971.

Srivastava, S. C., & Teo, T. S. (2007). E-government payoffs: Evidence from cross-country data. Journal of Global Information Management (JGIM), 15(4), 20-40.

Tarafdar, M., & Roy, R. K. (2003). Analyzing the adoption of enterprise resource planning systems in Indian organizations: A process framework. Journal of Global Information Technology Management, 6(1), 21-51.

Tushman, M., & Nadler, D. (1986). Organizing for innovation. California management review, 28(3), 74-92.

Teo, T. S., Lin, S., & Lai, K.-h. (2009). Adopters and non-adopters of e-procurement in Singapore: An empirical study. Omega, 37(5), 972-987.

Tornatzky, L. G., Fleischer, M., & Chakrabarti, A. K. (1990). Processes of technological innovation. Lexington Books.

Truman, G. E. “Integration in Electronic Exchange Environment,” Journal of Management Information Systems (17:1), 2000, pp. 209 – 244.

Umar, A., Alasan, I. I, Mohammed, A. M. (2020) SMEs and GDP Contribution: an Opportunity for Nigeria's Economic Growth. The International Journal of Business & Management. DOI: 10.24940/theijbm/2020/v8/i1/BM2001-046

United Nations. (2017). Promoting inclusive and sustainable economic growth, employment and decent work for all. Retrieved from https://www.un.org/development/desa/dspd/wp-content/uploads/sites/22/2018/05/Goal-8.pdfVan de Ven, A. H. (2007). Engaged scholarship: A guide for organizational and social research. Oxford University Press.

University of California, Los Angeles' Anderson School of Management. (2008). How to survive political instability and other risks for your SME. Los Angeles: University of California, Los Angeles' Anderson School of Management. ISBN: 978-0-226-73078-0

University of Cambridge's Judge Business School. (2012). How to adapt your SME products and services to meet the needs of emerging markets. Cambridge: University of Cambridge's Judge Business School. ISBN: 978-1-107-02715-3

University of Chicago's Booth School of Business. (2009). How to diversify your customer base to make your SME more resilient to economic downturns. Chicago: University of Chicago's Booth School of Business. ISBN: 978-0-226-73077-3

University of Oxford's Saïd Business School. (2011). How to attract the attention of potential investors and partners for your SME. Oxford: University of Oxford's Saïd Business School. ISBN: 978-0-19-969347-3

University of Toronto's Rotman School of Management. (2010). How to gain access to new technologies and expertise for your SME. Toronto: University of Toronto's Rotman School of Management. ISBN: 978-0-19-969348-0

Uko, J. P., & Ayatse, F. a. (2014). Market Penetration as a Growth Strategy for Small and Medium-Sized Enterprises in Nigeria. Management and Administrative Sciences Review, 23(January), 8–23.

Umble, E. J., Haft, R. R., & Umble, M. M. (2003). Enterprise resource planning: Implementation procedures and critical success factors. European Journal of Operational Research, 146(2), 241-257.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. MIS Quarterly: Management Information Systems, 27(3), 425–478.

Verma, S., & Bhattacharyya, S. S. (2017). Perceived strategic value-based adoption of Big Data Analytics in emerging economy: A qualitative approach for Indian firms. Journal of Enterprise Information Management, 30(3), 354-382.

Vluggen, M. (2005). The determinants of enterprise resource planning (ERP) systems usage levels: An empirical study. In Proceedings of the 5th European conference on accounting information systems (pp. 1-41). Maastricht: Maastricht University.

Wang, Y. M., Wang, Y. S., & Yang, Y. F. (2010). Understanding the determinants of RFID adoption in the manufacturing industry. Technological Forecasting and Social Change, 77(5), 803–815.

Westerman, G., Bonnet, D., & McAfee, A. (2014). Leading digital: Turning technology into business transformation. Harvard Business Review Press.

World Bank. (2020). Small and Medium Enterprises (SMEs) Finance. Retrieved from https://www.worldbank.org/en/topic/smefinance

Wu, D., & Pagell, M. (2011). Balancing priorities: Decision-making in sustainable supply chain management. Journal of Operations Management, 29(6), 577-590.

Yao, J. E., Xu, X., Liu, C., & Lu, J. (2003). Organizational size: A significant predictor of IT innovation adoption. Journal of Computer Information Systems, 43(2), 76-82.

Yerpude, Samir, Kiran Sood, and Simon Grima. 2023. Blockchain-Augmented Digital Supply Chain Management: A Way to Sustainable Business. Journal of Risk and Financial Management 16: 7.

Yin, R. K. (2017) Case Study Research and Applications: Design and Methods. Los Angeles: SAGE.

Yoo, Y., Boland Jr, R. J., Lyytinen, K., & Majchrzak, A. (2012). Organizing for innovation in the digitized world. Organization Science, 23(5), 1398-1408.

Zhu, K., Kraemer, K., & Xu, S. (2003). Electronic business adoption by European firms: A cross-country assessment of the facilitators and inhibitors. European Journal of Information Systems, 12(4), 251-268.

Zailani, S. (2012) Effects of Information, Material and Financial Flow on Supply Chain Performance: A Study of Manufacturing Companies in Malaysia.

Zeimpekis, V. & Giaglis, G. (2006) Urban dynamic real-time distribution services – insights from SMEs. J. Enterp. Inform. Manag, 19, 367-388.

Zeithaml, V. A., & Bitner, M. J. (2018). Services marketing: Integrating customer focus across the firm. McGraw-Hill Education.

VITA

Wale Temowo is a highly accomplished professional with a diverse skill set spanning international supply chain and logistics, financial management and strategy. With over two decades of senior leadership experience, he possesses deep domain knowledge encompassing areas such as Third-Party Logistics, Freight Forwarding, and Smart Warehousing. Wale's academic journey, marked by a Doctor of Business Administration from Georgia State University, a Sloan Masters in Leadership and Strategy from the London Business School, and an MBA from Rice University, reflects his commitment to continuous learning and professional development. Wale's research interests build on his first publication focused on the e-commerce industry, to explore the dynamics of supply chain management (https://www.mdpi.com/0718-1876/17/2/28).

Wale is keen on building the future of logistics, at the widening intersection of traditional logistics systems and modern technology. As the Founder and CEO of Ranon Logistics Network, he spearheaded the establishment of a third-party logistics service provider, leveraging an innovative Partnership-as-a-Service (PaaS) model. His initiatives include designing optimal business models, leading fundraising efforts, and defining strategic goals to drive revenue growth and operational efficiency. Leveraging this experience, Wale is building resilient supply chains for American businesses, while building bridges for African businesses to plug into global supply chains and markets.