EXPLORING THE IMPACT OF BUSINESS INTELLIGENCE (BI) FOR DECISION MAKING WITHIN SUPPLY CHAIN PROCESSES AND THEIR INFLUENCE ON SUPPLY CHAIN PERFORMANCE

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ABSTRACT

The dynamic business environment of today is one of constant competition and that necessitates that the businesses that operate therein be able to create and maintain competitive advantage. Business Intelligence (BI) has emerged as a critical resource for organizations striving to improve their decision-making processes through data-driven insights When effectively integrated, with supply chain management processes, BI can strengthen coordination, visibility and responsiveness thus improving supply chain outcomes. This research is at the intersection of BI and supply chain performance, and it investigates the application of this within the manufacturing sector in Nigeria where supply chains are constricted by infrastructural and systemic challenges

The research aims to examine the influence BI has through the lenses of information sharing, connectivity, and decision-making processes and how that influences integration and performance. A quantitative approach is adopted, using structural equation modelling to analyse survey data collected and test research hypotheses.

The complete and usable data was collected from 205 supply chain professionals in Nigeria. The Key findings of the research show indicate a significant positive relationship between business intelligence capabilities and Connectivity and Information sharing as well as Business intelligence having a significant and positive influence on supply chain process integration, which in turn improves overall performance. These findings underscore the strategic role of data-driven decision-making in enhancing supply chain outcomes, particularly in emerging economies.

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CHAPTER ONE:
INTRODUCTION

1.0 INTRODUCTION

This chapter introduces the study on the impact of business intelligence (BI) for decision-making within supply chain processes and its influence on supply chain performance. The chapter discusses the aim and objectives of the study, derive hypotheses and state the rationale for the study. However, despite its recognized benefits, the full impact of BI on supply chain performance remains underexplored, especially in contexts such as Nigeria, where infrastructure and technology present unique challenges.

1.1RESEARCH CONTEXT

As organizations face growing complexities in global markets, driven by technological advances, shifting customer demands, and external disruptions, the role of BI in supply chain management has become crucial. BI systems offer data-driven insights that support critical decisions, helping organizations optimize operations, forecast demand, and manage risks effectively thus heavily influencing a supply chain' performance. The dynamic business environment of today is one of constant competition and that necessitates that the businesses that operate therein be able to create and maintain competitive advantage (Qrunfleh &Taradfar 2013). As such in an increasingly data driven world BI integration has become essential and vastly recognised as an enabler within the supply chain management space that serves the role being able to assist in navigating volatile demand patterns, manage evolving consumer expectations and possible disruptions. This research is at the intersection of BI and supply chain performance, and it investigates the application of this within the manufacturing sector in Nigeria.

1.2 RESEARCH BACKGROUND

Nigeria is viewed as Africa's largest economy with a GDP of $477 billion as estimated by the World bank in 2023 (World Bank, 2023). The nation is heavily reliant on oil exports and is primarily recognised as an oil producing economy; ranked as the 16th largest oil producing nation in the world as at 2023, producing about 1.5million barrels of crude oil between the years of 2016 to 2023.

Researchers have posited that the nations heavy dependence on oil production and export has negatively affected the bolstering of other economic sectors, due to lack of focus and inconsistent macroeconomic policies for growth in the other sectors (Onayemi, 2022). The nation is in need of economic diversification in the midst of global oil crises, rising debt burdens and youth unemployment rates (National Bureau of Statistics[NBS], 2022) and manufacturing is one such sector in need of revitalisation , because it has the potential to reduce the dependence of the economy on oil, but to also insulate the economy from the distasteful fiscal/budgetary risks associated with negative oil price shocks, create job opportunities, reduce import dependence and promote diverse exports (KPMG, 2023).

It is well known that the manufacturing sector of a country is a key driver in the nation's economic growth, productivity and competitiveness, and the Nigerian manufacturing industry was which was once a thriving contributor to the economy has stagnated, contributing only an estimated 10% to the nominal GDP as of 2024.

It is noted that in advanced countries, the manufacturing sector is a leading sector in many respects; it is an avenue for increasing productivity in relation to import substitution and export expansion, creating foreign exchange earning capacity, raising employment, promoting the growth of investment at a faster rate than any other sector of the economy, as well as wider and more efficient linkage among different sectors (Opaluwa et al, 2010).

Thus, the need for the reawakening of the Nigerian manufacturing sector is imperative and amidst other infrastructural development deficits, the need for policy reforms; the need for technology adoption offers a pathway to growing the sector and overcoming barriers holding it back. This is evidenced by the fact that the larger manufacturing companies as early technological adopters have demonstrated the transformative impact of the tech they have applied within their supply chains and operational processes (Oyelaran-Oyeyinka, 2023).

It is important to note that companies- even within the manufacturing sector, do not work in isolation to fulfil demand and require a network of other parties to be involved. This complex network (called a supply chain) with which a company ensures the creation and passage of its products to their target consumer (Christopher, 1999) is important to consider because it needs to be adaptable, intuitive, and integrated so it can be responsive enough to quickly changing market conditions as well as create opportunities to thrive (Geyi et al., 2020; Liao, 2020; Shekarian et al., 2020)

In research, it has been identified that companies need to have the ability to harness the information that is generated within it, and in the case of supply chains there is an abundance of data generated relating to the past and present (Manavalan and Jayakrishna, 2019). Supply chain management (SCM) can be facilitated through Business Intelligence as it reduces the uncertainty that exists with customer behaviour by increasing visibility through data and analysis and allowing for improved and on time decision making as well as overall performance of the supply chain (Swafford, et al., 2008). This can be evidenced by a study carried out in 2020 where 56% of managers admitted increased investments in digitization of their SCM practices over the past three years (Mazareanu, 2020)

The rapid advancement of digital technologies has transformed supply chain management (SCM), positioning business intelligence (BI) as an essential tool for enhancing decision-making capabilities. Scholars have emphasized that BI enables organizations to access real-time data, streamline operations, and improve overall efficiency. According to Adenekan, Solomon, Simpa and Obasi (2023), BI systems integrate diverse data sources across supply chain networks, providing critical insights that enhance the precision of demand forecasting, inventory control, and risk management strategies. This capability allows supply chain managers to make informed decisions that align with market trends and customer demands, fostering agility and responsiveness in dynamic environments (Simpson et al., 2024)

As global supply chains become increasingly interconnected and volatile due to factors such as geopolitical tensions, pandemics, and climate change, the necessity for agile, data-driven decision-making has reached an unprecedented level of urgency (Kelka, 2024,). This need stems from increased complexity of supplier network. The globalization of supply chains has led to a more complex network of suppliers, manufacturers, and distributors spread across different regions. As companies navigate this complexity, they must be equipped with accurate, real-time data to make informed decisions. Agile, data-driven decision-making allows organizations to quickly adapt to changes and manage their supply chain effectively (Sadeghi et al., 2024). The dynamics of consumer demand are continually shifting due to factors such as technological advancements and changing preferences (Olawale et al., 2024). Companies must leverage data analytics to forecast demand accurately and respond swiftly to fluctuations.

In such a context, the use of BI could offer potential for enhanced decision making, supply chain process integration and improving responsiveness and agility particularly in economies like Nigeria as has been established in developed economies.

1.3 RATIONALE FOR FOCUSING ON THE NIGERIAN CONTEXT

As prior established there has been a need to revive and revitalise the Nigerian manufacturing sector, as it has the capacity to generate mass employment and increase value added exports which is important for socioeconomic stability (Ibeh et al.; 2024). The sector faces certain key challenges including infrastructural deficits, poor and unfocused policies for the sector amongst others. Thus, making the choice of the Nigerian manufacturing sector for this study relevant for several reasons; the concepts and nuances of this study are emerging concepts in the landscape, and this study aims to expand the existing body of research on the application of Business intelligence (BI) in decision-making within Nigeria, an area that remains underexplored.

This study aims to expand the existing body of research on the application of innovative technologies especially Business Intelligence (BI) in decision-making within Nigeria, an area that remains underexplored. While numerous studies have investigated BI applications in developed countries, their findings may not be directly applicable to developing nations such as Nigeria due to significant differences in infrastructure, technology, and organizational capacity (Oyerogba et al., 2024); Igboanus, 2023). For instance, developed countries typically have more advanced digital infrastructures and greater access to data analytics resources, which enable more seamless BI integration and utilization. In contrast, developing nations often face challenges such as limited technological infrastructure, data fragmentation, and a shortage of skilled personnel to effectively harness the potential of BI (Szelagowski & Bemiak-Wozny, 2024).

In addition, the adoption and utilisation of BI in Nigeria is new with first adopters being in the Telecommunications, and banking sectors and a small percentage for large manufacturers in the country. Thus, this study will contribute to assessing how BI is used in supply chain decision-making specifically within the Nigerian context. The nuances of BI application as well as manufacturing issues in Nigeria, such as the need to overcome infrastructural and technological limitations, make it crucial to conduct localized research that can offer more relevant insights for businesses operating in developing countries.

Thus, this study will contribute to filling this research gap by assessing how BI is used in supply chain decision-making specifically within the Nigerian context. This approach will help to tailor strategies that are better suited to the unique challenges and opportunities present in the Nigerian supply chain environment (Gaffer, Augustina, & Wicaksono, 2024).

Furthermore, the study will advance research on BI and supply chain management by examining how BI facilitates decision-making within supply chain processes, with a particular focus on how these technologies can be leveraged to improve operational efficiency, risk management, and information sharing among supply chain partners (Jafari et al., 2023; Emon, Jhan, & Siam, 2024). Understanding these aspects within the context of Nigeria's supply chain ecosystem will provide valuable insights into the specific ways BI can enhance supply chain performance in developing nations.

Additionally, this study will emphasize the critical role of supply chain process integration as a mediator between BI utilization and supply chain performance. Supply chain integration, which refers to the seamless coordination and alignment of various processes and stakeholders within the supply chain, is essential for leveraging the full potential of BI. By investigating how BI contributes to process integration, this research will highlight its importance in achieving superior supply chain performance outcomes, such as increased efficiency, better decision-making, and improved customer satisfaction (Nwankwo et al., 2023). This focus will address a key research gap, as the mediating role of supply chain process integration between BI use and performance has not been sufficiently explored in the literature, particularly in the context of developing countries like Nigeria.

1.4 STATEMENT OF THE PROBLEM

Nigeria is an interesting area of study as it is listed as one of Africa's largest emerging economies (IMF, 2019), and one of the largest populations in the world. It is also an interesting area because of its contributions as a major supplier of oil as well as importer of commodities around the world.

The supply chain process in Nigeria is like other countries, starting with production materials sourcing, which is largely imported from China, Netherlands, South Korea, and Belgium or otherwise locally sourced. The imported or locally sourced raw materials are then used in the production of semi-finished and finished goods which are then stored and distributed for delivery to wholesalers and retailers to sell to the final consumer (PWC, 2020).

Nigeria suffers several systemic challenges that affect the economy such as chronic infrastructural lack, overreliance on imports and lack of focused regulations continues to suffer from inefficiencies, poor integration and limited use of data driven decision making, Business intelligence is recognised as an important tool, especially as it relates to its efficacy in providing organizations with actionable insights, enabling them to optimize and enhance decision-making, and improve overall performance (Dedić & Stanier, 2016; Kimball & Ross, 2016). Irrespective of the global recognition of business intelligence as a driver for competitiveness. This differs from the known results that exist in advanced economies. There is little empirical research that exist in the Nigerian manufacturing context, but more so research that captures certain supply chain concepts in measurable terms. Existing research focuses on the fast-moving consumer goods (FMCG) sector, which while a thriving sector, doesn't focus or improve on the entire manufacturing sector. It is of note that the consumer goods sector benefits significantly from BI-driven supply chain management. In this industry, where consumer preferences change rapidly, real-time data analytics provide valuable insights into market trends, customer behaviour, and purchasing patterns, BI supports through increased visibility and flexibility. Companies that leverage BI to manage their supply chains more efficiently can respond swiftly to changes in demand, reduce excess inventory costs, and ensure timely delivery of products (Sazu & Jahan, 2022). This lends learning to the overarching supply chain concepts shared between the sectors.

Furthermore, the study will advance research on BI and supply chain management by examining how BI facilitates decision-making within supply chain processes, with a particular focus on how these technologies can be leveraged to improve operational efficiency, risk management, and information sharing among supply chain partners (Jafari et al., 2023; Emon, Jhan, & Siam, 2024). Understanding these aspects within the context of Nigeria's supply chain ecosystem will provide valuable insights into the specific ways BI can enhance supply chain performance in developing nations.

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BI use and performance has not been sufficiently explored in the literature, particularly in the context of developing countries like Nigeria.

Despite the growing adoption of business intelligence (BI) technologies within supply chain processes, a significant gap persists in understanding the specific ways in which BI influences supply chain performance. Although existing studies suggest that BI can enhance various facets of supply chain operations—including operational efficiency, risk management, and customer satisfaction—there is still a lack of comprehensive insights into the mechanisms by which these improvements occur (Gaffer, Augustina, and Wicaksono, 2024; Jafari et al., 2023; Emon, Jhan, and Siam, 2024).

1.5 AIM OF THE STUDY

This study aims to explore the impact of business intelligence application on decision-making within manufacturing supply chains in Nigeria, especially in relation to the creation of supply connectivity, influencing information sharing and supply chain integration and the influence of these concepts on overall supply chain performance.

1.6 RESEARCH OBJECTIVES

The following objectives have been constructed to fill the research gaps and achieve the overarching aim of the study:

i. To examine components of the supply chain management process and it's working within the Nigerian context.
ii. To underpin the concepts of Business Intelligence (BI) and Supply Chain integration.
iii. To examine the applications of Business Intelligence (BI) functionalities within SC components especially as it relates to decision making for SC performance.
iv. To examine the relationship between the use of Business intelligence capabilities and its influence on supply chain performance through the mediating effects of connectivity, information sharing, and supply chain integration

1.7 RESEARCH QUESTIONS

The core question forming the study is.

"How does the application of Business Intelligence systems for supply chain process decision making affect supply chain performance"? From this central question we derive the following research questions (RQ):

i. To what extent are companies utilizing Business Intelligence in their supply chain processes for decision-making?
ii. How effectively are companies leveraging Business Intelligence to create connectivity between their internal departments and supply chain partners?
iii. To what degree is Business Intelligence being used to facilitate information sharing between companies, their departments, and supply chain partners?
iv. What is the relationship between the use of Business Intelligence and the integration of supply chain processes within companies, particularly in the Nigerian context?
v. How does the use of Business Intelligence for decision-making and supply chain process integration impact overall supply chain performance?

1.8 STUDY STRUCTURE AND RESEARCH MILESTONES

Figure 1*: Research Structure*

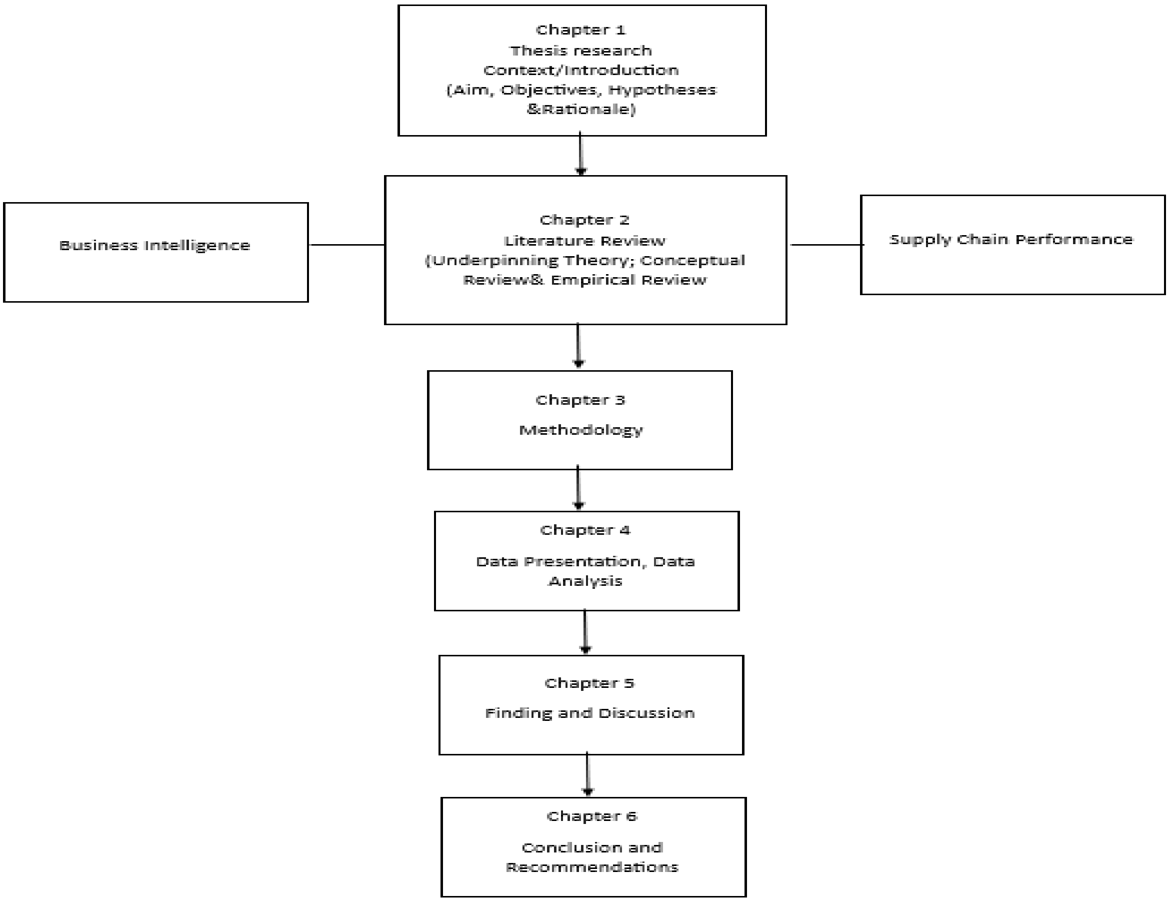


Figure 1 provides a visual representation of the sequence of activities that are fundamental to understanding the overall structure and purpose of the project. The diagram offers a clear overview of how the various stages of the research are interconnected and how they contribute to the project's global aim. By laying out the steps in a chronological manner, the figure helps to clarify the flow of the research process, ensuring that each phase is understood within the context of the broader project.

Beginning with the initial phase, the structure emphasizes the importance of reviewing relevant literature on key topics such as business intelligence (BI), supply chain processes, and supply chain performance. This review forms the foundation of the study, enabling a thorough examination of existing knowledge, identifying gaps, and positioning the current research within the academic discourse. By drawing on both theoretical and empirical studies, the literature review helps establish the context for the research, ensuring that the subsequent stages are grounded in a solid conceptual framework.

The next phase, as shown in Figure 1, involves the development of the methodology, which adopts a positivist approach. This philosophical stance aligns with a quantitative research design, focusing on objective, data-driven inquiry to test hypotheses and derive conclusions. The choice of a quantitative approach reflects the study's aim to analyze measurable variables, such as the impact of BI on supply chain integration and performance, and to generate statistically valid findings. This section of the study outlines the research design, data collection methods, and analysis techniques, ensuring that the methodology is robust, transparent, and suitable for answering the research questions.

Following the methodology, the findings and discussion sections are presented, as highlighted in Figure 1. These sections delve into the results of the data analysis, examining both scholarly views that support the study's aim and objectives, as well as those that offer counterarguments or challenge the study’s assumptions. The discussion critically engages with the findings, comparing them with the literature reviewed earlier, and assessing the extent to which the data aligns with or diverges from previous studies. This phase is essential for understanding how the research contributes to the field, offering new insights or confirming established knowledge.

Finally, the figure outlines the conclusion section, which brings the study to a close by summarizing the key findings and drawing final inferences. This section reflects on whether the research has successfully addressed its aim and objectives and provides recommendations for future research or practical applications. The conclusion also considers the limitations of the study and suggests how these could be overcome in future work, ensuring that the research makes a meaningful contribution to the ongoing dialogue on BI and supply chain performance.

By presenting the activities and milestones in a chronological order, Figure 1 ensures that the project's different stages are easy to understand and follow. It provides a roadmap that not only clarifies the sequence of events but also demonstrates how each phase of the research builds on the previous one, leading to a coherent and comprehensive study. This structured approach is crucial for ensuring that the research process is systematic, organized, and aligned with the study's overarching goals

1.9 SUMMARY OF CHAPTER

This chapter provides a comprehensive introduction to the study, outlining the essential elements that frame its direction and scope. It begins by presenting the background of the study, establishing the context in which the research is conducted, and the significance of the topic being investigated. This background offers insight into the current state of knowledge on the subject and highlights the gaps that this research seeks to address.

Furthermore, the chapter articulates the aim of the study, which serves as the central focus guiding the entire research process. This aim sets the stage for a deeper exploration of key issues related to Business Intelligence (BI) applications in supply chain management and its impact on decision-making processes in Nigeria. Following this, the objectives of the study are clearly outlined, breaking down the broader aim into specific, measurable outcomes that the research intends to achieve. These objectives provide a roadmap for the investigation and ensure that the study remains focused and organized throughout its course.

CHAPTER TWO

THE STRUCTURE OF THE NIGERIAN MANUFACTURING INDUSTRY AND THE RELEVANCE OF BI AND SCM

2.1 INTRODUCTION

This chapter helps to position the any further literary, empirical and theoretical contributions of this thesis within the industrial reality of Nigeria. It helps to establish the links between the use of BI capabilities and supply chain concepts in an economy characterised by infrastructural bottlenecks, informality and weak data ecosystems. It aims to build the notion, that the growth and improvement of the Nigerian manufacturing sector is a useful lever for economic diversification, as well as exploring the usefulness of tech adoption and use (particularly BI) are promising instruments for the revival of the sector. The chapter sheds lighter as to why western conventional assumption of BI and supply chains may not hold in Nigeria, justifying the study’s focus.

2.2 OVERVIEW OF THE NIGERIAN MANUFCATURING SECTOR

The Nigerian manufacturing sector has experienced a lot of evolution, and it can be closely linked to the nation's overall economic and even political history. These shifts are ranging from colonial and post-colonial extractive production, to import substitution, market liberalisation and industrial diversification efforts. These stages of development within the sector would be important to understand to set the scene and boost the understanding of the influences and the state of the sector

2.2.1. HISTORICAL EVOLUTION OF THE NIGERIAN MANUFACTURING SECTOR

Manufacturing in Nigeria originated in the colonial era were largely operating on a small scale with primarily artisanal and craft industries such as blacksmithing, pottery and textile. These production methods relied heavily on local methods and tools. This era also saw some introduction of some sophisticated manufacturing tools for agricultural processing and served the purpose of export and boosting the colonial economy instead of local development, this evolutionary period existed from the 1940s to the 1960s and was focused on large scale exports of raw materials such as cocoa, palm oil, cotton and groundnuts and the import of finished products from the United Kingdom (Obitayo, 1989) . It has been posited that this dependency structure that was created not leaving room for any indigenous industrialisation and progress.

Following on, was the import substitution industrial strategy, which came about post-independence (post 1960). This strategy was common amongst newly independent African nations and aimed at the reduced dependence on import and encouraged the local production of basic consumer products such as textiles, cement, food and beverages. This strategy involved protectionist policies; increased tariffs and restrictions on imports, the attraction of foreign direct investment from multinational firms such as Unilever, UAC, and Guinness, the establishment of industrial estates and development banks (Eze, 2020).

The Discovery and the boom of oil in the 1970s majorly transformed the economic priorities of the nation, there were massive inflows of revenue from crude oil exports led to state- led investments in infrastructure and state-owned enterprises across manufacturing subsectors, it is important to note that Nigeria needed to import a lot of technology and inputs. This period faced some structural weaknesses, as the manufacturing activity was mostly concentrated around low-tech assembly, there was a shortage of raw materials and there was a heavy reliance on imported machinery and intermediate products. The final nail in the coffin was the oil price collapse of the early 1980s, which unveiled the declining capacity of the sector and increased unemployment.

The next phase of industrialisation was the structural adjustment and liberalisation era of the mid 1980s -1990s. this era was characterised by the devaluation of the national currency, removal of import tariffs and subsidies, mass privatisation of state-owned enterprises and pushing for private sector led industry growth (Nelson, 2025). This era exposed Nigerian manufacturers to international competition without the appropriate infrastructure tech capability and financial support to allow them to compete effectively, and at this time there was a closure of many manufacturing firms and several others operated below capacity (capacity utilisation dropped from about 70% in the 1970s to below 40% in the late 1980s) (Oniyide & Ogunjinmi, 2024).

The industrial reforms era of the 2000s -2010s came next, and this was fuelled by the return of the nation to democratic rule in 1999. There were various initiative launched to improve the manufacturing climate such as the NEEDS (National Economic Empowerment and Development Strategy), the push for SME development, foreign investment and infrastructure rehabilitation, and the introduction of backward integration policies to encourage the local sourcing of locally sourced materials, in this period, certain industries, notably cement manufacturing (led by the Dangote group) achieved remarkable growth. This era revealed the challenges of erratic power supply and transport infrastructure, as well as limited tech capability and low investment in research and development.

In the last decade, the contemporary era 2010- till date, the nation has made renewed efforts to boost manufacturing industry as a pillar for economic diversification beyond oil. The Nigeria industrial revolution plan (NIRP) launched in 2014 was created under the federal ministry of industry trade and investment with an aim to make the sector a global competitor by 2025, naming agro-processing, light manufacturing, solid materials and petrochemicals as key drivers for industrial growth. Concurrently, the Economic Recovery and Growth Plan (EGRP, 2017-2020) as a plan was also launched to boost industrialisation through import substitution, local content promotion and infrastructural development.

There has also been a growing emphasis on digital transformation within manufacturing and supply chains, through the integration of automation technology, BI and Enterprise Resource Planning (ERP) systems to improve productivity and competitiveness, with larger firms such as Dangote group, Unilever and nestle have begun leveraging these tools for analytics, decision making, logistics optimisation and integration.

These historical policy shifts have given rise to the fragmentation that exists in the system which continue to shape how firms operate. The understanding of this is crucial for interpreting the role of Business intelligence as an enhancing resource within manufacturing supply chains.

2.2.2. THE MANUFACTURING LANDSCAPE IN NIGERIA

The manufacturing sector in Nigeria is an economic sector that contributes an estimated 10 % of the total GDP with recent statistics showing notable short term growth spurts in nominal terms but mixed real growth, evidence of the sectors latent capacity and structural fragility. The sector is comprised of heterogenous subsectors such as food and beverages, cement, and building materials, pharmaceuticals, textiles, basic materials, motor assembly etc. the manufacturing activates are localised in large cities such as Lagos state, Port Harcourt (Rivers state), Ibadan (Oyo state) and Ogun state. The sector is dominated by the cement and building materials, food and beverage, wood and textiles, tobacco, and chemicals and fertilisers.

The Manufacturers Association of Nigeria (MAN); an association created to promote and advocate the interest of its registered members (manufacturers) with the Government, through its proactive role in policy formulation and implementation, to ensure the sectors competitiveness and growth provides a more concise sectoral grouping for manufacturing activities, which is used for this study. They make this assertion according to the manufacturers that are registered with the association (MAN, 2010).

There are ten (10) sectoral groups, and seventy-four (74) sub sectoral groups noted,

and they are as follows

i. Basic metal, iron, steel and fabricated metal products

ii. Pulp, paper, paper products, printing and publishing products

iii. Electrical and Electronic products

iv. Wood, wood products and furniture products

v. Non-metallic minerals products

vi. Textiles, wearing apparel, carpet leather and leather footwear products

vii. Motor vehicle and miscellaneous assembly

viii. Domestic and industrial plastic, rubber and foam products

ix. Food, beverages and tobacco products

x. Chemical and pharmaceutical products

The diversity of the subsectors considered would imply a wide range a variety in coordination and organisational practices, information processing ability and digital maturity; thus, reinforcing the relevance of business intelligence as a firm level resource that could vary in its influence information sharing, connectivity, supply chain integration and performance in this context.

2.3 SUPPLY CHAIN DYNAMICS WITHIN THE NIGERIAN MANUFACTURING SECTOR

A supply chain, in its simplest terms, encompasses all the activities needed to deliver goods or services to the end consumer. It focuses on the core processes within an organization that transform raw materials or components into finished products or services. This requires looking upstream to suppliers and their provision of raw materials or parts, as well as downstream through the organization's activities, leading to the delivery of goods or services to the final consumer.

Supply chains in Nigeria operate in a hybrid structure, integrating formal (linear and structured with clear roles and traceability etc) industrial networks comprising large domestic and multinational manufacturers and broad a broad informal (non-linear, flexible and relationship based) economy of small-scale producers, artisans, traders and logistics intermediaries (Adelekan & Adepoju, 2023). This duality results in a system of a wide variation between supply chain partners in terms of technological sophistication, process maturity, and data integration capability. The resulting 'chain' within this system is more of a networked configuration usually overlapping and circular, with players and performing multiple roles, this structure can allow for some adaptability in uncertain environments but also introduces other inefficiencies (Adeyanju & Adenikinju, 2022).

They also operate a combination of local and global linkages, with many firms depending on imported raw materials, intermediate goods and machinery largely imported from China, Netherlands, South Korea, and Belgium or otherwise locally sourced. The imported or locally sourced raw materials are then used in the production of semi-finished and finished goods which are then stored and distributed for delivery to wholesalers and retailers to sell to the final consumer (PWC, 2020).

Another feature is that there is a lot of fragmentation and multi- tiers in the supplier bases primarily with small scale or informal suppliers, which makes it such that there is a lot of upstream complexity and risk. (Odunsina 2022; Oladoye & Akinlo, 2023). In addition to fragmentation there is a weak level of upstream/downstream integration. There is a limited level of coordination between sourcing, production, warehousing, distribution and retail as several companies manage these as discrete functions creating coordination and integration gaps and inefficiencies. As a result, there are gaps in information and visibility. Several firms are discrete in their processes and as such do not see the need for integrated IT systems, creating systems with ERP and SCM visibility. Odusina (2022) in their study, stated that small manufacturers in Lagos noted internal departmental silos as a challenge being faced.

It is also noteworthy that the downstream activities rely on wholesale and retail intermediaries due to weak logistics infrastructure as well as other systemic challenges that affect the overall performance of their chains including poor road networks and power supply, foreign exchange dependence and volatility, low technological and analytical adoptions and reliance on manual methods, institutional and regulatory barriers, a large informal sector, high levels of inflation, political instability. these challenges have a collective effect on the supply chain's ability for responsiveness, cost effectiveness and reliability.

The need for the adoption of structured supply chain management practices has been evidenced in literature as a means to mitigate these constraints. For instance, Samuel and Gabriel (2022) found that SCM practices such as supplier relationship management, supply chain planning, information sharing and logistics coordination have a positive influence on operational efficiency and profitability in Nigerian manufacturing organisations. Similarly, Ifekanadu et al. (2023) observed that firms that adopted strategic partnerships and IT based coordination experience better and reduced cycle times and increased customer satisfaction. Irrespective of this, the level of SCM adoption remains uneven, larger companies with larger backings tend to have more streamlined practices, while smaller companies struggle with the cost and technical expertise that it takes to implement such frameworks (Oladoye & Akinlo, 2023)

2.4 THE ROLE AND POTENTIAL FOR BUSINESS INTELLIGENCE WITHIN THIS SECTOR

Business Intelligence (BI) has emerged as a fundamental tool for organizations striving to improve their decision-making processes through data-driven insights (Dedić & Stanier, 2016; Kimball & Ross, 2016), BI enables companies to extract meaningful information from vast amounts of data, which is crucial for maintaining competitiveness and agility. BI encompasses a broad spectrum of applications, methodologies, and technologies that support data collection, analysis, and visualization, ultimately aiding in both short-term operational decisions and long-term strategic planning (IBM, 2011).

In the context of manufacturing supply chains, Business Intelligence (BI) has significant capabilities and value and has become increasingly critical as companies strive to enhance efficiency, visibility, forecasting, supplier analytics and agility in their operations (Mikalef et al., 2018; Gupta and George, 2016).

One of the primary benefits of BI capabilities in SCM is enhanced visibility across the entire supply chain. According to Ngai et al. (2024), BI provides supply chain managers with real-time insights into operations, enabling them to monitor various aspects of the supply chain more effectively. This heightened visibility allows for the identification of potential bottlenecks and inefficiencies that may have previously gone unnoticed. For example, companies can track inventory levels, production schedules, and shipping times more precisely, leading to quicker decision-making. With BI tools providing real-time data, supply chain managers can respond immediately to fluctuations in demand or disruptions in the supply chain, preventing costly delays and stockouts.

Additionally, BI capabilities help companies predict demand patterns through predictive analytics, which enables more accurate forecasting. This predictive power allows organizations to plan for future demand based on historical data, market trends, and external factors such as economic indicators (Davenport & Harris, 2024). As a result, companies can better align their production and inventory strategies with anticipated demand, thereby reducing excess stock and minimizing holding costs. This proactive approach also improves customer satisfaction, as businesses can ensure timely deliveries and avoid product shortages.

Another critical area where BI capabilities positively influence SCM is supplier relationship management. By leveraging BI tools, companies can analyse supplier performance data, including delivery times, product quality, and pricing trends (Chen et al., 2024). This data-driven approach enables businesses to assess their suppliers more effectively, identifying which suppliers are performing well and which may need improvement. In turn, companies can optimize their supplier base, fostering stronger, more reliable partnerships. These enhanced relationships lead to better contract negotiations, more favourable terms, and increased supplier accountability, all of which contribute to a more efficient and resilient supply chain.

Furthermore, BI helps in mitigating risks associated with supply chain disruptions, as well as managing supplier performance through analytics, and scenario modelling. By continuously monitoring supplier performance and external risks such as political instability or natural disasters, businesses can proactively create contingency plans to address potential disruptions before they affect operations. This real-time monitoring allows for quicker responses to supply chain risks, enabling companies to switch to alternative suppliers or adjust their production schedules as needed. Gunasekaran et al. (2024) highlight that the ability of BI to standardize data across supply chain partners facilitates seamless communication and collaboration, allowing companies to implement contingency plans more effectively.

With all the known aspects of the possibilities that can be achieved using BI, the average Nigerian manufacturing supply chain could have some benefits for addressing the supply chains that exist. For instance, one of the key dimensions of BI is data sourcing or extraction, which involves gathering data from various internal and external sources. Internal data can come from systems such as customer relationship management (CRM) systems, enterprise resource planning (ERP) systems, or sales and inventory databases, while external data sources might include market research reports, social media platforms, and third-party data providers (Martínez et al., 2024). The ability to access and collect data from diverse sources allows organizations to have a comprehensive view of their operations, market trends, and customer behaviours. This capability is useful for addressing the issue of data/information asymmetry and network fragmentation that exists in the manufacturing supply chain space (Odusina, 2022)

In addition, BI has the potential to reduce the high exposure the supply chains have to external shocks through the analytical dimension of BI is another critical aspect that allows organizations to extract meaningful insights from their integrated data. Analytics involves the use of statistical models, predictive algorithms, and machine learning techniques to identify patterns, trends, and anomalies that are not immediately visible through simple observation. These analyses can be classified into three categories: descriptive analytics, which summarizes historical data to identify trends; predictive analytics, which uses historical data to forecast future outcomes; and prescriptive analytics, which recommends actions to optimize outcomes (Shmueli & Koppius, 2023). For example, predictive models can be used to forecast demand fluctuations, inventory levels, foreign exchange fluctuations or customer behaviour, allowing organizations to proactively adjust their strategies. Descriptive analytics, on the other hand, can provide insights into past performance, helping organizations understand where improvements are needed.

Decision support is another crucial dimension of BI that is useful for tackling the problem of the overreliance on manual methods and eliminating guess work and managerial intuition. Where insights derived from analytics are presented to decision-makers in ways that support strategic, tactical, and operational decision-making. Decision support systems (DSS) are often integrated with BI tools to allow decision-makers to access the insights generated from analytics. According to Power (2023), DSS empowers organizations to make data-driven decisions by providing scenario modelling, what if analyses, and optimization tools. These systems help executives, managers, and operational staff make decisions by providing them with relevant data and analytical results in a timely manner.

With all these capabilities, this study conceptualises BI not just a standalone incremental technological tool but a potential strategic driver that supports decision making and supply chain integration and eventual supply chain performance improvements in supply chains in Nigeria. This position allows the study to increase BI-SCM theory by showing its capacity under infrastructural and institutional constraints.

2.5. NOVELTY OF THIS RESEARCH

Empirical studies in Nigeria provide some but limited evidence that business intelligence (BI) and Big Data Analytics (BDA) improve supply chain outcomes, particularly visibility, forecasting accuracy, flexibility and resilience (Okpara et al., 2024), which is consistent with the findings across developing economies that the data driven decision making contributes to supply chain performance (Gunakaseran et al, 2017). However, there are a few identifiable gaps in the literature; the first being the fact that most studies rely on survey data that is concentrated in the consumer goods sector, thus limiting the generalisability to other manufacturing sectors.

The second being that BI is treated as a single large construct rather than exploring the components such as data integration, analytical modelling, decision support etc. this way of measurement can affect and prevent a deeper understanding of the effect that the application of BI can have on supply chain performance (Popovic et al., 2018; Shollo & Gallers, 2016)

The third limitation would be that empirical work has largely neglected mediating and moderating mechanisms that explain how BI capabilities translate into improved outcomes. Most Nigerian studies focus on direct BI → performance effects, ignoring potential mediators such as supply chain integration, decision quality, or information sharing (Adeyanju & Adenikinju, 2022; Adenuga, 2023). Likewise, contextual moderators such as firm size, infrastructure reliability, or digital maturity known to influence technology-driven performance effects (Rashid et al., 2022; Dubey, Gunasekaran, & Childe, 2020) — are rarely tested in the Nigerian context.

This research also sheds some light on the constraints and challenges facing the sector, discussed earlier; these challenges create a highly uncertain environment with fragmented information flows and higher operating costs. It does appear that several problems are macro-structural issues and require government intervention (inconsistent power supply, Port control issues, Road networks an insecurity), however there are other issues that are amenable to firm-level interventions, using Business intelligence. In such a context, the use of BI could offer potential for enhanced decision making, supply chain process integration and improving responsiveness and agility. This research grounds the conceptual model in the operational realities of the sector, offering context-specific explanations of the applications of BI into supply chain integration and performance.

2.6 SUMMARY OF CHAPTER

This chapter provides more context of the condition of the Nigerian manufacturing sector, outlining the essential elements that frame the difference between what is known and the uniqueness of the Nigerian context. It presents an overview, historical evolution and landscape of the sector as well as discussing the challenges faced, establishing the context in which the research is conducted, and the impact that BI can have within the sector. This chapter further offers insight into the current state of knowledge and establishes the novelty of the Nigerian manufacturing context.

CHAPTER THREE: LITERATURE REVIEW

3.1 INTRODUCTION

This chapter of the thesis develops the foundational concepts and theoretical underpinnings of the study, establishing a comprehensive understanding of the concepts framing the study. It begins with a thorough review of the relevant literature, examining prior research and theoretical insights that align with the study's objectives. This review helps to contextualize the research aim and problem and provides a framework for analysing the key variables involved in the study; and in addition, the chapter introduces a conceptual framework as well as the theoretical backing that serves as a foundation for the study, guiding the analysis and interpretation of the data. The chosen theoretical framework is carefully selected to underpin the study's objectives and provide a lens through which the research can be viewed.

3.2. CONCEPTUALISING SUPPLY CHAIN MANAGEMENT

As previously established, companies are unable to carry out the duty of fulfilling customer orders by themselves and as such rely on other companies or parties to fulfil certain parts of the process. This collaboration creates the concept of the 'supply chain' which can be defined as the set of value- adding activities connecting the enterprise's suppliers and its customers, the essential principle of these activities is the value addition from the receiving of input or raw materials to production, to the point of delivery to customers (Levi at al (2004).

Building on the understanding of the supply chain, the management of a complex web of suppliers, products/services, consumers etc is an important next consideration.

The concept of Supply Chain Management (SCM) was first introduced in 1982 by Oliver and Webber, who used the term to describe an approach to inventory management that emphasized the strategic supply of raw materials (Oliver & Webber, 1982). Initially, SCM focused on optimizing inventory flows and ensuring that materials moved efficiently from suppliers to manufacturers. However, the idea quickly evolved as academics began to recognize its broader implications for managing the entire flow of materials, services, and information across organizational boundaries.

By the early 1990s, researchers like Cooper and Ellram (1993) provided a more comprehensive theoretical foundation for SCM, distinguishing it from traditional logistics and materials management approaches. SCM was no longer just about optimizing individual segments of the supply process; it became a holistic strategy that integrated multiple functions and organizations into a cohesive system (Cooper & Ellram, 1993). This integration of suppliers, manufacturers, distributors, and customers across the entire supply chain was essential for improving the efficiency and responsiveness of firms in a rapidly changing market environment (Mentzer et al., 2021).

At its core, SCM intends to streamline the processes and functions involved in supply chains to ensure cost minimisation, streamlining operational processes, and ensuring that products reach end-users in the most efficient and timely manner possible (Fernando et al, 2024). It also considers the necessity for partnership building with suppliers and consumers to boost value creation (Adebanjo and Awolusi, 2023).

In its traditional conception, SCM represents the coordination of material, financial, and information flows across suppliers, manufacturers, distributors, and customers to maximise overall value (Chopra & Meindl, 2019). However, this concept presupposes a level of infrastructural and institutional maturity that is usually not present in developing countries. In contexts like Nigeria, SCM must therefore be understood as both an adaptive and relational process (Okpara & Wynn, 2007; Ugochukwu et al., 2012). Rather than being primarily technology-driven, supply chain coordination in such environments often relies on informal trust-based relationships, improvisation, and human-mediated information exchange (Adebayo et al., 2021). This dynamic, though frequently treated as a limitation in the literature, also represents a unique adaptive capability, one that allows supply chain actors to function despite infrastructural weaknesses and market uncertainty. The nuances of BI application management supply chains in Nigeria, such as the need to overcome infrastructural and technological limitations, make it crucial to conduct localized research that can offer more relevant insights for businesses operating in developing countries.

Moreover, while many global studies view SCM primarily as an operational optimisation process, in developing economies it often plays a strategic survival role (Ambe & Badenhorst-Weiss, 2012). Firms must continuously adjust supply chain configurations to mitigate external shocks such as currency devaluation, raw material shortages, or policy changes. These challenges highlight the need to reconceptualise SCM not as a static process of coordination, but as a dynamic system of adaptation embedded in a volatile institutional landscape (Bagchi et al., 2015)

3.2.1 EXPLORING SUPPLY CHAIN MANAGEMENT (SCM) FRAMEWORKS

There are different SCM frameworks that exist, each offering unique perspectives on how best to enhance the efficiency and effectiveness of supply chain operations.

One of the most widely adopted frameworks is the **Supply Chain Operations Reference (SCOR) model**, developed by the Supply Chain Council (now part of APICS). The SCOR model categorizes supply chain activities into six core processes: Plan, Source, Make, Deliver, Return, and Enable. It provides standardized metrics and best practices, making it valuable for performance benchmarking and process optimization across industries (APICS, 2022).

Another influential framework is the Mentzer et al. (2001) supply chain management **model**, which defines SCM as the systemic, strategic coordination of traditional business functions and tactics. This framework emphasizes the integration of key processes both within and across firms to enhance long-term performance and competitiveness. Similarly, Lambert and Cooper's Global Supply Chain Forum (GSCF) framework identifies eight key business processes (e.g., customer relationship management, order fulfilment) that must be integrated for effective supply chain performance (Lambert & Cooper, 2000).

Strategic alignment is also emphasized in **Fisher's (1997) model**, which matches supply chain strategy to product type—functional products requiring efficient supply chains, while innovative products demand more responsive, agile systems. Expanding on this, **Christopher (2000)** and others introduced **lean, agile, and hybrid (leagile)** supply chain paradigms. Lean approaches focus on waste elimination and cost efficiency, while agile systems prioritize flexibility and responsiveness in volatile markets.

Furthermore, Lee's (2004) Triple-A supply chain framework proposes agility, adaptability, and alignment as core capabilities of high-performing global supply chains. These frameworks collectively provide conceptual and practical tools to understand, design, and manage supply chains effectively in diverse and dynamic business environments.

In more recent times Chen et al. (2024) proposed a framework focused on SCM constructs and measurements. Their study consolidates previous research and integrates findings into a comprehensive framework that undergoes iterative measurement analysis. Key elements of their framework include environmental uncertainty, customer focus, top management support, competitive priorities, information technology, strategic purchasing, logistics integration, and supplier and buyer performance. Tan et al. (2024) explored the evolution of SCM literature and presented a framework that highlights two main perspectives: one focused on purchasing and supply activities, and the other on transportation and logistics functions. These two perspectives converge into an integrated view of SCM, illustrating the transition from a fragmented approach to a holistic, coordinated supply chain strategy.

Mentzer et al. (2024) aimed to define SCM and developed two supporting frameworks. The first framework outlines the antecedents and consequences of SCM, while the second is a conceptual model based on a consensus definition of SCM. This framework illustrates supply chain flows, business functions encompassed by SCM, and the critical role of customer value and profitability as primary drivers.

Scholars have increasingly recognised that the SCM frameworks developed in Western contexts may not seamlessly translate to developing economies (Boso et al., 2017; Kache & Seuring, 2017). In emerging markets, supply chain actors contend with institutional voids, unreliable infrastructure, erratic policy environments, and poor logistics performance (Amankwah-Amoah, 2018). Nigeria exemplifies these challenges: frequent power outages, port congestion, poor road networks, and weak enforcement of trade regulations severely constrain supply chain efficiency (Akinwale et al., 2023; Nnamdi et al., 2020). Consequently, the ability to manage information and relationships becomes far more critical than in settings with mature logistical systems.

3.2.2 THE SUPPLY CHAIN OPERATION REFERNCE (SCOR) MODEL

As earlier referenced, one of the most widely recognized models is the Supply Chain Operations Reference (SCOR) model, created by the Supply Chain Council, a global non-profit organization. SCOR was designed to provide practical guidelines for evaluating and improving supply chain processes by identifying, measuring, and reorganizing SCM operations. This model organizes SCM activities into five key components: Plan, Source, Make, Deliver, and Return, representing the processes involved in the product life cycle (Gunasekaran et al., 2024).

The Plan process comprises activities related to the coordination of supply and demand across the supply chain network. It involves strategic and tactical functions such as forecasting, inventory planning, and supply network design. Effective planning ensures alignment between market requirements and operational capabilities (APICS, 2017). The process serves as a governance mechanism, enabling organizations to define performance targets and manage supply chain policies.

The Source process addresses the procurement of goods and services to fulfil production and customer demand. It includes supplier identification, contract negotiation, ordering, and receipt of inputs. Source processes are critical for maintaining input quality, lead time reliability, and cost control, which in turn influence overall supply chain responsiveness and efficiency (Supply Chain Council, 2012).

The Make process encapsulates all activities associated with the transformation of raw materials into finished goods. It supports multiple production strategies—make-to-stock, make-to-order, and engineer-to-order—and includes production scheduling, execution, quality assurance, and packaging. The effectiveness of this process impacts throughput, product quality, and manufacturing flexibility (APICS, 2017).

The Deliver process involves customer order management, warehousing, distribution, and transportation. It serves as the interface between the organization and the customer, directly influencing customer satisfaction and service-level performance. This process also encompasses invoicing and financial settlement, thus linking operational activities to financial outcomes (Supply Chain Council, 2012).

The Return process includes reverse logistics operations related to the receipt of defective, excess, or end-of-life products. It supports activities such as returns authorization, transportation, inspection, and disposition. Effective return processes contribute to sustainability objectives and enhance post-sale service performance.

This study adopts the SCOR model as a conceptual framework for the application of BI capabilities to support data enabled decision making across supply chain processes as it provides a standardised, process-oriented approach to the strategic, operational and informational dimensions of supply chain management through its afore discussed core processes. This framework provides a structure for the exploration of BI's influence in structured operational areas i.e. BI supporting planning accuracy, supplier visibility, and evaluation, production coordination and delivery. Its multidimensional metrics align closely with the study's conceptual framework, which integrates Business Intelligence, decision-making, information sharing, connectivity, and integration as key determinants of performance.

The model's focus on process visibility and cross-functional coordination is particularly relevant for this study as it allows for the integration of the concepts of BI enabled connectivity and information sharing. It is also relevant for Nigeria's manufacturing context, where supply chains are characterised by fragmentation, informality, and infrastructural limitations

(Akinwale et al., 2023; Amankwah-Amoah, 2018) it provides a structured and adaptable lens for analysing how BI enabled systems can compensate for the operational inefficiencies. By employing SCOR, this study therefore provides a structured yet context-sensitive means of linking information-enabled decision processes to measurable performance outcomes within Nigeria's manufacturing supply chains.

3.3 CONCEPTUALISING CONNECTIVITY AND INFORMATION SHARING

The concepts of connectivity and information sharing are widely recognised as foundational enablers of effective supply chain management, and while they are closely related, they capture different but complementary aspects of inter and intra- organisational coordination.

Connectivity refers to the structural and technological capacity that allows supply chain actors to exchange data, communicate and access shared systems, and information sharing reflects the behavioural and relational process through which timely, accurate and relevant information is exchanged and used for decision-making (Zhao et al., 2010; Prajogo & Olhager, 2012).

Looking from a supply chain perspective, connectivity gives the infrastructural backbone that supports coordination in and across organisational boundaries.

This includes digital platforms, information systems integration, and communication technologies that enable firms to link internal functions with external partners such as suppliers, distributors, and logistics providers (Rai, Patnayakuni & Seth, 2006). Without adequate connectivity, information remains fragmented across functional silos, limiting visibility and constraining the ability of firms to synchronise planning, production, and distribution activities. As such, connectivity is increasingly viewed not merely as an IT concern, but as a strategic capability that underpins relational and process integration across the supply chain (Kim & Lee, 2010).

Information sharing, by contrast, captures the extent to which connected actors exchange meaningful data in a manner that supports joint decision-making. This includes the sharing of demand forecasts, inventory levels, production schedules, and performance metrics, as well as contextual information that enhances mutual understanding and coordination (Flynn, Huo & Zhao, 2010). Effective information sharing is characterised not only by frequency, but also by accuracy, timeliness, completeness, and relevance. Prior research suggests that high-quality information sharing reduces uncertainty, mitigates opportunistic behaviour, and improves alignment between supply chain partners (Li et al., 2006; Cao & Zhang, 2011).

The relationship between connectivity and information sharing is therefore sequential and interdependent. Connectivity enables the technical possibility of information exchange, while information sharing reflects the actual utilisation of that capability within relational and organisational contexts. Studies have shown that investments in information systems alone do not automatically lead to improved coordination unless they are accompanied by governance mechanisms, trust, and shared norms that encourage information use and collaboration (Rai et al., 2006; Zhao et al., 2010). This distinction is particularly relevant in emerging economy supply chains, where uneven digital maturity and informal coordination practices may limit the effectiveness of connectivity unless actively translated into shared decision processes.

Within the context of Business Intelligence-enabled supply chains, connectivity and information sharing play a critical mediating role between analytical capability and operational outcomes. BI systems enhance connectivity by integrating data from multiple internal and external sources into unified platforms, while simultaneously supporting information sharing through dashboards, reports, and analytics that can be accessed across functional and organisational boundaries (Mikalef et al., 2018). By improving both the availability and interpretability of information, BI facilitates shared situational awareness and coordinated responses to demand variability, supply disruptions, and environmental uncertainty.

Theoretical perspectives such as the resource-based view and dynamic capabilities theory further underscore the importance of connectivity and information sharing as mechanisms through which firms leverage digital resources for competitive advantage. Connectivity enhances the firm's ability to sense and access distributed information, while information sharing supports collective interpretation and coordinated action, both of which are essential for effective supply chain integration (Teece, 2007; Dubey et al., 2019). Accordingly, these constructs are best understood not as outcomes in themselves, but as enabling processes that translate BI capabilities into integrative supply chain practices and performance improvements.

3.4 CONCEPTUALISING SUPPLY CHAIN INTEGRATION

Supply Chain Integration (SCI) is widely recognised as a strategic capability that enhances the synchronisation of material, information, and financial flows across organisational boundaries. Although the concept has evolved over three decades, contemporary research converges on SCI as a multidimensional, relational, and information-driven construct that shapes how firms collaborate to achieve superior supply chain performance ((Flynn et al., 2010; Zhao et al., 2010)). In the context of Nigerian manufacturing, where supply chains are fragmented, information visibility is low, and operational unpredictability is high SCI assumes heightened relevance as a mechanism for mitigating institutional silos and improving resource utilisation.

Early conceptualisations framed SCI primarily as coordination of logistics functions (Stevens, 1989) and as globalisation increased supply interdependencies, the definition expanded to encompass strategic alignment between internal processes and external partners. Frohlich and Westbrook's (2001) influential "arc of integration" model positioned SCI as the degree of upstream and downstream connectivity with suppliers and customers. More recent definitions emphasise collaborative information exchange, trust-based relationships, and shared decision-making (Prajogo & Olhager, 2012).

A widely accepted definition is one by Flynn et al. (2010) which conceptualises SCI as the degree to which a firm strategically collaborates with its supply chain partners and manages intra- and inter-organisational processes to achieve effective and efficient flows of products, services, information, money, and decisions. This definition is forms a crucial piece of knowledge and is particularly compatible with this study because it positions connectivity and information as core enablers of supply chain integration; it links with the dynamic capabilities' theory view that supply chain integration is a capability built on by the use of Business intelligence, and its ability to connect and enable information sharing

3.4.1 DIMENSIONS OF SUPPLY CHAIN INTEGRATION

SCI is viewed in literature as a multidimensional construct that is typically operationalised through three mutually reinforcing dimensions:

3.4.1.1 Internal Integration

Internal integration refers to the alignment, coordination, and information sharing among cross-functional units within an organisation (Kahn & Mentzer, 1998). It includes joint planning between procurement, production, logistics, and sales, as well as shared performance goals and integrated information systems. Internal integration is critical because disconnected internal processes undermine any attempt to integrate externally (Wong, Boon-itt & Wong, 2011).

In the Nigerian manufacturing context, internal integration is often hindered by manual processes, silo-based organisational cultures, and limited digital infrastructure (Adelekan & Adepoju, 2023). Your study suggests that BI systems—through dashboards, predictive analytics, and real-time visibility enhance internal integration by enabling shared data, standardised reporting, and coordinated decision-making.

3.4.1.2 Supplier Integration

Supplier integration concerns collaborative planning, joint product development, shared forecasting, and real-time exchange of operational information with upstream partners (Zhao et al., 2010). Effective supplier integration helps reduce delivery delays, minimise inventory risk, and increase reliability. Research has shown that, Nigerian manufacturers rely heavily on imported raw materials and small-scale local suppliers who lack digital maturity. As a result, supplier integration is often shallow, transactional, and prone to disruption (Adeola & Olapoju, 2021). However, integration can be strengthened through BI-enabled visibility tools such as supplier performance dashboards and forecast-sharing platforms that reduce information asymmetry and build trust.

3.4.1.3 Customer Integration

Customer integration entails close cooperation with downstream partners, including distributors, retailers, or end-users. It involves sharing demand forecasts, collaborating on distribution planning, and gaining insights into customer preferences (Droge, Vickery & Jacobs, 2012). In Nigeria, customer demand is volatile due to macroeconomic instability, currency fluctuations, and inconsistent consumer purchasing power. Effective customer integration, supported by data analytics, enables firms to anticipate demand shifts, customise production, and maintain service levels despite uncertainty.

3.5 CONCEPTUALISING SUPPLY CHAIN PERFORMANCE

Supply Chain Performance (SCP) is a critical outcome variable in supply chain management literature, representing the efficiency, responsiveness, and resilience of a firm's end-to-end operations (Beamon, 1999; Gunasekaran et al., 2004). Broadly, SCP refers to the degree to which a supply chain's processes can produce desired outcomes. In earlier conceptualisations, these outcomes focused on productivity, inventory turnover, and cost minimisation and customer satisfaction (Beamon, 1999). However, in contemporary supply chains—characterized by volatility, global interdependence, and data abundance measuring and enhancing performance increasingly depends on a firm's ability to make informed decisions and adapt to change, the concept has grown to include more strategic dimensions such as flexibility, responsiveness, innovation and sustainability. Recent literature emphasizes multi-dimensional frameworks that incorporate both operational efficiency and strategic adaptability. This shift reflects the growing need for supply chains to perform not only in stable environments but also under conditions of disruption, requiring real-time responsiveness, collaborative planning, and predictive capabilities (Wieland et al., 2021).

As afore mentioned, there is a consensus in recent literature on the multi-dimensional nature of SCP, and although the specific composition of these dimensions varies depending on context, strategy, and data availability. The main dimensions identified across literature are: (1) efficiency and cost, (2) responsiveness and flexibility, (3) quality and reliability, and (4) integration and collaboration. In emerging economies, a fifth-dimension resilience and adaptability are increasingly recognised as essential (Dubey, Gunasekaran & Childe, 2019; Aigbogun, Gbadamosi & Sherifat, 2014). Table 1 below summarises how these dimensions align with theory, scm framework (SCOR) and emerging markets performance perspectives.

Table 1: Supply chain performance measurement features

Dimension	Typical Measures	Theoretical link	Relevance to study
Efficiency	Cost, inventory and capacity utilisation	Resource based view	Efficiency under infrastructural constraints
Responsiveness	Order lead times, forecast accuracy	Dynamic capability	Coping with supply and demand volatility
Quality/ Reliability		Dynamic capability	Mitigating for supplier inconsistency

Integration/collaboration	Information sharing	Knowledge based view	BI-driven integration across fragmented networks
Resilience	Recovery time,	Dynamic capability theory	Coping with systemic disruptions

In contexts like Nigeria's manufacturing sector where supply chains are informal, infrastructure is weak, and data is scarce. Standardised measures may not fully capture performance realities.

Therefore, this study extends the conceptualisation of SCP by introducing BI as an enabler of traditional and adaptive performance outcomes. This reframes SCP from a static measure of efficiency to a dynamic outcome of information-enabled agility and resilience. This is done by, exploring the link between BI and SCP i.e. illustrating how BI tools (analytics, dashboards, predictive models) influence SCP through improved decision-making and integration. Contextualising SCP for emerging markets by redefining efficiency and responsiveness within the limits of infrastructural and institutional voids. As well as expanding SCP to include resilience positioning adaptability as a measurable, performance-driven outcome relevant to volatile economies.

3.6 CONCEPTUALISING BUSINESS INTELLIGENCE

Business Intelligence (BI) has emerged as a fundamental tool for organizations striving to improve their decision-making processes through data-driven insights (Dedić & Stanier, 2016; Kimball & Ross, 2016), BI enables companies to extract meaningful information from vast amounts of data, which is crucial for maintaining competitiveness and agility. BI encompasses a broad spectrum of applications, methodologies, and technologies that support data collection, analysis, and visualization, ultimately aiding in both short-term operational decisions and long-term strategic planning (IBM, 2011).

Different scholars that have explored this concept have broken in down in different ways. According to Davenport & Harris (2023), BI refers to the "the use of an organization's disparate data to provide meaningful information and analysis to employees, customers, suppliers, and partners for more efficient and effective decision-making." This definition highlights BI's core function: improving decision-making by making data-driven insights easily accessible and actionable for both internal and external stakeholders. By leveraging real-time data, organizations can ensure that decisions are based on current and relevant information, which is critical in today's fast-paced business environment. For example, BI tools can provide executives with a snapshot of financial performance, supply chain status, or customer satisfaction metrics, which can directly influence strategic direction.

Levenson and Boris (2023) offer a broader view of BI, defining it as "a set of methodologies, processes, architectures, and technologies that transform raw data into meaningful and useful information used to enable more effective strategic, tactical, and operational insights and decision-making." This more comprehensive definition underscores BI's multi-dimensional nature, highlighting that BI is not just about the technology used to gather data but also the methodologies and processes that interpret and analyse that data to generate useful knowledge. This multifaceted perspective emphasizes the importance of having a holistic BI infrastructure that integrates data management systems, analytical tools, and decision-support systems to create a seamless workflow for stakeholders at all levels of the organization. BI serves as a bridge between raw data and informed decision-making, facilitating strategic, tactical, and operational insights. It empowers decision-makers at every level of the organization, from top-level executives who set the strategic direction to operational managers who fine-tune day-to-day activities.

There isn’t one unified definition for BI. However, these definitions of Business Intelligence provide the study with a foundational grasp of the concept. It shows BI capacity for decision support, increasing visibility and creating value for the latent data that already exists within the supply chain.

For this study, BI is viewed more as an enabling resource that supports automation for decision support, connectivity and integration across supply chain processes. The study focuses on its ability for facilitating integration and performance.

3.6.1 DIMENSIONS OF BUSINESS INTELLIGENCE

Business Intelligence (BI) is a multi-dimensional concept that encompasses various methodologies, processes, and tools designed to collect, integrate, analyse, and present business information. These components work synergistically to enhance decision-making processes across different organizational levels, from strategic leadership to operational management.

One of the key dimensions of BI is data sourcing or extraction, which involves gathering data from various internal and external sources. Internal data can come from systems such as customer relationship management (CRM) systems, enterprise resource planning (ERP) systems, or sales and inventory databases, while external data sources might include market research reports, social media platforms, and third-party data providers (Martínez et al., 2024). The ability to access and collect data from diverse sources allows organizations to have a comprehensive view of their operations, market trends, and customer behaviours. This broad data sourcing capability is critical for creating a complete and accurate data landscape that informs decision-making.

Once the data is collected, the next crucial dimension is data integration. Data integration involves merging data from various streams, transforming raw information into a unified format that is suitable for analysis. This process requires sophisticated data cleaning, data transformation, and data normalization techniques to ensure that the final dataset is consistent, accurate, and reliable (Haug et al., 2023). According to Martínez et al. (2024), data integration plays a pivotal role in ensuring that disparate data sources are aligned, facilitating a holistic view of the organization's activities. The integration process often involves the use of ETL (Extract, Transform, Load) tools, which allow organizations to efficiently handle large volumes of data and ensure that it is readily available for analysis. A well-integrated data system ensures that key stakeholders, regardless of their function or department, have access to consistent and actionable insights. This dimension represents the extent to which BI systems enable coordinated decision making and reduce informational siloes.

The analytical dimension of BI is another critical aspect that allows organizations to extract meaningful insights from their integrated data. Analytics involves the use of statistical models, predictive algorithms, and machine learning techniques to identify patterns, trends, and anomalies that are not immediately visible through simple observation. These analyses can be classified into three categories: descriptive analytics, which summarizes historical data to identify trends; predictive analytics, which uses historical data to forecast future outcomes; and prescriptive analytics, which recommends actions to optimize outcomes (Shmueli & Koppius, 2023). For example, predictive models can be used to forecast demand fluctuations, inventory levels, or customer behaviour, allowing organizations to proactively adjust their strategies. Descriptive analytics, on the other hand, can provide insights into past performance, helping organizations understand where improvements are needed. In this study, the analytical capability of BI reflects the system's ability to transform integrated data into actionable insights that influence performance outcomes

Decision support is another crucial dimension of BI, where insights derived from analytics are presented to decision-makers in ways that support strategic, tactical, and operational decision-making. Decision support systems (DSS) are often integrated with BI tools to allow decision-makers to access the insights generated from analytics. According to Power (2023), DSS empowers organizations to make data-driven decisions by providing scenario modelling, what-if analyses, and optimization tools. These systems help executives, managers, and operational staff make decisions by providing them with relevant data and analytical results in a timely manner. For example, a retail company might use a decision support system to decide on pricing strategies based on customer purchasing patterns or supply chain optimization by evaluating supplier performance. The integration of decision support tools within BI ensures that insights are not only available but also actionable and translate into effective strategies across all levels.

Lastly, data visualization is often seen as a complementary dimension that enhances the utility of BI systems. Data visualization tools such as dashboards, heat maps, bar charts, and interactive reports are designed to simplify complex datasets and present them in an easily digestible format. According to Few (2023), effective data visualization helps decision-makers interpret complex data quickly and accurately, allowing for faster and more informed decisions. Dashboards, for instance, provide real-time updates on key performance indicators (KPIs), enabling managers to monitor the health of various business operations at a glance. Heat maps can be used to visualize geographic data or customer behaviour, providing a clear picture of regional demand or sales concentration. The use of real-time reporting ensures that decision-makers are always equipped with up-to-date information, which is especially important in fast-changing industries where timeliness and accuracy are critical (Few, 2023).

Together, these dimensions—data sourcing, data integration, analytics, decision support systems, and data visualization—form the backbone of Business Intelligence systems that drive effective decision-making in organizations. Each dimension contributes to the overarching goal of BI, which is to transform raw, unstructured data into actionable insights that can improve business performance. According to Shmueli and Koppius (2023), the integration of these dimensions enables organizations to gain a comprehensive understanding of their operations and the market, empowering them to make strategic decisions that drive competitiveness and business success. With BI becoming increasingly essential for organizations to remain agile and competitive, the role of these dimensions will continue to evolve, integrating new technologies such as AI, machine learning, and big data analytics to deliver even more powerful insights.

3.6.2 BUSINESS INTELLIGENCE AS A DRIVER FOR SUPPLY CHAIN INTEGRATION

Business intelligence plays a pivotal role in enabling integration by providing centralized data platforms that facilitate process synchronization and collaborative decision-making and can be viewed as a causal mechanism through which information visibility and decision quality translate to performance outcomes. Through BI-driven integration (i.e. real time access, analytical insight and cross functional visibility), organizations can eliminate redundancies, improve demand forecasting, and streamline procurement, production, and logistics processes. A well-integrated supply chain reduces lead times and enhances operational efficiency by ensuring that all stakeholders work cohesively toward common objectives. Integration also enhances customer service by enabling real-time order tracking, demand-driven production planning, and dynamic inventory management. Companies that achieve higher levels of integration can quickly adapt to disruptions, maintain supply chain continuity, and enhance their ability to deliver value to customers. Moreover, BI-enabled integration allows organizations to evaluate supplier performance and mitigate risks by identifying potential disruptions before they escalate into significant operational challenges. These capabilities facilitate collaborative decision making, coordinated planning and execution.

The role of BI in Supply Chain Integration is significant, as it enables real-time data sharing and analysis, which is crucial for effective collaboration between supply chain partners. Through BI tools, companies collect, process, and analyse large volumes of data from various sources, such as sales forecasts, production schedules, and inventory levels, to gain insights into their supply chain operations (Davenport & Harris, 2024). These insights help in identifying inefficiencies, predicting demand fluctuations, and optimizing inventory management. According to the International Supply Chain Institute (2023), companies that successfully incorporate BI into their supply chain operations experience a 15% improvement in operational efficiency and a 10% reduction in supply chain costs. This improvement is largely attributed to the ability of BI tools to provide real-time data analysis and predictive insights, allowing businesses to optimize processes such as inventory management, transportation, and supplier coordination (Ngai et al., 2024).

It can be seen that BI is useful for enabling data driven decision making, connectivity, collaboration and information sharing when rightly applied which are the foundational principles for the existence of supply chain integration

However, challenges remain in fully integrating supply chains and one of the primary issues is data quality and standardization. For BI to be effective in a supply chain context, the data being shared across partners must be accurate, timely, and standardized. In Nigeria, for example, inconsistent data formats and unreliable communication channels between supply chain partners can hinder effective integration (Ibe & Okon, 2024). According to the Nigerian Logistics Performance Index (2023), 45% of businesses in the country struggle with data inconsistencies that prevent effective supply chain integration. When combined, BI and SCI lead to improved collaboration, faster decision-making, and reduced operational costs.

However, challenges such as data standardization, technological investment, and resource limitations, particularly in developing regions like Nigeria, need to be addressed to fully realize the benefits of this integration.

3.7 THEORETICAL FRAMEWORKS

This study adopts the resource-based view, knowledge-based view and dynamic capability theories to underpin the study and address the research aim and objectives.

3.7.1 RESOURCE-BASED VIEW (RBV)

The Resource-Based View (RBV) posits that firms attain a sustainable competitive advantage by effectively leveraging their internal resources (Barney, 1991). The theory is a strategic management theory that explain how the bundle of organizational resources helps the management to achieve competitiveness (Peteraf, 1993; Wernerfelt, 1984).

According to RBV, the resources referred to are intangible and tangible assets which can be technologies, human resources and organisational infrastructure and facilities. (Akter, et al., 2016). These resources must fulfil the VRIO framework which suggests that the resources should be valuable, rare, inimitable and organised.

The Resource-Based View (RBV) of a firm is a useful framework to establish the importance of business intelligence as a resource for a company The theory posits that firms achieve a sustainable competitive advantage by identifying, developing, and effectively leveraging their internal resources, particularly those that are valuable, rare, inimitable, and non-substitutable (Barney, 1991).

Business Intelligence (BI), capabilities such as data analytics, information systems, and technical expertise are increasingly recognized as strategic resources that drive organizational success.

These capabilities enable firms to enhance their decision-making processes, optimize supply chain operations, and achieve superior performance outcomes (Ibe & Okon, 2024). For instance, advanced BI systems allow organizations to process and analyse vast amounts of data, identify emerging trends, and make data-driven decisions that improve inventory management and demand forecasting. This resource-centric approach positions firms to differentiate themselves in highly competitive markets by improving operational efficiency and delivering superior customer experiences (Hossain et al., 2023).

3.7.1.1 BUSINESS INTELLIGENCE AS A KEY RESOURCE

Business intelligence encompasses a suite of technologies, processes and capabilities that enable companies to collect analyse and make decisions based on data driven insights. The intrinsic value of BI emerges through its outputs; For example, predictive analytics—a key component of BI—can help firms forecast demand with greater accuracy, leading to optimized inventory levels and reduced holding costs. A study by Duan et al. (2024) highlights how firms that utilize BI to streamline supply chain processes can achieve significant cost savings while simultaneously enhancing customer satisfaction. By treating BI capabilities as strategic assets, firms can reinforce their competitive positioning, particularly in dynamic environments characterized by rapid technological change and fluctuating market demands.

Additionally, the RBV framework underscores the importance of aligning BI capabilities with broader organizational strategies to maximize their impact. Organizations that integrate advanced tools like data warehousing and real-time analytics into their supply chain management systems can respond more swiftly to market changes by building on their unique data assets, analytical capabilities and knowledge infrastructures that they develop thereby improving agility and resilience by creating adaptive and predictive models. For instance, Ibe and Okon (2024) found that companies with well-developed BI capabilities were better equipped to handle supply chain disruptions, as they could quickly identify bottlenecks and reconfigure operations to mitigate risks. This adaptability not only enhances supply chain performance but also contributes to a higher return on investment (ROI) through reduced operational costs and improved decision-making efficiency.

Furthermore, BI capabilities contribute to cost reductions and operational efficiencies by enabling firms to identify inefficiencies, eliminate waste, and streamline processes. For example, Hossain et al. (2023) emphasize that organizations using BI tools to monitor key performance indicators (KPIs) can proactively address inefficiencies before they escalate into larger issues. This proactive approach minimizes downtime, enhances resource allocation, and ensures that supply chain processes remain aligned with organizational objectives. Operational agility is another key benefit derived from BI as a strategic resource. Firms equipped with robust BI capabilities can adapt to changing market conditions more effectively, allowing them to capture new opportunities and mitigate risks. For instance, Duan et al. (2024) argue that firms leveraging real-time BI analytics are better positioned to navigate global supply chain disruptions, such as those experienced during the COVID-19 pandemic. By using BI to gain real-time visibility into supply chain operations, firms can respond dynamically to shifts in demand, supplier constraints, or transportation delays.

The Resource-Based View provides a valuable theoretical lens for understanding how BI capabilities can serve as strategic resources that drive competitive advantage. Through the effective development and utilization of BI tools, organizations can enhance decision-making processes, improve supply chain performance, and achieve sustainable operational efficiencies. By aligning BI investments with organizational objectives and viewing these capabilities as critical assets, firms can reinforce their market positioning, improve ROI, and build resilience against the uncertainties of modern supply chain environments.

This theory serves as a guiding framework for exploring the impact of BI on supply chain performance in the Nigerian manufacturing industry. By looking as BI as an internal resource, it explores its capacity to influence data-driven decision-making, information sharing, connectivity and supply chain integration.

3.7.2 DYNAMIC CAPABILITIES FRAMEWORK

Dynamic Capabilities Theory (DCT) represents a significant progression from the Resource-Based View (RBV), offering a more comprehensive understanding of how firms attain and sustain competitive advantage in environments characterized by volatility, uncertainty, and accelerating technological change such as Nigeria. While RBV primarily emphasizes the possession of resources that are valuable, rare, inimitable, and non-substitutable (Barney, 1991), it has been critiqued for its static orientation and limited explanatory power regarding organizational adaptation within dynamic contexts (Eisenhardt & Martin, 2000; Zollo & Winter, 2002). In response to these limitations, the dynamic capabilities framework shifts analytical emphasis from mere resource ownership to the organisational processes of resource orchestration, renewal, and transformation. This theoretical refinement provides a basis for explaining how organisations can consistently maintain superior performance over extended periods despite environmental turbulence (Teece, Pisano & Shuen, 1997).

Teece et al. (1997) define dynamic capabilities as a firm's ability to "integrate, build, and reconfigure internal and external competences to address rapidly changing environments." This definition emphasizes the processual and evolutionary nature of capabilities, contrasting with the more structural view of RBV. Eisenhardt and Martin (2000) refine the definition, presenting dynamic capabilities as identifiable, repeatable, and patterned routines that enable firms to achieve new resource configurations. They argue that dynamic capabilities are not inherently rare; instead, their effectiveness lies in how they are deployed within specific contexts.

The supply chain context is inherently dynamic, especially in emerging economies like Nigeria where firms face infrastructural weaknesses, volatile regulatory regimes, currency fluctuations, and fragmented logistics networks (Afolayan et al., 2020; Adeleye et al., 2021). Such conditions amplify the need for firms to possess robust dynamic capabilities to navigate uncertainty.

Dynamic capabilities influence supply chain performance through several mechanisms:

- **Supply Chain Sensing:** detecting changes in demand, supplier risks, transportation bottlenecks, or geopolitical disruptions (Dubey et al., 2021).
- **Integration and Coordination:** orchestrating information, material, and financial flows across diverse partners (Flynn et al., 2010).
- **Adaptation and Reconfiguration:** modifying supply chain processes, adjusting sourcing strategies, or altering distribution networks (Beske, 2012).

Firms with strong dynamic capabilities can adapt their supply chain structures faster, improve responsiveness, mitigate risks, and enhance operational efficiency.

3.7.2.1 BI AS A DRIVER FOR DYNAMIC CAPABILITIES

In this framework, Business Intelligence (BI) plays a fundamental role in enhancing organizations' dynamic capabilities, particularly in supply chain management. BI provides the tools and technologies that allow organizations to analyse vast amounts of data, track performance, and adapt strategies quickly in response to fluctuating supply chain conditions. As the business environment becomes more volatile, competitive, and unpredictable, the ability to leverage BI effectively enables firms to maintain strategic agility, which is key to long-term success.

In complex and uncertain environments, effective integration requires more than information flow; it demands the continual reconfiguration of relationships, routines, and technologies to maintain supply chain coherence and performance (Ambrosini & Bowman, 2009). Here, Business Intelligence (BI) plays a pivotal role in enabling and accelerating these dynamic integration processes. This fuels the hypothesis for the relationship between Business intelligence and supply chain integration.

BI's contribution to dynamic capabilities is evident in how organizations use it to monitor key performance indicators (KPIs), identify potential disruptions, and adjust their operational strategies to mitigate risks. Teece et al. (2023) emphasize that BI tools allow companies to capture real-time insights, which are crucial for making informed decisions during supply chain disruptions. For example, using predictive analytics, firms can identify emerging threats or shifts in supply chain dynamics before they materialize, allowing for proactive decision-making. This foresight enables companies to adjust their strategies, implement contingency plans, and minimize risks. Zhou et al. (2024) illustrate this in the context of the COVID-19 pandemic, where companies that used BI tools to predict supply chain disruptions were better able to navigate the crisis and continue operations with minimal setbacks. In this sense, BI acts as an enabler of adaptive capacity, a key element of dynamic capabilities that allows organizations to align their resources, processes, and strategies with evolving market demands and conditions.

The rapid adaptation facilitated by BI not only strengthens the resilience of supply chains but also allows organizations to seize emerging opportunities. In industries where supply chain conditions are in constant flux—such as consumer electronics or healthcare—companies need to be agile and responsive to market changes. Santos et al. (2024) argue that BI tools empower organizations to respond swiftly to new trends, whether it is the introduction of innovative products, shifts in consumer preferences, or supply shortages. For instance, BI-powered tools can help identify new suppliers or logistical partners that can offer better value during a disruption, enabling firms to capitalize on market opportunities while maintaining a resilient supply chain.

Moreover, the integration of BI fosters a proactive organizational culture, one that emphasizes continuous improvement and strategic agility. In this context, companies are not only reactive to disruptions but also continuously seek ways to improve and refine their operations, making them more adaptable and resilient over time. Teece et al. (2023) note that organizations with well-developed dynamic capabilities are better able to sense and seize opportunities, reconfigure their supply chain processes, and learn from both successes and failures.

This focus on continuous adaptation, driven by the insights gained from BI, helps firms stay ahead of competitors and position themselves for sustainable growth.

3.7.2.2 SUPPLY CHAIN INTEGRATION AS A DYNAMIC CAPABILITY

The Dynamic Capabilities Framework (DCF), as articulated by Teece (2007), highlights the critical role of a firm's ability to integrate, build, and reconfigure both internal and external competencies in response to rapidly changing environments. In Nigeria's volatile business landscape characterised by FX instability, infrastructural bottlenecks, and unpredictable supply disruptions—SCI becomes a dynamic capability essential for resilience. BI strengthens this by improving sensing (data collection), seizing (decision-making), and reconfiguring (adaptive responses).

This framework also speaks to Supply chain integration, as it identifies the fact that SCI is not a static state but a dynamic organizational capability—one that allows firms adapt, coordinate, synchronise and reconfigure to respond to changing supply chain conditions, disruptions, and opportunities. In complex and uncertain environments, effective integration requires more than information flow; it demands the continual reconfiguration of relationships, routines, and technologies to maintain supply chain coherence and performance (Ambrosini & Bowman, 2009).

SCI is seen as a dynamic capability for several reasons; the first is its ability to enable coordinated adaptation as integrated supply chains adapt more quickly to disruptions, because information and decisions flow smoothly across partners (Zhao et al., 2010). SCI is also known to deepen relational and organisational learning. According to Dyer and Singh (1998), integration increases knowledge exchange, joint problem solving and collaborative learning which hold true to the key foundational principles of the theory. Thirdly, SCI allows firms to restructure logistics flows, adjust procurement strategies, redesign planning processes, and jointly manage demand with customers thus supporting resilience and responsiveness (Ivanov & Dolgui, 2020)

3.7.3 KNOWLEDGE-BASED THEORY

Knowledge-Based Theory (KBT) emphasizes the fundamental role of knowledge as a key driver of organizational performance, with the premise that a firm's ability to generate, acquire, and apply knowledge contributes significantly to its competitive advantage and long-term success. In the context of Business Intelligence (BI), the application of KBT highlights how BI systems serve as enablers of knowledge creation and sharing by providing access to vast amounts of relevant data and insights. These systems not only enhance decision-making but also foster a deeper understanding of supply chain dynamics (Zarei et al., 2023). By integrating data from multiple sources such as transactional data, customer feedback, supplier performance, and market trends BI creates a comprehensive knowledge base that supports collaborative decision-making among stakeholders, thereby enhancing organizational efficiency.

BI systems enable firms to convert raw data into actionable insights, which is pivotal for effective knowledge management. As García-Pérez et al. (2024) note, the ability to extract meaningful insights from diverse data sources allows organizations to make more informed strategic decisions. For example, by analysing customer preferences and behaviours, companies can adjust their product offerings or customize marketing strategies, creating a competitive edge in the market. Similarly, monitoring supplier performance through BI systems helps organizations identify potential risks or inefficiencies in the supply chain, which can be addressed proactively. As a result, BI facilitates not only the accumulation of knowledge but also its practical application across various operational areas. This knowledge-sharing capacity, integral to KBT, is vital for organizations striving to enhance decision-making and optimize their supply chain operations.

A key tenet of KBT is that knowledge resides not only in systems but also within individuals and organizational routines. BI systems contribute to this by embedding analytical routines into supply chain processes, thereby facilitating organizational learning and knowledge codification. For instance, BI-supported dashboards and performance indicators help identify bottlenecks, root causes, and best practices over time, contributing to institutional memory. Moreover, BI facilitates **knowledge sharing** across functional silos, enhancing collaboration between procurement, manufacturing, distribution, and customer service teams.

The knowledge assets generated through BI are also critical for inter-organizational integration. Supply chains are networks of organizations, and knowledge flow across organizational boundaries is essential for coordination and agility. BI systems that aggregate internal data with external sources (e.g., supplier performance, market trends, customer feedback) enable firms to make more informed decisions based on a holistic understanding of the ecosystem (Delen & Demirkan, 2013). BI systems enable firms to convert raw data into actionable insights, which is pivotal for effective knowledge management. As García-Pérez et al. (2024) note, the ability to extract meaningful insights from diverse data sources allows organizations to make more informed strategic decisions. For example, by analysing customer preferences and behaviours, companies can adjust their product offerings or customize marketing strategies, creating a competitive edge in the market. Similarly, monitoring supplier performance through BI systems helps organizations identify potential risks or inefficiencies in the supply chain, which can be addressed proactively. As a result, BI facilitates not only the accumulation of knowledge but also its practical application across various operational areas. This knowledge-sharing capacity, integral to KBT, is vital for organizations striving to enhance decision-making and optimize their supply chain operations.

The collaborative nature of knowledge-sharing within a BI-enabled environment fosters a culture of continuous learning and adaptation. According to Davis et al. (2024), BI systems enhance organizational agility by providing real-time data that enables rapid response to changing market conditions. As a result, supply chain managers and other decision-makers can act more swiftly and decisively, fostering innovation and adaptability. This is particularly important in today's fast-paced and competitive business landscape, where supply chains are becoming increasingly complex and subject to disruptions. Organizations that integrate BI with a knowledge-sharing culture are better equipped to navigate such challenges, enabling them to stay competitive and resilient in the face of uncertainty.

The use of BI tools also facilitates cross-functional collaboration by making knowledge accessible to all relevant stakeholders. In practice, BI systems serve as a bridge between data collection and actionable insights, empowering organizations to transform raw data into valuable knowledge that informs strategic decisions. García-Pérez et al. (2024) emphasize that data visualization tools are a crucial component of BI systems, enabling managers to identify trends and patterns that can inform various business strategies, such as product development, market entry, and customer engagement. For instance, by analysing customer feedback and purchasing behaviours, BI systems can help firms tailor their offerings and enhance customer satisfaction. The ability to leverage this collective knowledge fosters greater alignment of supply chain strategies with broader organizational goals, ensuring that operations and business objectives are well-integrated.

Furthermore, cultivating a culture of knowledge sharing within organizations is essential for fostering innovation and enhancing the performance of supply chains. Davis et al. (2024) argue that organizations that prioritize knowledge sharing across departments—enabled by BI tools—can achieve more cohesive and agile supply chain operations. For example, when marketing teams share customer insights with supply chain managers, the latter can adjust inventory and logistics plans to better match demand patterns, minimizing stockouts and excess inventory. Similarly, when procurement teams share supplier performance data with other stakeholders, they can collaborate on strategies to improve supplier relationships and mitigate risks. By encouraging collaboration and transparency, BI systems help create an environment conducive to continuous improvement, allowing organizations to adapt quickly to new challenges and capitalize on emerging opportunities.

The integration of Business Intelligence (BI) within supply chain management aligns with the Knowledge-Based Theory (KBT) by facilitating knowledge creation, sharing, and application across an organization. By transforming raw data into actionable insights, BI systems enhance decision-making, improve organizational agility, and foster innovation. The collaborative environment promoted by BI enables companies to leverage collective knowledge, resulting in better alignment between supply chain strategies and organizational goals. As a result, organizations can not only optimize supply chain operations but also build a culture of continuous learning and improvement, essential for long-term success in a dynamic business environment.

3.8 RESEARCH GAP

Despite the increasing importance and the wealth of literature that exists on Business Intelligence (BI), supply chain performance etc, several gaps remain in the understanding of the interrelatedness of these concepts.

Most existing research focuses on either BI and its role in enhancing organisational performance through improved data integration and visibility, or supply chain management separately, failing to examine how these two areas interact synergistically to enhance performance Loska et al., 2024). Thus, further investigation is needed to understand how organizations can effectively integrate BI capabilities within their supply chain especially within emerging economies such as Nigeria.

The next gap would be the limited contextual evidence linking BI and supply chain outcomes in the Nigerian Manufacturing sector. A lot of existing BI research is disproportionately concentrated in technologically advanced countries with more mature digital infrastructures (Mikalef et al., 2019; Grover et al., 2018). In contrast, African and Nigerian studies typically examine BI adoption and its challenges but rarely evaluate its operational or integrative impact within supply chains (Akanbi et al., 2022). In addition, given the volatility, infrastructural inadequacies, and fragmented supplier networks characterising Nigerian manufacturing (Adeleye et al., 2021), the role of BI as an information-processing and decision-enablement resource becomes even more salient. However, empirical evidence demonstrating how BI addresses these contextual weaknesses remain scarce. Thus, the need for more literature on the role of BI and its influence on supply chain outcomes.

There is also not enough research integrating the concepts of BI SCI and SCP in a unified causal model. A lot of studies explore the impact of BI on supply chain performance (Wamba et al., 2020) or the impact of SCI on supply chain performance (Flynn et al.,2010). There are a few studies that look at BI as a precedent and enabler for SCI and a few studies that study SCI as a mechanism through which BI influences performance.

While theoretical frameworks like the Resource-Based View and Knowledge-Based Theory highlight the potential benefits of BI for supply chains, they are underused in the context of

African supply chains (Kissi, 2024). The successful implementation of BI systems in supply chains requires not only technical capabilities as a resource, its ability to build capabilities but also cultural and organizational change. These theories are not well represented and applied in Nigerian supply chain contexts

There is also the fact that Nigerian studies typically measure supply chain performance (SCP) using simplistic operational indicators (cost, speed, delivery reliability). Very few incorporate flexibility, innovation capability, information quality, or risk responsiveness all crucial dimensions for volatile environments (Beamon, 1999; Guan et al., 2016). This study shows the need for a multidimensionality in measuring SCP in the Nigerian manufacturing supply chain context.

Addressing these research gaps will contribute to a more robust understanding of the role of Business Intelligence in supply chain management, ultimately enabling organizations to leverage BI effectively to enhance decision-making and improve performance.

3.9 HYPOTHESIS DEVELOPMENT AND CONCEPTUAL FRAMEWORK

In an increasingly dynamic and competitive environment, understanding the factors that drive organizational performance, and adaptability has become a critical area of research. Scholars and practitioners alike emphasize the importance of integrating innovative practices to maintain a competitive edge (Teece et al., 2016). This study seeks to address this gap by examining the specific mechanisms through which digital capabilities impact organizational adaptability, providing a clearer understanding of the conditions under which these technologies foster sustained success.

Grounded in the Resource-Based View (RBV) (Barney, 1991) and Dynamic Capabilities Theory (Teece et al., 1997), this research proposes that organizations equipped with advanced digital technologies are better positioned to respond to market changes and operational disruptions. Existing literature suggests that firms with superior technological resources can achieve higher levels of flexibility and responsiveness (Kane et al., 2015; Teece, 2018). However, empirical evidence on the direct causal relationship between digital innovation and adaptability remains limited (Warner & Wäger, 2019). This study builds on these theoretical foundations to develop and test hypotheses that clarify the role of digital capabilities in enhancing organizational resilience.

By integrating insights from prior studies and addressing existing gaps, this research formulates hypotheses that link digital capabilities to adaptive outcomes. The following sections present the empirical basis for each hypothesis, outlining the expected relationships and the rationale behind them. This approach not only advances academic knowledge but also offers practical insights for organizations seeking to leverage technology for sustainable growth and resilience.

3.9.1 THE RELATIONSHIP BETWEEN BUSINESS INTELLIGENCE(BI) AND SC DECISION MAKING

The application of Business Intelligence (BI) functionalities within supply chain (SC) components has revolutionized decision-making processes, enabling organizations to achieve greater efficiency, visibility, and responsiveness across various SC functions. BI tools are primarily used to analyse vast amounts of data, providing actionable insights that help managers make informed, data-driven decisions. This capability is essential in areas such as demand forecasting, inventory management, supplier relationship management, and logistics optimization, all of which are critical components of the supply chain.

One of the most prominent applications of Business Intelligence (BI) in Supply Chain (SC) management is demand forecasting, where advanced analytics are used to predict future demand trends with remarkable precision. Demand forecasting plays a crucial role in ensuring that companies meet customer needs without overstocking or facing stockouts, both of which significantly affect profitability. Utilizing BI tools, companies analyse historical sales data, market trends, customer behaviour, and even external factors such as economic shifts or seasonal changes. This comprehensive analysis enables companies to develop more accurate predictions about future demand, allowing them to adjust their supply chain activities accordingly.

Beyond just improving production schedules and inventory management, accurate demand forecasting facilitated by BI also supports better customer service. When a company can accurately predict demand, it reduces the chances of stockouts, which can lead to customer dissatisfaction or lost sales opportunities. On the other hand, preventing overstocking ensures that capital is not tied up in excess inventory, which can lead to markdowns and reduced profitability. Consequently, BI-powered demand forecasting helps companies maintain a balanced approach to inventory management that maximizes both customer satisfaction and operational efficiency.

According to Adebayo (2024), companies that incorporate BI into their demand forecasting processes have seen up to a 20% improvement in forecast accuracy, which has a direct impact on both operational efficiency and cost savings. This enhanced precision in forecasting enables businesses to better align their production schedules with real market demand, reducing instances of unsold inventory and minimizing carrying costs. Furthermore, with more accurate demand forecasts, companies can optimize their procurement processes, ensuring that they order the right number of raw materials or components needed for production, thereby avoiding waste and unnecessary expenses.

Liddell (2024) explored how technological advancements are transforming SCM processes, particularly through automation, digitalization, and artificial intelligence (AI). The study highlighted that modern supply chains are increasingly leveraging digital solutions to enhance visibility, transparency, and responsiveness.

Drilling down to BI use particularly, Popovič et al. (2018) investigated the role of BI tools in improving organizational performance and decision-making. The study found that BI systems positively influence performance by improving data accessibility and decision accuracy. By extending the Information System Success Model (ISSM), the research showed how the successful implementation of BI directly contributes to better managerial decisions and long-term strategic outcomes (Popovič et al., 2018)

Shollo & Galliers (2016) explored the integration of BI systems, focusing on the interplay between technological infrastructure and human factors. The study found that both elements significantly influence how BI enhances decision-making. User training and acceptance are critical for maximizing BI's potential, while technological readiness ensures seamless data collection and analysis (Shollo & Galliers, 2016).

In the Davenport and Harris (2024) study, the findings show improvements in decision- making speed and accuracy due to the adoption of BI. Additionally, 30% of companies reported cost savings through optimized processes such as inventory control and logistics management. The authors concluded that BI enhances decision-making by providing actionable insights, but they also emphasized that data quality and staff expertise are critical for success.

In conclusion, the above studies and others of similar nature have attested to the fact that the application of Digitization (on a broad scale -i.e. using IT, CRM or AI tools) have the capacity to influence supply chain decision making process, thus resulting in the first hypothesis of the study.

H_1: The use of Business Intelligence within supply chain processes influences decision-making.

3.9.2 THE RELATIONSHIP BETWEEN BUSINESS INTELLIGENCE AND CONNECTIVITY

Connectivity serves as a foundational element in the successful implementation of BI within supply chains. It represents the degree of digital linkage between various supply chain entities, encompassing both technological and organizational connectivity. Without high connectivity, BI tools may operate in silos, limiting their potential benefits. For instance, a company may have robust demand forecasting models, but if suppliers and distributors are not digitally connected, the insights may not translate into operational efficiency. Therefore, BI-driven connectivity ensures that supply chain partners align their operations, leading to greater efficiency, cost reduction, and improved customer service.

BI fosters seamless communication among suppliers, manufacturers, distributors, and retailers. This enhanced connectivity facilitates real-time data exchange, enabling supply chain actors to respond swiftly to market changes and demand fluctuations. Improved connectivity strengthens supplier relationship management, optimizes inventory levels, and enhances end-to-end visibility across the supply chain.

In literature, Maroufkhani, Ismail, and Ekhsan (2020) conducted a quantitative study to analyse the adoption of Business Intelligence (BI) in supply chains and its role in creating connectivity among supply chain stakeholders in Malaysian manufacturing firms. Their findings revealed that the integration of BI enhances the flow of information and facilitates connectivity, leading to better collaboration and decision-making within the supply chain.

Chae, Olson and Sheu (2014) also highlighted in their case study, that BI enhances connectivity by integrating data from various parts of the supply chain, such as suppliers, manufacturers, and distributors. This integration ensures that all stakeholders have access to accurate and timely information, resulting in improved decision-making and reduced operational inefficiencies.

Jeble, Dubey, and Childe (2018) explored the relationship between BI and supply chain resilience and the results indicated that BI creates connectivity by providing real-time data and analytics, which enhance supply chain visibility and coordination. This connectivity was found to be crucial in improving resilience and overall performance in dynamic and uncertain environments.

Zhang et al. (2018) examined sustainable supply chain management (SSCM) practices and the role of BI in enhancing connectivity. They demonstrated that BI tools facilitate the integration of sustainability practices by improving data sharing and communication among stakeholders. The study highlighted that this connectivity enhances both environmental and economic performance.

These empirical studies collectively underline the significance of BI in creating connectivity within supply chain processes, especially consideration of what the impact of the concept has on the Nigerian manufacturing sector thus resulting in the second hypothesis of the study.

H_2: The use of Business Intelligence positively influences connectivity within supply chain processes.

3.9.3 THE RELATIONSHIP BETWEEN BUSINESS INTELLIGENCE AND INFORMATION SHARING

Information sharing refers to the exchange of critical data across the supply chain network. This includes demand forecasts, production schedules, inventory levels, transportation routes, and customer preferences**.** BI platforms play a crucial role in aggregating, analysing, and disseminating this information. Supply chains that leverage BI-driven information sharing **tend to be** more agile, cost-effective, and responsive to market changes**.** When stakeholders have access to shared insights, they can align their operations and optimize processes, leading to greater efficiency.

Equally important to the effectiveness of BI is the role of information sharing. In a highly interconnected supply chain network, the ability to exchange critical data such as demand forecasts, production schedules, inventory levels, and customer preferences—enhances transparency and collaboration. BI platforms facilitate the aggregation, analysis, and dissemination of this data, ensuring that all supply chain stakeholders are aligned in their decision-making. Effective information sharing allows firms to develop more accurate demand forecasting models, reducing the likelihood of stockouts or excess inventory. This data-driven approach enhances responsiveness, enabling organizations to adjust production and distribution strategies in real time based on market conditions. Moreover, transparent data exchange fosters trust among supply chain partners, leading to stronger relationships and more effective collaboration. By utilizing BI-enabled dashboards and predictive analytics, companies can gain deeper insights into supplier performance, customer behaviour, and logistical challenges, thereby reducing risks associated with demand fluctuations, supplier delays, and logistics disruptions.

In a study by Trkman et al. (2010), the authors explored how BI capabilities influence supply chain performance through improved information sharing. The study assesses the relationships between BI, information sharing, and performance outcomes. The findings revealed that BI enhances information flow across the supply chain, which, in turn, leads to improved operational efficiency and customer satisfaction. This emphasizes the critical role of BI in enabling transparent and accurate information exchange among supply chain partners.

Hazen et al. (2014) conducted a study to investigate the role of data quality and BI in fostering effective information sharing within supply chains. Their analysis revealed that high-quality

BI systems improve the accuracy and timeliness of shared information, significantly reducing decision-making delays and operational risks. The study concluded that BI-driven information sharing leads to enhanced supply chain agility and resilience.

In conclusion, the above studies have attested to the fact that the application of BI as a tool has the capacity to influence information sharing. These studies have led to consideration of what the impact of this can have in the context of the Nigerian manufacturing sector, thus resulting in this hypothesis of the study.

H_3: The use of Business Intelligence positively influences information sharing within a supply chain.

3.9.4 THE RELATIONSHIP BETWEEN BUSINESS INTELLIGENCE AND SUPPLY CHAIN INTEGRATION

Business Intelligence (BI) has increasingly been recognised as a critical enabler of supply chain integration, particularly in environments characterised by information asymmetry, operational fragmentation, and coordination challenges. Supply chain integration (SCI) requires the alignment of processes, information flows, and decision-making across internal functions and external partners, a condition that is difficult to achieve without timely, accurate, and shared information ((Flynn et al., 2010; Prajogo & Olhager, 2012). BI systems support this requirement by transforming dispersed operational data into integrated, accessible insights that can be shared across organisational boundaries, thereby facilitating coordinated planning and execution.

From a theoretical perspective, the relationship between BI and SCI can be explained through the resource-based view (RBV), which conceptualises BI as a strategic organisational resource that enhances coordination and value creation when effectively deployed (Barney, 1991; Akter et al., 2016). BI capabilities such as data integration, analytics, and real-time reporting enable firms to synchronise activities across procurement, production, and distribution functions, reducing internal silos and supporting cross-functional alignment. Empirical studies have shown that organisations with advanced BI capabilities exhibit higher levels of internal integration, as decision-makers across functional units rely on shared data platforms and standardised performance metrics (Hossain et al., 2023; Martínez et al., 2024).

Beyond internal alignment, BI also plays a significant role in enabling external integration with supply chain partners. By enhancing visibility into demand patterns, inventory levels, and supplier performance, BI systems support collaborative decision-making and joint planning with upstream and downstream partners (Davenport & Harris, 2023). Enhanced information transparency reduces uncertainty and builds relational trust, both of which are essential conditions for effective supply chain integration (Zhao et al., 2011). Studies examining digitally enabled supply chains suggest that firms that leverage BI for information sharing and connectivity are better positioned to achieve relational and process integration, leading to improved coordination and responsiveness (Ngai et al., 2024; Dubey et al., 2019).

The importance of BI-enabled integration is particularly pronounced in emerging economy contexts, where supply chains are often characterised by infrastructural limitations, informal coordination mechanisms, and fragmented information flows. In such environments, integration is less dependent on automation and more reliant on the quality of information and decision-making processes that connect supply chain actors (Amankwah-Amoah, 2018; Adebayo et al., 2021). BI provides a mechanism through which firms can compensate for structural inefficiencies by improving visibility, facilitating coordination, and supporting adaptive responses to volatility. This aligns with dynamic capabilities theory, which posits that firms develop competitive advantage by sensing, seizing, and reconfiguring resources in response to environmental change (Teece, 2007). Within this framework, BI strengthens a firm's capacity to integrate supply chain activities by enabling informed, timely, and coordinated decision-making.

Despite these theoretical and empirical insights, existing literature has not sufficiently established the direct relationship between BI and supply chain integration, particularly within manufacturing supply chains in developing economies. Much of the prior research either examines BI in isolation or treats supply chain integration as an outcome of relational governance without explicitly considering the informational and analytical capabilities that underpin integration. Consequently, there remains a need for empirical models that explicitly examine BI as an enabling capability that drives supply chain integration through enhanced information sharing, connectivity, and decision quality. Accordingly, the following hypothesis is proposed:

H_4**:** Business Intelligence has a positive effect on supply chain integration.

3.9.5 THE RELATIONSHIP BETWEEN CONNECTIVITY AND SUPPLY CHAIN INTEGRATION

As established earlier there is an existing relationship between BI and connectivity, this section highlights the necessity of connectivity for supply chain integration. In the work of Frohlich and Westbrook (2001) An International Study of Supply Chain Strategies," Frohlich and Westbrook conducted an extensive eight-year field study involving over 300 on-site days to investigate supply chain integration strategies across various industries. They identified five alternative arcs of supply chain integration and found that broader integration with both suppliers and customers led to superior performance. This study underscores the positive impact of extensive connectivity on supply chain integration.

Flynn et al. (2010) conducted an empirical analysis to explore the relationship between supply chain integration (SCI) and performance outcomes. Utilizing survey data from manufacturing firms, they found that internal integration serves as a foundation for external integration with suppliers and customers. The study concluded that both internal and external integrations are positively associated with operational and business performance, highlighting the importance of connectivity in achieving effective SCI.

Conversely, Narasimhan and Kim (2002) examined the impact of supply chain integration on firm performance, considering product and market characteristics as moderating factors. Through empirical analysis, they discovered that the benefits of integration vary depending on these characteristics, suggesting that the relationship between connectivity and supply chain integration is not universally positive but contingent upon specific contextual factors.

Wiengarten et al. (2014) in their research investigated the effects of supply chain integration on operational performance. They employed a meta-analytic approach, analyzing data from multiple studies. The findings indicated that while there is a general positive effect of integration on performance, the strength of this relationship is influenced by factors such as industry type and regional differences, suggesting that connectivity's impact on supply chain integration may not be uniformly significant across all contexts.

Huo (2012) conducted an empirical study to assess the impact of supply chain integration on firm performance, considering both internal and external integration dimensions. The study utilized survey data from manufacturing firms and found that internal integration positively influences external integration, which in turn enhances operational performance. This sequential relationship highlights the critical role of connectivity in achieving comprehensive supply chain integration.

Zhao et al. (2011) study explored the mediating role of supply chain integration between competitive strategy and firm performance. Using survey data from Chinese manufacturing firms, the researchers found that supply chain integration mediates the relationship between differentiation strategy and firm performance, emphasizing that connectivity and integration are essential for strategy implementation and performance improvement.

Koufteros et al. (2005) examined the relationship between organizational integration strategies and competitive capabilities. Their empirical study revealed that integration with suppliers and customers enhances product development capabilities and overall performance, suggesting that connectivity is a vital component of effective supply chain integration.

Van der Vaart and Van Donk (2008) the authors investigated the impact of supply chain integration on performance, considering the role of contextual factors. They found that the positive effects of integration on performance are contingent upon factors such as environmental uncertainty and product complexity, indicating that the significance of connectivity in supply chain integration may vary based on specific circumstances.

These empirical studies have led to consideration of what the impact of this can have in the context of the Nigerian manufacturing sector, thus resulting in this hypothesis of the study.

H5: there is a significant relationship between connectivity and supply chain integration

3.9.6 THE RELATIONSHIP BETWEEN INFORMATION SHARING AND SUPPLY CHAIN INTEGRATION

Cui, Allon, Bassamboo, and Van Mieghem (2015) combined empirical and theoretical analyses to measure the value of information sharing in supply chains. The researchers conducted a case study with a leading consumer packaged goods company, employing time-series analysis to evaluate the impact of shared downstream demand information on supply chain performance. The study demonstrated a statistically significant positive value of information sharing, emphasizing its role in enhancing supply chain integration and operational efficiency.

Baihaqi and Sohal (2013) examined the impact of information sharing on organizational performance within supply chains. They utilized survey data from manufacturing firms to assess how integrated information technologies, internal integration, and information quality influence the degree of information sharing. Their findings indicated that higher levels of information sharing, facilitated by quality information and technological integration, positively affect organizational performance. They concluded that effective information sharing is integral to achieving supply chain integration and enhancing performance.

These empirical studies have led to consideration of what the impact of this can have in the context of the Nigerian manufacturing sector, thus resulting in this hypothesis of the study.

H6: There is a significant relationship between information sharing and supply chain integration

3.9.7 THE RELATIONSHIP BETWEEN BUSINESS INTELLIGENCE, SUPPLY CHAIN INTEGRATION AND SUPPLY CHAIN PERFORMANCE

As the supply chains become more global and increasingly complex, characterised by fast moving demand pattern, firms are seen to invest more in business intelligence as a response and while BI creates the potential for superior decision making, its effects on performance outcomes are not entirely automatic. Research has suggested that the mechanisms through which BI translates into measurable performance outcomes are seen through inter and intra-organisational coordination through integration. As such there is a strong relationship between the concepts.

Business Intelligence (BI) capabilities play a transformative role in modern supply chain management, enabling organizations to enhance efficiency, reduce costs, and improve responsiveness. As the global business environment becomes increasingly data-driven, organizations must navigate complex supply networks while maintaining agility and resilience. BI tools empower companies to harness vast amounts of data, enabling them to optimize decision-making processes and enhance operational performance. These tools facilitate the extraction of meaningful insights from raw data, allowing organizations to detect inefficiencies, anticipate disruptions, and capitalize on emerging opportunities. However, the successful implementation of BI in supply chain management is not automatic; rather, it is significantly influenced by the key mediating factor of supply chain integration, influenced by information and connectivity.

These factors bridge the gap between raw data and actionable insights, ensuring that supply chain stakeholders can fully leverage BI capabilities to drive performance improvements and gain a competitive advantage in the marketplace. Without SCI, BI outputs stand the risk of becoming isolated results that fail to influence partner behaviour or create synchronicity. Thus, BI provides the what (by way of data driven insights) and SCI provides the how (coordination and collaboration mechanisms) that lead to performance outcomes.

Empirical studies have increasingly confirmed this mediation logic; for instance, Jafari et al. (2023) explores the influence of Business Intelligence (BI), integration, and agility on supply chain performance, examining how these elements interact to enhance supply chain outcomes.

the study reveals that BI, integration, and agility are crucial for achieving better supply chain performance, with BI having the most significant impact. The findings indicate that BI not only directly improves supply chain performance but also positively affects integration and agility within the supply chain, moreover, the study demonstrates that integration plays a direct role in enhancing supply chain agility. This paper provides a novel conceptual model that bridges the theoretical and empirical relationship between BI, integration, agility, and supply chain performance. It offers valuable insights for both researchers and practitioners interested in improving supply chain outcomes through BI and related capabilities.

Recent research in developing and transition economies provides a crucial nuance; the mediating role of SCI can be conditional upon institutional and infrastructural constraints. Studies from manufacturing sectors in emerging markets highlight that poor data quality, siloed legacy systems, and weak partner digital maturity reduce the direct effect of BI on SCP unless deliberate integration investments are made. In such settings, BI adoption without parallel efforts to strengthen internal integration (cross-functional standardisation, intra-firm workflows) and external integration (EDI/API onboarding, contractual information sharing protocols) often yields limited performance returns. Therefore, the empirical record underscores that SCI is not merely an additive complement to BI, but frequently the necessary precondition for BI to deliver measurable SCP benefits, particularly in resource-constrained environments.

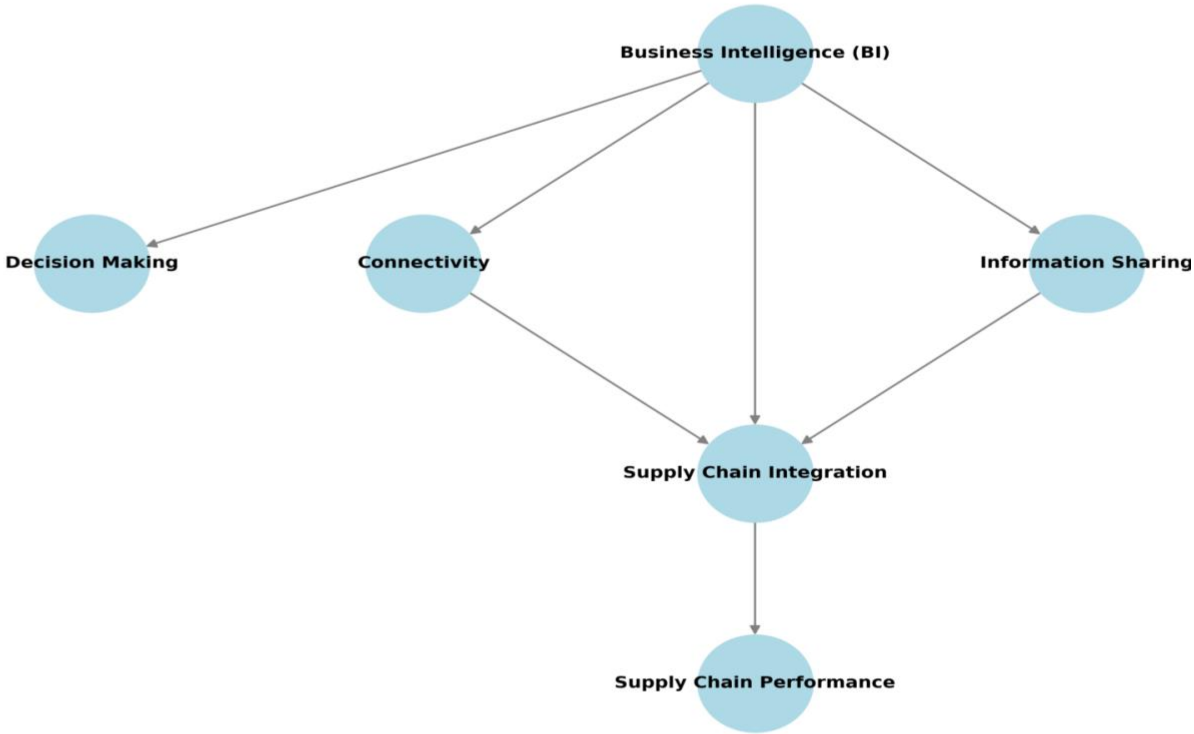
In conclusion, the above studies have attested to the fact that the application of BI as a tool has the capacity to influence supply chain integration and in turn supply chain performance. These studies have led to consideration of what the impact of this can have in the context of the Nigerian manufacturing sector, thus resulting in this hypothesis of the study.

H7: The use of Business Intelligence and the achievement of supply chain process integration significantly influence supply chain performance.

3.10 CONCEPTUAL FRAMEWORK AND MODEL DEVELOPMENT

Based on the empirical reviews and the hypotheses formulated thereof, a larger picture is then created as depicted in figure 2 below.

***Figure 2**: Conceptual framework and hypothesis*



The conceptual framework presented in this study illustrates the interconnected relationships between these variables. Specifically, BI is hypothesized to have influence upon **decision-making, connectivity, information sharing, and supply chain integration**. Additionally, both **connectivity and information sharing** play crucial roles in enhancing **supply chain integration**, which, in turn, serves as a mediator between BI and **supply chain performance.** By mapping out these relationships, this framework provides a structured approach to understanding how BI-driven strategies impact supply chain performance.

CHAPTER 4: RESEARCH METHODOLOGY

4.0 INTRODUCTION

This chapter is dedicated to outlining the research methodology employed in this study, which is crucial for addressing both the primary and secondary research questions outlined in the thesis. The methodology serves as the backbone of the research, guiding the approach taken to gather, analyse, and interpret data.

4.1 RESEARCH PHILOSOPHY

In any research endeavour, the methodology serves as a crucial blueprint that guides the process of data collection, measurement, and analysis. Saunders, Lewis, and Thornhill (2019) introduce the concept of the 'research onion' to provide a structured framework for refining and developing research strategies. This model consists of six distinct layers: research philosophies, approaches, strategies, choices, time horizons, and techniques and procedures. Each layer represents essential decisions that significantly shape the research design and its overall execution. It is also important to note that prior research on the interactions between Business intelligence and supply chain management concepts (integration and performance etc) are historically carried out through empirical data collection and causal relationship observation (Yu, et al., 2018).

At the core of the research onion lies the choice of a research philosophy, which profoundly influences every aspect of the research process. These philosophies are broad paradigms that define the beliefs and assumptions about how knowledge is developed. Saunders et al. (2019) highlight four key research philosophies: positivism, realism, interpretivism, and pragmatism. Among these, positivism and interpretivism are the most applied in social research. Building on the selected philosophy, the next layer involves choosing a research approach. The two dominant approaches are deductive and inductive. A deductive approach is used to test existing theories by formulating and empirically testing hypotheses, while an inductive approach generates new theories based on observed patterns in the data (Saunders et al., 2019). The choice between these approaches impacts subsequent decisions regarding research strategies and techniques.

The next layer involves making choices about methodology, such as using mono-methods, mixed methods, or multi-methods. Mono-methods involve a single data collection technique, either qualitative or quantitative. In contrast, mixed and multi-methods utilize multiple techniques to provide richer insights into the research topic (Tashakkori & Teddlie, 2010). This layer underscores the importance of methodological pluralism in addressing complex research questions. Following this, the research strategy layer incorporates methods such as experiments, surveys, case studies, grounded theory, ethnography, and action research. Each strategy has specific strengths and is suited to this research objectives and questions (Creswell &Creswell, 2017). Time horizons, the next critical layer, include cross-sectional and longitudinal studies. Cross-sectional studies capture data at a single point in time, providing a snapshot analysis. In contrast, longitudinal studies track data over extended periods, offering

insights into changes and trends (Bryman, 2016). Finally, the outermost layer addresses techniques and procedures for data collection and analysis.

This involves practical elements such as sampling methods, data collection instruments, and analytical techniques. Applying these rigorously ensures the reliability and validity of the research findings (Saunders et al., 2019).

Positivism emphasizes that researchers should work with observable realities in society to generate generalizations. It advocates for the objective analysis of data and facts without the influence of subjective biases (Scotland, 2012; Saunders et al., 2012). By adopting this philosophy, research focuses on testing hypotheses through the discovery of measurable and observable data (i.e., quantitative data). Additionally, it seeks to identify functional relationships between causal factors and outcomes, thus facilitating the prediction and control of phenomena (Park et al., 2020). Under a positivist approach, quantitative methods such as surveys, experiments, and statistical analysis are commonly used, as they allow for the testing of hypotheses and the establishment of cause-and-effect relationships (Denscombe, 2014). The focus is on collecting measurable, observable data that can be analysed to produce objective, replicable, and generalizable findings. For instance, in the field of supply chain management, a positivist might study the relationship between business intelligence and supply chain performance by analysing numerical data such as operational metrics, transaction volumes, or efficiency ratios, with the aim of drawing conclusions that could apply broadly to similar contexts (Hagaman and Wutich, 2017).

This research adopts the positivist philosophy because it seeks to establish objective truths and laws governing phenomena through empirical observation and quantifiable data. This philosophy is foundational as the research aims to test the relationships between the concepts of BI, SCI and SCP in Nigeria. It also fulfils the need to create generalisable insights on the findings within the Nigerian manufacturing industry. By adopting the positivist philosophy, this research aligns with a scientific approach that values empiricism, objectivity, and the discovery of universal laws through quantifiable evidence (Eze et al., 2024).

4.2 RESEARCH APPROACH

The research approach provides a logical framework through which the study is designed, executed and interpreted. Prior research on the interactions between BI and supply chain concepts (management, integration, performance etc) are usually conducted using empirical methods i.e. these studies set out to test relationships between measurable concepts. This sort of empirical methods adopts a deductive research approach as this approach aims to empirically test theoretically formed propositions regarding the relationships between concepts. This approach is rooted in the concept of moving from general knowledge to specific i.e. it moves form established theory to testable hypothesis (Saunders et al., 2019).

This research adopts this approach as it explores the role of BI as a resource and a driver for building the capacity of connectivity, information sharing and integration and how it influences supply chain performance. These hypothesised relationships are built on the backbone theories of the resource-based view (RBV), dynamic capabilities theory (DCT) and the knowledge-based theory to frame the concepts.

This approach is appropriate to the study because whilst there are empirical validations supporting the relationships between the concepts, it allows the research to evaluate if the theoretical assumptions hold true in the more complex infrastructure environment of an emerging economy such as Nigeria.

4.3 RESEARCH DESIGN

This study adopts a quantitative research method, emphasizing a structured and systematic approach to both data collection and analysis. The decision to employ this approach stems from the need for precision in research priorities: evidence-based decision-making, hypothesis testing, replicability of findings, and robust data analysis. Quantitative methods align well with these objectives, allowing for the generation of systematic, rigorous, and well-documented research outcomes in the field of study. As a result, this methodology helps ensure compliance with research standards, academic governance, ethical considerations, and applicable laws, minimizing the risk of bad decisions and research misconduct.

In terms of statistical validity, the quantitative approach focuses on collecting and objectively analysing numerical data, often derived from large sample sizes. This method enables researchers to identify patterns, relationships, and trends, facilitating objective interpretations and generalizations from the data (Starman, 2013). Through this structured approach, the study aims to produce findings that are reliable, replicable, and generalizable to broader contexts.

Given the reliance on quantitative methods, the approach taken in this study naturally follows a deductive reasoning process. Deductive reasoning starts with a theoretical framework or hypothesis, which is then tested through data collection. The aim is to either confirm or refute the hypothesis (Pandey & Pandey, 2021). This process supports the development of general conclusions, applicable beyond the specific research sample, thus ensuring broader relevance and practical application of the study's findings.

Expanding upon this, the use of quantitative methods provides numerous advantages. It allows for the precise measurement of variables, facilitating the identification of patterns, correlations, and trends within the dataset (Armstrong et al., 2022). Moreover, the structured nature of quantitative research enhances the replicability of findings, bolstering the reliability and validity of the conclusions. However, it is important to recognize the limitations of this approach. Quantitative methods often overlook contextual factors and fail to capture the complexity of human behaviour or social phenomena (Tracy, 2019). The reliance on numerical data can sometimes limit the depth of understanding, particularly in research topics where subjective experiences or qualitative aspects are significant.

The quantitative research method provides a rigorous and structured approach to gathering and analysing numerical data, facilitating objective conclusions and enhancing the generalizability of findings to broader populations when appropriate (Mohajan, 2020). This methodology is widely applied across multiple disciplines, including social sciences, natural sciences, business, and health sciences, helping researchers quantify relationships, patterns, and trends.

One key strength of quantitative research lies in its systematic nature, offering clear procedures for data collection and analysis (Dawadi, 2021). This approach ensures consistency throughout the research process, enhancing the credibility and reliability of findings. Additionally, quantitative research's focus on objectivity minimizes personal biases, ensuring that conclusions are drawn from the data itself rather than subjective interpretation.

Moreover, the ability of quantitative research to generalize findings beyond the specific sample studied is a significant advantage (John, Adkin, & Chauvin, 2020). By employing representative sampling techniques and robust statistical analyses, researchers can infer patterns and relationships that are likely to be applicable to diverse populations. This generalizability enhances the practical relevance of research findings, allowing them to be applied to real-world situations.

However, despite its strengths, quantitative research also has limitations. The method struggles to capture the complexity of human experiences and social phenomena, as numerical data may not adequately reflect nuanced perspectives or cultural subtleties (Chai et al., 2021). Additionally, the reductionist nature of quantitative methods can oversimplify complex phenomena, resulting in an incomplete understanding of the research topic. Lastly, by prioritizing numerical data, quantitative research may sometimes overlook critical contextual factors, potentially undermining the validity and applicability of its findings in specific scenarios.

4.4 RESEARCH INSTRUMENT DESIGN

When determining the most appropriate research method for this study, a review of existing empirical studies on business intelligence (BI) use in supply chain processes was conducted. These prior studies predominantly utilized case study approaches (Shanks & Sharma, 2010) or survey-based methodologies (Dong et al., 2009; Trkman et al., 2010; Oliveira et al., 2012; Mandal, 2019).

This study adopts the survey research design, and as seen in table 1 The choice of a survey research design is supported by several key factors. First, the survey method addresses the need for efficient and rapid data collection, as highlighted by Tracy (2019), making it ideal for gathering insights from a geographically dispersed population. The online platform enhances accessibility and scalability, allowing for broad distribution through email and social media channels, which can reach a large and diverse audience. In addition, features such as submission limits, mandatory questions, and validation check which help ensure data integrity and participant adherence to predetermined guidelines. The ability to leverage Google Forms' real-time analytics also provides dynamic tracking of response rates and key metrics, enabling researchers to adjust data collection strategies as needed (John, Adkin, & Chauvin, 2020).

The decision to adopt a survey design was further driven by the advantages of collecting substantial amounts of data from a diverse sample in a short period. This is particularly useful when aiming to reach a wide range of respondents or when operating within tight timeframes. Surveys offer a standardized method of data collection, promoting consistency in the responses obtained (Aithal & Aithal, 2020). Additionally, the use of a questionnaire as the survey tool provides respondents with a structured format for submitting their answers, facilitating smooth data collection and enabling more efficient analysis and interpretation. The questionnaire format also allows for anonymity, which may encourage respondents to offer honest and candid feedback, thereby increasing the reliability of the data (Roehl & Harland, 2022). However, it is important to recognize some limitations of survey research. One notable issue is the potential for response bias, where participants may provide answers, they believe are socially desirable rather than accurately reflecting their true opinions or behaviours. Despite this, surveys remain a valuable and practical method for collecting large-scale data in a structured and standardized manner.

The literature supports the use of surveys as a suitable method for such inquiries. Surveys are a key quantitative research tool, frequently used to collect large volumes of data from diverse samples to explain relationships between concepts (Neuman, 2014). The survey method offers several advantages, including the ability to engage a large and geographically dispersed population, which enhances the study's statistical power and representativeness. Additionally, the use of surveys facilitates the collection of substantial amounts of information within a relatively short time frame, making it both efficient and cost-effective.

Moreover, employing a survey-based approach allows for the utilization of validated models and frameworks, which have been established in previous studies. This contributes to the reliability and replicability of the research findings, as these models provide structured formats for data collection, enabling researchers to draw comparisons and validate their results against existing literature. Given that BI systems and supply chain processes involve numerous quantitative metrics—such as operational performance indicators, information flow efficiency, and integration levels—the survey method is particularly apt for capturing and analysing these variables systematically.

Additionally, the nature of this study, which seeks to explore BI's influence on supply chain integration and performance, requires a method that can gather a broad range of data from professionals who interact with these systems. Surveys provide an effective means of gathering such responses, allowing for the generalization of findings across different industries and organizations. Furthermore, the anonymity provided by surveys can encourage more candid responses, reducing potential biases that might arise from direct interviews or focus groups. For these reasons, this study will employ a survey-based approach to collect the necessary data on BI use and its impact on supply chain processes

Table 2: Justification for choosing survey over other methods

Options	Features	Pros for this study	Cons for this study
Survey	- Structured set of questions for data collection - Can be administered to a large sample - Can be conducted online, by phone, or on paper	-Cost-effective - Standardized data makes analysis easier - Can reach geographically dispersed samples	- Limited depth of understanding - Response rates can vary - Potential for response bias - Fixed questions may not capture all nuances
Single case study	- In-depth analysis of a single case - Detailed contextual understanding	- Provides deep, comprehensive insight - Can explore rare or unique cases	- Limited generalizability - High risk of researcher bias -Time-consuming

	- Can use multiple data collection methods	- Can generate hypotheses for further research - Flexible and adaptable to changes	- Findings may not be applicable to other cases
Multiple case study	-In-depth analysis of several cases - Comparative analysis between cases - Uses multiple sources of evidence - Flexible research design	- Provides rich, detailed data - Allows for comparison across cases - Can identify patterns and themes -Enhances validity through triangulation	- Time-consuming - Resource-intensive - Complexity in managing and analysing data - Potential for researcher bias

Source: Student Idea, 2024

4.4.1 SURVEY DESIGN

The design of the questionnaire and the scales generated for the measurement of the concepts, was reliant on established scales from previous literature, and a multidimensional scale construct was selected to conceptualize the variables. This decision stems from the understanding that a multidimensional construct allows for a more comprehensive description of objects or people from various perspectives, compared to a unidimensional construct, which focuses on a single dimension (Blumberg et al., 2014). By incorporating multiple dimensions, this model captures complexity and nuance of the different concepts, thus making it the ideal approach for this study.

The questionnaire created for this study contained two sections a) collecting demographic data regarding the type of manufacturing company, the position of the respondent in the company, the state the company operates in, the BI systems being used in the company, how long the company has used the BI system, and the company size. These questions are designed to create a profile for the respondents and give relevant insights. Section b contains concept specific questions (i.e. questions relating to measuring BI use, connectivity etc) measured using a five-point Likert scale. The questionnaires are generated to be closely related to the objectives of the research.

Table 3 sheds lighter on the constructs and dimensions were adapted from literature

Table 3:Summary of operationalization variables

Variable	**Sub-Construct**	**Description**
Business Intelligence (BI)	Data Analytics, Data reporting, and decision support,	The process of analysing data to generate actionable insights, enhancing decision-making within

		supply chains (Chen & Paulraj, 2004).
Supply Chain Integration	Internal Process Alignment, Cross-functional Collaboration, and the Integration of External partnerships	Coordination and collaboration among internal departments (e.g., procurement, production, distribution) to streamline processes and information flow (Lee, 2000).
Supply Chain Performance	Lead times, Order fulfillment rates, Customer Satisfaction levels, Cost Minimization, Supply Chain Risk Management, Supply Chain Visibility, and Supply Chain Waste Minimization. Whitten et al. (2012)	The ability to deliver products or services with minimal waste and optimal resource utilization, measured by costs and time (Coyle et al., 2013).
Connectivity	IT systems, Communication Channels, and the extent to which data can be accessed and shared among supply chain partners. Fawcett et al. (2009); Brandon-Jones et al. (2014); Duan and Xiong (2015)	Connectivity refers to the degree to which various components of the supply chain are interconnected, enabling seamless communication and interaction among stakeholders.

Information Sharing	timeliness, accuracy of information exchange and quality of shared information. Cao and Zhang (2011)	It encompasses the exchange of relevant and timely information among various stakeholders, including suppliers, manufacturers, and distributors (Cao & Zhang, 2011).
Decision making	Data applications, problem solving, application of strategic choices, reduction of bias and managerial efficiency Charles Wan, Rodrigo Belo, Leid Zejnilović (2022)	**Decision-making** is the cognitive and analytical process of selecting the best course of action among multiple alternatives to achieve a specific goal or solve a problem.

Table 2 provides a summary of the operationalization of the variables, including a brief explanation of each construct. The key variables—BI, supply chain integration, and supply chain performance—were conceptualized as multidimensional constructs to capture the full spectrum of their impact on the supply chain processes. For instance, BI was operationalized to account for its different roles, from data analytics to decision support, while supply chain performance was measured across dimensions such as efficiency, flexibility, and responsiveness. This holistic approach ensures that the variables are thoroughly examined in relation to their multifaceted nature.

4.4.1.1 BUSINESS INTELLIGENCE AS A VARIABLE

Business Intelligence (BI) is increasingly recognized as a crucial driver of effective decision-making within organizations. As described by Sharda, Delen, and Turdan (2014), BI is a tool that enhances decision-making through features such as improved cost and data quality, combined reporting, and environmental reporting. The operationalization of BI in this study adopts a five-dimensional construct adopted from previous literature, which allows for a comprehensive understanding of its various facets. These dimensions encompass, analytics, reporting, and decision support, each contributing to the overall effectiveness of BI systems for decision making and facilitating connectivity and information sharing. Moreover, the empirical study conducted by Al-Ma'aitah (2013) serves as a guiding reference for the operationalization of BI, given its contextual similarities. This alignment ensures that the measures employed in this research resonate well with established findings in the field, enhancing the validity of the results. Table 4 provides a detailed overview of the operationalization of the data warehouse variable, illustrating how each dimension of BI is assessed through specific items and scales.

Table 4:Business intelligence (BI) as a variable

Popvic et al. (2012), Ahmad (2015), Fink et al. (2017), Fosso Wamba et al. (2017), Wang and Byrd (2017), Brinch et al. (2018), Ferraris et al. (2018), Aydiner et al. (2019), Mikalef et al. (2019), Susa Vugec et al. (2020)	(i) Facilitation of Information sharing (ii) Ability for pattern identification in large sets of data (iii) Sensitivity to changes in business environment (iv) Supporting data integration (v) facilitating Business decision making

4.4.1.2 CONNECTIVITY AS A VARIABLE

Connectivity refers to the degree to which various components of the supply chain are interconnected, enabling seamless communication and interaction among stakeholders. In the context of business intelligence, effective connectivity ensures that data flows effortlessly across different platforms and systems, facilitating real-time decision-making and responsiveness (Lee & Whang, 2019).

Table 5: Connectivity (C) as a variable

Fawcett et al. (2009); Brandon-Jones et al. (2014); Duan and Xiong (2015)	(i) Current information systems satisfy communications requirements (C1) (ii) Information applications are highly integrated within the firm and supply chain (C2) (iii) Adequate information systems linkages exist with partners in supply chain network (C3)

Source: Fawcett et al. (2009); Brandon-Jones et al (2014); Duan and Xiong (2015)

To operationalize connectivity, this study will evaluate factors such as the integration of IT systems, the effectiveness of communication channels, and the extent to which data can be accessed and shared among supply chain partners. These factors are essential for enhancing collaborative efforts, which are crucial for optimizing supply chain performance. The responses will be measured using a Likert scale, like the BI variable, allowing for analysis of respondents' perceptions regarding the effectiveness of connectivity within their organizations.

4.4.1.3 INFORMATION SHARING AS A VARIABLE

Information sharing is a critical component of supply chain management. It encompasses the exchange of relevant and timely information among various stakeholders, including suppliers, manufacturers, and distributors (Cao & Zhang, 2011). Effective information sharing can lead to improved forecasting, reduced inventory costs, and enhanced service levels.

Table 6: Information sharing (IS) as a variable

Source: Cao and Zhang (2011)

Cao and Zhang (2011)	(i)	relevant information (IS1)
	(ii)	timely information (IS2)
	(iii)	Accurate information
	(iv)	Complete information
	(v)	Sensitive information

For this study, information sharing will be operationalized through dimensions such as the timeliness, accuracy information exchange and quality of shared information. By utilizing a Likert scale to assess these dimensions, the study aims to capture the perceptions of respondents on how effectively their organizations engage in information sharing practices, ultimately linking this to overall supply chain performance.

4.4.1.4 DECISION MAKING AS A VARIABLE

Decision making is a critical component of this study, and it investigates the cognitive and analytical process of selecting the best course of action among multiple alternatives to achieve a specific goal or solve a problem

Table 7: Decision Making as a variable

Source: Charles Wan, Rodrigo Belo, Leid Zejnilović (2022)

Charles Wan, Rodrigo Belo, Leid Zejnilović (2022)	(i)	Data applications,
	(ii)	problem solving,
	(iii)	application of strategic choices,
	(iv)	reduction of bias and
	(v)	managerial efficiency

For this study, Decision making sharing will be operationalized through the dimensions mentioned in table 7 above. By utilizing a Likert scale to assess these dimensions, the study aims to capture the perceptions of respondents on how effectively their organizations decision making practices, ultimately linking this to overall supply chain performance.

4.4.1.5 SUPPLY CHAIN INTEGRATION AS A VARIABLE

Supply chain integration refers to the alignment and coordination of activities across the supply chain to achieve a unified approach towards meeting customer demands. It includes both internal integration within organizations and external integration with suppliers and customers (Zhao et al., 2011). This integration is vital for fostering collaboration, improving efficiency, and enhancing responsiveness to market changes.

Table 8: Supply chain integration as a variable

Source: Zhao et al (2011)

Zhao et al (2011)	(i) Integration of systems in alignment with company goals (ii) Integration geared towards internal process alignment (iii) Integration of systems for cross functional collaboration (iv) Integration of systems for interdepartmental decision making (v) Integration to support external partnerships

In this study, supply chain integration will be operationalized by examining dimensions such as internal process alignment, cross-functional collaboration, and the integration of external partnerships. These dimensions will be assessed using a Likert scale, allowing the researcher to gauge the extent to which organizations perceive themselves as integrated and the benefits derived from such integration.

4.4.1.6 SUPPLY CHAIN PERFORMANCE AS A VARIABLE

Supply chain performance is a multifaceted construct that encompasses various dimensions, including efficiency, flexibility, responsiveness, and quality (Gunasekaran et al., 2004). It reflects how well a supply chain operates in delivering value to customers while minimizing costs. Understanding supply chain performance is critical for identifying areas for improvement and driving competitive advantage.

Gunasekeran et al (2004)	(i) Supply chain visibility (ii) Supply chain risk management

	(iii)	Supply chain waste minimisation
	(iv)	Cost minimisation to final consumers
	(v)	Lead time management
	(vi)	Customer satisfaction levels

Table 9: Supply chain performance as a variable

For this study, supply chain performance will be operationalized by measuring these dimensions through specific metrics, such as lead times, order fulfilment rates, and customer satisfaction levels, cost minimization, supply chain risk management, supply chain visibility, and supply waste minimization. The use of a Likert scale will enable respondents to evaluate their organizations' performance across these dimensions, providing valuable insights into the overall effectiveness of their supply chain processes.

4.4.2 MEASUREMENT SCALES

Appropriate measurement scales were adopted to operationalize each construct, ensuring the instrument's reliability and validity. For this study, responses were measured using a five-point Likert scale, with anchors ranging from "strongly disagree" (1) to "strongly agree" (5) (Chen & Paulraj, 2004). The choice of a five-point Likert scale is justified by its capacity to capture a broad range of attitudes and perceptions, providing more granularity and better distinguishing between different levels of agreement or disagreement (Revilla, Saris, & Krosnick, 2014). Additionally, research has shown that a five-point scale strikes a balance between offering respondents enough options to express nuanced opinions without overwhelming them, which can happen with larger scales (Preston & Colman, 2000).

Table 10: Measurement Scales for Variables

Variable Categories	Variables	Likert Response Method	Measurement Scaling Type
Independent Variable	Business Intelligence (BI)	5-point Likert Scale	Ordinal Scale (Reflective Construct)
Dependent variable	Connectivity	5-point Likert Scale	Ordinal Scale (Reflective Construct)
Dependent Variable	Information Sharing	5-point Likert Scale	Ordinal Scale (Reflective Construct)
Dependent Variable	Supply Chain Integration (SCI)	5-point Likert Scale	Ordinal Scale (Formative Construct)
Dependent variable	Supply Chain Performance (SCP)	5-point Likert Scale	Ordinal Scale (Formative Construct)

Source: Student Idea, 2024

In this study, a structured framework is employed to examine the interplay between Business Intelligence (BI), Supply Chain Integration (SCI), and Supply Chain Performance (SCP). This framework is categorized into independent and dependent variables, each measured using a 5-

point Likert scale to capture respondents' perceptions effectively. The independent variables in this research include Business Intelligence (BI), Connectivity, and Information Sharing.

The dependent variables in this study are Supply Chain Integration (SCI) and Supply Chain Performance (SCP). Supply Chain Integration represents the degree to which various supply chain activities are coordinated and aligned. High levels of SCI can lead to improved operational efficiency and better responsiveness to market demands. Supply Chain Performance serves as a crucial indicator of how effectively a supply chain functions, measured through various metrics such as efficiency, flexibility, and responsiveness. A strong SCP reflects the overall success and effectiveness of the supply chain.

To measure the independent and dependent variables, a 5-point Likert scale is utilized, allowing respondents to express their opinions ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The choice of a 5-point scale is supported by literature indicating that having more response options enhance reliability and capture the complexities of respondents' attitudes (Chen & Paulraj, 2004). This method ensures a nuanced understanding of respondents' views on BI, connectivity, information sharing, SCI, and SCP, thereby facilitating a robust analysis.

The independent variables—Business Intelligence, Connectivity, and Information Sharing—are treated as reflective constructs. This means that variations in these variables reflect underlying dimensions or attributes. For instance, higher usage levels of BI are expected to correlate with improved connectivity and enhanced information sharing practices. On the other hand, the dependent variables—Supply Chain Integration and Supply Chain Performance—are conceptualized as formative constructs. This implies that they consist of multiple dimensions or indicators that collectively define them. For example, SCI encompasses aspects such as process alignment and collaboration, while SCP could include metrics like efficiency and flexibility. In this context, respondents' perceptions of various aspects measured by the Likert scale contribute to the overall assessment of these constructs. This structured approach effectively examines the relationships between BI, connectivity, information sharing, SCI, and SCP. By employing appropriate measurement methods, the study aims to capture the nuanced perceptions of respondents, enabling a comprehensive analysis of how these variables impact supply chain processes and outcomes.

4.5 SURVEY PRE TESTING

The survey instrument underwent a rigorous pre-testing process, conducted in four stages to ensure its clarity, relevance, and effectiveness.

4.5.1 INITIAL REVIEW

In the first stage, the researcher, along with the research supervisor, examined the questionnaire for clarity, ambiguity, and the appropriateness of the selected measures (DeVellis, 2012). This process focused on ensuring that each item appropriately reflected the constructs being measured and that the questions were easily understandable. The team also evaluated whether the questionnaire comprehensively addressed the study's key areas (Dillman, 1978). Based on this review, the instrument underwent further refinements, primarily focused on improving the language and structure of certain questions to enhance clarity.

4.5.2 EXPERT FEEDBACK

In the second stage, the refined questionnaire was uploaded onto the Google forms, and anonymous links were distributed to 10 supply chain consultants and managers working in Nigeria's manufacturing sector. These professionals were asked to assess the survey's structure, readability, ambiguity, and completeness. Their feedback was critical in identifying any lingering issues related to language or question interpretation, and their suggestions were incorporated into the final version of the survey. This process helped ensure that the instrument was appropriate for the target audience and that the questions were clear and easy to understand.

Table 11: Responses from expert feedback

Criterion	Feedback/Findings	Action Taken
Clarity of Instructions	Most respondents understood the instructions and could carry on filling the questionnaire	No actions were taken
Understanding of Questions	Some respondents indicated some confusion with the wording of the questions	The confusing questions were made clearer
Relevance of Questions	None of the respondents questioned the relevance of the questions	No actions were taken
Flow and Logical Order	None of the respondents questioned the flow or logical order of the questions	No actions were taken
Length of Time to Complete	Some respondents indicated displeasure at the length of the questionnaire	The length of the questionnaire was not altered
Technical/Platform Issues	None of the respondents complained about having any technical issues	No actions were taken
Participant Engagement	The engagement from the respondents were good	No actions were taken
Any Repetitive Items	There were no repetitive items	No actions were taken

4.5.3 PILOT TEST

In the third stage, a pilot test was conducted with a small sample of participants to assess the survey's overall functionality and to identify any technical issues with the system. A cooperative relationship was formed with chambers of commerce and with their cooperation, and the use of their internal researchers and research assistants and distribution companies, the pilot study was administered to about 50 professionals working actively in the manufacturing industry. The respondents were gathered from companies registered in chambers of commerce in Lagos and Port Harcourt. The pilot test ensured that all questions were presented in the correct format, that responses were being recorded accurately, and that participants could navigate the survey without difficulty. The results were then tested for reliability and validity particularly. Poorly performing variables were removed (for instance, in the initial iteration of the research model there was a variable representing Supply network structure and the reliability values were poorly performing and as such it was completely removed, and the model was redesigned) other poorly performing items were edited or merged and adjusted to create better and more reliable and valid outputs.

Based on the pilot test feedback, minor adjustments were made to enhance user experience.

4.5.4 FINAL MODIFICATIONS

In the final stage, all feedback from the pre-tests was collated and used to make the final modifications to the survey instrument. The final version was optimized for clarity, precision, and user-friendliness.

The constructs measured in the survey were operationalized based on their roles in the model. All the exogenous constructs (e.g., BI adoption, supply chain integration) were operationalized as reflective constructs, meaning that the measured variables are seen as being caused by the underlying construct. In contrast, the dependent constructs, such as supply chain performance (SCP), were operationalized as formative constructs. This means that the indicators collectively define the construct and are not interchangeable (Diamantopoulos & Siguaw, 2006). The distinction between reflective and formative constructs was critical to ensuring that the appropriate measurement model was applied for each construct, enhancing the validity of the study's conclusions.

4.6 INDUSTRY SELECTION

Research indicates that financial institutions, insurance companies, telecommunications firms, manufacturing, and trading companies are among the leading users of Business Intelligence (BI) systems (Olzak & Ziemba, 2006). Given that this study focuses on supply chains and their processes, selecting the manufacturing sector is particularly appropriate as it spans the full scope of the supply chain, from sourcing raw materials to final distribution.

In Nigeria, the manufacturing sector is a significant contributor to the economy, accounting for approximately 10% of the country's Gross Domestic Product (GDP) annually. Manufacturing activities are concentrated in major cities such as Lagos, Port Harcourt, and Ibadan in the southern region. This sector involves millions of people in the production of household goods, consumer products, automobiles, agriculture, mining, cement, and building materials, among others. The Nigerian manufacturing industry is primarily driven by subsectors including cement and building materials, food and beverages, tobacco, chemicals and fertilizers, wood products, and textiles. Of these, just three subsectors—food and beverages, cement, and textiles—generate 77% of the total manufacturing output, making them the most valuable contributors. Additionally, breweries and flour mills are also significant players in the sector.

The key data sources for understanding manufacturing activities in Nigeria include the National Bureau of Statistics (NBS), Bank of Industry (BOI), Central Bank of Nigeria (CBN), and the Manufacturers Association of Nigeria (MAN). Upon reviewing manufacturing companies registered with MAN, it was noted that 350 companies are currently registered and active. For the purposes of this study, only those companies most likely to use and implement Business

Intelligence (BI) in their supply chain processes were selected. This decision was informed by brief interviews with representatives from the MAN research department, who provided insights into which companies have adopted BI technologies within their operations.

4.7 DATA COLLECTION

Data for the study were collected using a structured survey questionnaire, which has proven to be an effective data collection tool in supply chain management research (Adigwe et al., 2024). The survey was targeted at key informants who held functional leadership positions in relevant areas such as logistics/transportation, operations management, and purchasing/procurement. This selection was justified by the fact that these individuals possess specialized knowledge and experience in the day-to-day operations and strategic decisions related to Supply Chain Management (SCM) (Nnaji, 2023). To enhance response rates and ensure clarity, each questionnaire was accompanied by a cover letter from the Manufactures Association of Nigeria (MAN) explaining the study's purpose, followed by phone calls to encourage participation, which is a method aligned with best practices in survey-based research (Ibeh et al., 2024).

To ensure the reliability and validity of the constructs, the questions were adapted from existing literature, a widely accepted approach that helps maintain consistency with prior research while allowing for comparability (Olaniyi et al., 2024). The development of the questionnaire was refined through consultations with nine supply chain management experts from academia and industry. This ensured the instrument's face and content validity, thereby improving its overall quality and relevance (Olu-Steven, 2023).

All survey items were measured using a five-point Likert scale, ranging from strongly disagree to strongly agree. This scale is commonly used in SCM research due to its simplicity, ease of interpretation, and its ability to capture respondents' attitudes and perceptions with sufficient granularity (Obisesan, 2023). The use of this scaling method helps ensure that respondents' views are quantified in a consistent manner, facilitating data analysis and interpretation.

4.7.1 THE STUDY POPULATION

In alignment with the method of data collection described above, the study's population consists of all manufacturing companies list of registered Manufacturers from MAN 2023-2024. A total of 350 respondents, all of whom were drawn from these manufacturing companies in Nigeria. These respondents were selected based on their functional roles in key supply chain areas such as logistics, operations management, and procurement, ensuring that the data collected were relevant to the study's focus on supply chain management (SCM). The selection of respondents from manufacturing companies was appropriate, given that this sector is heavily reliant on efficient supply chain processes for production, distribution, and inventory management (Adigwe et al., 2024). Additionally, since the manufacturing sector in Nigeria is highly diverse and faces unique logistical challenges, the selection of respondents from this sector provides a rich source of data that can reveal significant patterns related to SCM practices (Ibeh et al., 2024).

To facilitate data collection from this population, a structured survey questionnaire was employed, which, as previously mentioned, was sent to the key informants. The survey's design ensured that it was tailored to capture the specific challenges and strategies of business intelligence and SCM within Nigeria's manufacturing sector. By adapting question items from established literature and using a five-point Likert scale, the study provided a standardized and comparable means of measuring key business intelligence and SCM variables, ultimately ensuring that the data collected were robust and reflective of the operational realities within Nigerian manufacturing companies (Obisesan, 2023)

4.7.2 SAMPLE SIZE ESTIMATION AND SAMPLING TECHNIQUE

Whilst selecting the sample for this study, it was important to consider the Nigerian manufacturing landscape, as well as the challenges of certain sampling techniques, after consideration, purposive sampling was chosen to be the most accurate method for this study.

Purposive sampling is a non-probability sampling technique useful for selecting participants deliberately based on their possession of specific characteristics that are pivotal for the research. It was important to the research that respondents have specialised knowledge and interaction regarding business intelligence and other concepts of the study.

This was important to do as unlike probability sampling methods which focuses on representativeness, this method allows targeting respondents that have experience with the research concepts, which is important especially in the context of the Nigerian manufacturing sector where organisations vary and access to knowledgeable personnel can be inconsistent as well as the logistical constraints, limited digital infrastructure and organisational (data) gate keeping.

Thus, the respondents targeted were managers, supervisors, analysts (i.e. decision makers) because of their responsibility for operational decision making, technology adoption, information flows and performance monitoring in their companies. This ensures that their responses to the questionnaire are informed and experiential rather than general perceptions.

Purposive sampling allows for a balance between methodological rigour and Nigerian contextual realities.

4.7.2.1 SAMPLE SIZE DETERMINATION

In the study, the Taro-Yamane sample size formula was employed to determine the appropriate sample size for the population. This formula is critical in ensuring that the selected sample is representative of the entire population, thereby improving the reliability and generalizability of the findings. The Taro-Yamane formula is widely used in research to determine sample sizes when working with a finite population. The algebraic expression for the formula is as follows:

$$n = \frac{N}{1+N(e)^2}$$

Where:

n = the required sample size

N = the total population size (350 in this case, representing respondents from manufacturing companies in Nigeria)

e = the margin of error, typically set at 5% (0.05)

$$n= \frac{420}{1+420(0.05)^2}$$

$$= \frac{420}{1+420(0.0025)}$$

$$= \frac{240}{1+1.05}$$

$$= \frac{420}{2.05}$$

= <u>approximately 187</u>

This formula is useful in reducing the likelihood of sampling errors by calculating the ideal number of respondents required to accurately reflect the population. In this study, applying the Taro-Yamane formula ensures that the sample size is not too large, which could result in unnecessary resource consumption, or too small, which might compromise the validity of the results (Ahmed, 2024). A total of 250 copies of questionnaire were distributed to the study respondents. The study made use of the simple random sampling techniques. The use of simple sampling in identifying these respondents is particularly justified in this context, as it allowed the researchers to target those with specialized knowledge and decision-making authority witthin their organizations, enhancing the quality of insights gathered (Olaniyi et al., 2024).

4.8 RESEARCH RIGOUR

Validity and reliability are fundamental tools in quantitative research, ensuring the credibility and trustworthiness of the study's findings. These concepts play a crucial role in making knowledge derived from research fact-based and legitimate, as they provide a framework for evaluating how well the research measures what it intends to and how consistent those measurements are over time (Golafshani, 2003).

4.8.1 VALIDITY OF THE STUDY RESEARCH INSTRUMENT

Validity refers to the degree to which a research instrument accurately measures the specific concept it is intended to measure. It ensures that the results of the study are a true reflection of the phenomena under investigation. Validity is critical in determining whether the conclusions drawn from the data are both sound and relevant to the research questions. In this study, ensuring validity means verifying that the survey questionnaire effectively captures the intended dimensions of business intelligence and supply chain management (SCM) practices within Nigerian manufacturing firms. By doing so, the study can draw valid conclusions regarding the relationship between SCM practices and operational outcomes (Ahmed, 2024). There are different types of validity (content, construct, and criterion validity), each addressing a specific aspect of how well the research tool performs in relation to the intended measurements.

The validity of the survey construct was assessed using the Exploratory Factor Analysis (EFA) technique. EFA is a statistical method used to identify underlying relationships between measured variables by analysing the patterns in the responses of survey participants. This method allows researchers to uncover latent variables, or "factors," that influence the observed responses (Young and Pears, 2014). According to recent literature, EFA is particularly useful when researchers are working with complex constructs or modifying existing instruments, as it helps to determine how newly included or adjusted variables interact with the original survey items (Ahmed et al., 2024).

There are two main types of factor analysis: exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). Exploratory factor analysis seeks to explore and identify the underlying factors that explain why survey items influence responses in a particular way. This type of analysis is typically used in the early stages of research or when modifying pre-existing survey instruments. Confirmatory factor analysis (CFA) is a more advanced technique used to confirm or validate the factor structure already hypothesized or revealed by EFA, usually in a predictive manner (Ibeh and Olu-Steven, 2024). EFA is an essential tool for ensuring that newly introduced variables in a construct are valid and relevant to the research context.

In this study, the EFA technique was employed due to modifications made to the original pretested questionnaire, which was adapted from Al-Ma'aitah. The original survey was modified to incorporate additional theoretical insights on strategic decision-making derived from the literature review. Given these adjustments, it was necessary to test whether the newly added factors in the survey construct influenced the participants' responses and to examine the strength of the relationship between these new factors and the observed data (Olaniyi and Obisesan, 2024). EFA was chosen because it enables researchers to reveal whether the added variables align with the theoretical framework or exhibit a significant impact on the measured outcomes (Golafshani, 2023).

To conduct this analysis, the data were processed using the Statistical Package for the Social Sciences (SPSS) Version 25, a powerful tool for factor analysis. The SPSS software supported the identification of the principal components and helped in determining the factor loadings, which are indicators of the strength of the relationship between each variable and the underlying factors. This step is crucial for validating the construct's validity, as it ensures that the included variables contribute meaningfully to explaining the phenomenon under investigation (Obisesan, 2023). The factor loadings and other relevant statistical measures provided insights into whether the survey instrument was valid, reliable, and capable of capturing the newly introduced theoretical constructs effectively.

4.8.2 RELIABILITY OF THE STUDY RESEARCH INSTRUMENT

Reliability refers to the extent to which the research results are consistent and replicable over time. If the same study were conducted again under similar conditions, reliable results would yield the same or similar outcomes. This consistency is vital for quantitative research as it strengthens the generalizability of the findings. In this study, reliability was assessed using Cronbach’s alpha value. Cronbach’s alpha is a statistical measure commonly used to evaluate the internal consistency of survey instruments, which indicates how closely related a set of items are as a group (Olaniyi et al., 2024). Higher Cronbach alpha values (typically above 0.70) indicate a higher degree of reliability, suggesting that the variables measured in the survey produce stable and consistent results across different respondents (Golafshani, 2003).

The use of Cronbach’s alpha in this study provides confidence in the reliability of the data, as it demonstrates that the survey items consistently measure the underlying variables (Business intelligence and SCM). This statistical reliability measure, along with validity testing, ensures that the findings of the study are not only accurate but also meaningful and replicable in similar contexts, thus enhancing the overall credibility of the research (Obisesan, 2023). Ensuring both validity and reliability is essential in quantitative research because these tools ensure that the research findings are not only reflective of the actual phenomena being studied but are also reliable enough to be reproduced in future studies. In the context of this study, addressing validity ensures that the specific SCM practices being measured are truly representative of the theoretical constructs, while ensuring reliability guarantees that the data collected from the Nigerian manufacturing firms can be trusted for consistent future application (Ibeh et al., 2024).

4.9 METHOD OF DATA ANALYSIS

The primary objective of this study is to investigate the impact of business intelligence (BI) components on supply chain management (SCM) performance. To achieve this, a conceptual model was developed in Chapter Two, offering a comprehensive overview of the key variables and corresponding hypotheses. This conceptual framework serves as a foundation for the study, guiding the analysis of the relationships between BI components and SCM performance. The hypotheses embedded in this model are tested through a quantitative approach, which enables the empirical validation of the relationships and the examination of how different BI components influence various aspects of SCM (Ahmed and Olu-Steven, 2024).

The data analysis strategy employed in this study began with the application of exploratory factor analysis (EFA), a statistical technique used to explore the underlying structure of the data by examining the relationships between individual variables and their components within the broader construct. EFA was utilized to identify and confirm the factor structure of the BI components, ensuring that each variable accurately represented the conceptual model and contributed meaningfully to the analysis of SCM performance (Ibeh et al., 2024). This step was crucial in validating the constructs and ensuring the reliability of the measurement instruments.

Following the completion of the exploratory factor analysis, the data analysis continued with the application of descriptive statistics, which provided a summary and numerical description of the variables within the dataset. Descriptive statistics are essential in quantitative research as they offer a clear and concise representation of the data, enhancing the overall interpretability of the findings. In this study, descriptive statistics were used to present the distribution of variables and to offer insights into central tendencies, variability, and the overall data spread (Saunders et al., 2012; Olaniyi and Obisesan, 2024).

Specifically, this study employed distribution graphs, means, and standard deviations as key descriptive statistics tools. Distribution graphs visually represented how the data points were spread across different variables, aiding in the identification of patterns and trends within the dataset. The mean provided an average value for each variable, offering a central point around which the data points clustered. Meanwhile, the standard deviation measured the extent of variability or dispersion in the data, indicating how much individual responses differed from the mean. These statistical measures were essential in summarizing the data, providing a clear numerical picture of the variables under study, and facilitating deeper analysis of how the BI components impacted SCM performance (Obisesan, 2023).

The combination of exploratory factor analysis and descriptive statistics allowed for a rigorous and systematic examination of the relationships between BI components and SCM performance. By first identifying the underlying factors through EFA and then summarizing the data with descriptive statistics, the study was able to offer both an in-depth exploration and a broad overview of the variables, enhancing the reliability and clarity of the results.

For the hypothesis testing of the conceptual model introduced in Chapter Two, this study followed the testing procedure outlined by Saunders et al. (2012) and Soekha (2016). This procedure involves both non-parametric and parametric statistics, selected based on the nature of the data being analyzed. Non-parametric statistics are particularly useful when the data do not meet the assumptions of normal distribution, allowing researchers to perform significance testing without the constraints of distributional assumptions. On the other hand, parametric statistics are used when working with numerical data that follow a normal distribution and have equal sample variances (Saunders et al., 2012; Soekha, 2016). The decision to utilize both non-parametric and parametric techniques ensures that the analysis is robust and accommodates various data distributions.

The significance testing procedure, as applied in this study, compares the actual data collected against the expected theoretical outcomes. This method is crucial for determining whether the observed relationships between variables are statistically significant, indicating whether the hypotheses should be accepted or rejected. Saunders et al. (2014) emphasize that hypothesis testing is a critical step in verifying theoretical models, as it helps researchers determine whether the relationships posited in the conceptual framework hold true in practice. By applying this procedure, the study aims to establish whether the BI components significantly impact SCM performance, as hypothesized in the conceptual model.

To assess the strength of the relationships between the independent and dependent variables, correlation analysis was employed. Correlation analysis is a statistical technique used to measure the direction and magnitude of the relationship between two variables (Saunders et al., 2012). This technique helped identify whether the variables moved together (positively or negatively) and the degree of association between them. A strong correlation would indicate a strong relationship between the BI components and SCM performance.

Additionally, to determine the causality between the variables, the study employed linear regression analysis. Linear regression is a parametric test that models the relationship between one or more independent variables and a dependent variable, providing insights into the predictive power of the independent variables (Obisesan and Femi-Favour, 2023). This analysis was crucial for testing the strength of the BI components' influence on SCM performance. Furthermore, to address any potential issues related to non-normal data distribution, the Wilcoxon signed-rank test was utilized. This non-parametric test compares two related samples and is used when the assumptions of parametric tests, such as normal distribution, are not met (Soekha, 2016; Olaniyi et al., 2024).

The entire hypothesis testing process was conducted using SPSS, a comprehensive statistical tool that allowed for efficient execution of both parametric and non-parametric tests. SPSS facilitated the correlation analysis, regression modeling, and the application of the Wilcoxon signed-rank test, ensuring that the results were reliable and accurate (Saunders et al., 2014). The combination of these statistical methods enabled the study to rigorously test the conceptual model and offer valuable insights into the relationships between BI components and SCM performance. The hypothesis testing procedure employed in this study was grounded in a rigorous statistical framework, drawing from both parametric and non-parametric methods. The use of correlation analysis, linear regression, and the Wilcoxon signed-rank test provided a comprehensive approach to examining the relationships between variables, ensuring the robustness of the findings.

4.10 ETHICAL CONSIDERATION

In this study, obtaining informed consent from all participants was a top priority, reflecting the commitment to ethical standards, particularly in ensuring voluntary participation, confidentiality, and the protection of personal information. Prior to their involvement, participants were thoroughly briefed on the study’s objectives, methodology, potential risks, and anticipated benefits. They were explicitly informed of their right to withdraw from the study at any stage without facing any negative consequences or penalties. This ensured that each participant's decision to engage was fully informed and made of their own volition.

To further safeguard participants, great emphasis was placed on ensuring that their involvement was entirely voluntary. No form of coercion, pressure, or undue influence was exerted to persuade individuals to participate. Participants had complete autonomy to decide whether to partake in the study, based on a clear understanding of its requirements and their personal willingness.

Additionally, stringent measures were employed to maintain the confidentiality of all personal data provided by participants. Any information collected during the study was anonymized, ensuring that participants' identities remained protected. All identifying details were stored separately from the research data, and secure systems were used to prevent unauthorized access to this information. Anonymization techniques, along with encryption protocols, were adopted to guarantee that participants' privacy was upheld at all stages of the research.

Beyond voluntary participation and confidentiality, the study took proactive steps to minimize any potential harm to participants. A comprehensive risk assessment was conducted before the study commenced to identify any potential risks or adverse effects that could arise from participation. This assessment allowed for the implementation of appropriate strategies to mitigate those risks. In cases where participants experienced distress or discomfort during the research process, provisions were made to offer necessary support, including access to resources or counseling. Ultimately, this study adhered strictly to ethical principles, ensuring participants were fully informed, their privacy was protected, and their well-being was prioritized throughout the research process. This approach underscores a commitment to maintaining the integrity of the research and the rights of all participants.

4.11 STUDY LIMITATIONS

Although this study aims to provide meaningful insights into the research topic, it is important to acknowledge certain limitations that could influence the generalizability and strength of the findings. First, the lack of extensive prior research on this specific subject area restricts the availability of established literature and theoretical models to guide the investigation. This gap in foundational knowledge may have limited the comprehensiveness of the background information and theoretical context, which in turn may affect how the study's results are interpreted.

Additionally, the study’s geographic limitations restricted the diversity and representativeness of the sample. Since participants were selected from specific locations or demographic groups, the full range of perspectives and experiences related to the research question may not have been captured. This lack of diversity could constrain the applicability of the findings to broader populations or different settings, potentially limiting their general relevance beyond the study's specific context.

Another significant limitation is the relatively small sample size, which may reduce the statistical power and accuracy of the findings. Smaller samples can make it harder to identify subtle patterns or relationships in the data, increasing the risk of bias or errors. While important insights can still be gained from smaller samples, the ability to detect statistically significant effects, particularly in more complex analyses, may be limited.

However, it is important to emphasize that these limitations do not undermine the overall value of the study's findings. By openly addressing these constraints, the research remains transparent and allows readers to better interpret the results within their context. Additionally, the study's rigorous methodology, which includes careful sampling strategies, robust data collection, and thorough analysis techniques, helps ensure the reliability and validity of the findings. These practices aim to minimize the impact of the identified limitations on the study’s conclusions. These limitations point to avenues for future research, such as expanding the geographical scope, increasing sample sizes, and developing more refined theoretical models to build upon the insights generated by this study.

4.12 SUMMARY OF THE CHAPTER

This section presents the selected research methodology, encompassing the research approach, design, and data collection methods. It also covers the study population, sampling techniques, instrument validity and reliability, pilot testing, data analysis procedures, ethical considerations, and study limitations. The following chapters will focus on testing the hypotheses and providing an in-depth analysis of the data.

CHAPTER FIVE: DATA COLLECTION AND ANALYSIS

5.0 INTRODUCTION

This chapter of the study presents the results of the analysis and some interpretation of the data collected to examine the relationships between business intelligence, supply chain integration and supply chain performance within the Nigerian Manufacturing sector. These analyses are in alignment with literature and the theoretical foundations of the study to address the research objectives and hypotheses developed in earlier chapters.

The chapter provides statistical outcome reports as well as insights into the workings of BI enabled capabilities influence integration and performance in an environment characterised by infrastructural constraints, operational uncertainties and fragmented supply chains. The chapter also presents summaries for the data through its descriptive (building the respondent profile and providing some grounding for subsequent findings) and inferential statistics (evaluating the measurement and structural models developed to test the hypothesised relationships). The data are presented in tables and analysed with the aid of descriptive statistics using Software while the inferential statistics involves the use of structural equations modelling with AMOS Software.

The result from this chapter serves as the foundation for the conclusions and recommendations made as well as the subsequent addressing of the research objective, research questions and the test of the conceptual model developed through the literature review.

5.1 PRELIMINARY DATA PRESENTATION (DEMOGRAPHIC DATA ANALYSES)

The demographic data plays an important role in setting the stage and providing context for understanding the population and interpreting findings (Saunders, Lewis and Thornhill, 2019). These sets of data are fundamental to the analysis and application of research findings (Babbie, 2020). As earlier mentioned, the research participants are professionals and decision makers in some capacity in the manufacturing industry in Nigeria, and their feedback is pivotal as they have hands on knowledge of their supply chains and the applications of BI within the industry. For this study, the demographic considerations were based on the respondent's industry type, the location that the manufacturing company operates in, the position of the respondents, the type of BI systems used in the company, the amount of time the systems have been used, and the size of the organisation. This study was conducted using a purposive sample from the population of companies registered with the manufacturers association of Nigeria (MAN) and were administered using independent research enumerators and retrieved for analysis and testing. 225 questionnaires were distributed to the respondents and 205 fully completed responses were retrieved and used for data analysis.

5.1.1 ANALYSIS OF RESPONDENTS BASED ON INDUSTRY

Table 12 presents the distribution of respondents by industry type, are specified by the Manufacturers Association of Nigeria (MAN).

Table 12: Distribution of respondents based on Industry type

Industry Type			
	Frequency	Percent	Cumulative Percent
Basic Metal, Iron & Steel	4	2.0	2.0
Chemical and Pharmaceuticals	39	19.0	21.0
Domestic/Industrial Plastic & Rubber	57	27.8	48.8
Electrical & Electronics	24	11.7	60.5
Food, Beverages & Tobacco	58	28.3	88.8
Motor Vehicles & Miscellaneous Assembly	6	2.9	91.7
Non-metallic Products	5	2.4	94.1
Pulp, Paper, Printing & Publishing	8	3.9	98.0

Textile, Apparel & Footwear	2	1.0	99.0
Wood & Wood Products	2	1.0	100.0
Total	205	100.0	

Source: SPSS, 2024

The sample includes a diverse range of subsectors with notable concentrations from Food, Beverages & Tobacco (28.3%) and Domestic/Industrial Plastic & Rubber (27.8%). These categories make up more than half of the total respondents, totalling 56.1% when combined. This indicates a strong representation from sectors that are recognised as some of the most active and operationally intensive in the Nigerian manufacturing sector (Nwankwo et al., 2023). This distribution reflects broader patterns within the national industrial landscape, where food processing and plastics/rubber manufacturing constitute major contributors to manufacturing GDP and employment. Their dominance in the sample strengthens the relevance of the study for understanding BI and supply chain integration in high-volume, logistics-intensive environments where timely information, coordination, and operational efficiency are critical. The results also reflect smaller sectors, such as Textile, Apparel & Footwear (1.0%), Wood & Wood Products (1.0%), and Basic Metal, Iron & Steel (2.0%), Chemicals and pharmaceuticals (19.0%), Electrical and Electronics (11.7%) are underrepresented, which is expected according to literature where these sectors face import pressures and limited adoption. Which provides additional breadth to the data set as there is a variety of respondents across sectors. These study findings provide an understanding and enhance the generalisability of the findings across a spread of industries.

5.1.2 ANALYSIS OF RESPONDENTS BASED ON POSITIONS

Table 13 shows the distribution of respondents by job position reveals a predominance of individuals in senior and intermediate roles. Specifically, senior-level respondents account for nearly half of the sample (49.8%), while those at the intermediate level make up 45.4%. Junior positions are less represented, with only 4.9% of respondents. The concentration of respondents in senior and intermediate positions indicates that the study's findings is shaped by insights from more experienced and decision-making employees within their organizations. This distribution implies that the data reflects perspectives associated with strategic thinking, managerial responsibilities, and broader organizational oversight, which are common at senior and intermediate levels.

Table 13: Distribution of respondents based on position

Position within the company			
	Frequency	Percent	Cumulative Percent
Junior	10	4.9	4.9
Intermediate	93	45.4	50.2
Senior	102	49.8	100.0
Total	205	100.0	

Source: SPSS, 2024

The low representation from junior-level employees (4.9%) suggests that the study does not capture as much insight on the views, challenges, or on-the-ground experiences typical at entry or early career stages. As a result, conclusions drawn from this sample may be more relevant to organizational strategies, leadership perspectives, and operational decision-making processes rather than day-to-day operational or entry-level viewpoints. This skew toward senior and intermediate positions enhances the study's relevance for discussions about organizational policy, strategy, and management but might limit its applicability in understanding issues that affect or are perceived differently by junior employees.

5.1.3 ANANLYSIS OF RESPONDENTS BASED ON STATES OF OPERATION

Table 14 shows the distribution of respondents by the state in which their company operates, and it shows that nearly half of the participants are from Lagos, with the remaining respondents primarily from Ogun and, to a lesser extent, Oyo. Specifically, 49.8% of the sample represents Lagos, 37.6% is from Ogun, and 12.7% comes from Oyo. This distribution aligns with the well documented industrial powerhouse that is southwestern Nigeria due to the infrastructural advantages and port proximity and consistent with guidance provided by MAN regarding firms that meet the study's profile. The representation from Lagos and Ogun means that the study's findings reflect the business environment, operational challenges, and industry practices typical of these states but can also be applicable to core Nigerian manufacturing ecosystems.

Table 14: Distribution of respondents based on state of operation

State of Operation				
		Frequency	Percent	Cumulative Percent
	Lagos	102	49.8	49.8
	Ogun	77	37.6	87.3
	Oyo	26	12.7	100.0
	Total	205	100.0	

Source: SPSS.2024

However, the lower representation from Oyo (12.7%) limits the ability to generalize findings to less industrialized states or regions with different economic conditions. Therefore, while the findings may be highly relevant for decision-making and strategic planning in Lagos and Ogun, their applicability to other states with distinct business climates or less developed industrial sectors may be limited. This distribution should be considered when interpreting the results, as it implies that conclusions may largely reflect the characteristics and challenges of these economically active states.

5.1.4 ANALYSIS OF RESPONDENTS BASED ON BI SYSTEMS USED

The data in Table 15 provides insights into the distribution of Business Intelligence (BI) tool usage among respondents. The most used tools include SAP, Oracle, and SAS BI which are all enterprise grade systems that require scalable analytics, integrated data environments and strong reporting capabilities, each representing a significant portion of the sample, while tools like TIBCO and Info Builders are less frequently used.

The distribution of BI tools used suggests that the respondent organizations employ a variety of BI solutions, with a preference for well-established platforms such as SAP, Oracle, and SAS BI. These platforms are known for their robust features, data management capabilities, and compatibility with large enterprise systems, indicating that many of the respondents are from larger, data-driven organizations with complex BI needs.

Microsoft Power BI, Qlik, and Tableau also have significant usage rates, which implies that organizations are interested in interactive, user-friendly data visualization tools that facilitate real-time insights and decision-making. This variety of tools highlights the importance placed on flexible, scalable BI solutions across the sample.

Table 15: Distribution of respondents based on types of BI systems used in their companies

BI systems used			
	Frequency	Percent	Cumulative Percent
Microsoft Power BI	20	9.8	9.8
SAP	32	15.6	25.4
Qlik	25	12.2	37.6
Oracle	31	15.1	52.7
Tableau	24	11.7	64.4

IBM Cognos	24	11.7	76.1
SAS BI	26	12.7	88.8
Info Builders	19	9.3	98.0
TIBCO	4	2.0	100.0
Total	205	100.0	

Source: SPSS, 2024

The lower usage of TIBCO (2.0%) and Info Builders (9.3%) suggests that these tools may be less accessible or suitable for the needs of most organizations in the sample, possibly due to factors like cost, compatibility, or specific feature limitations.

The prevalence of tools such as SAP and Oracle suggest that the respondents are likely operating within sectors that require high-level data analytics and integration capabilities, as these tools are commonly associated with industries such as finance, manufacturing, and large-scale retail. These findings indicate that the respondents' organizations prioritize BI tools that not only support complex analytics but also align with broader enterprise resource planning (ERP) systems. However, the distribution also underscores the diversity in BI tool adoption, which reflect varying organizational sizes, industries, and BI maturity levels within the sample. For BI vendors, this distribution signals a market demand for versatile, comprehensive analytics tools, with an opportunity to increase market share by tailoring solutions to meet the specific needs of different business sizes and sectors. For organizations, this distribution reveals a potential need to assess their BI tool choices continually to ensure alignment with their evolving data needs and competitive requirements.

5.1.5 ANALYSIS OF RESPONDENTS BASED ON THE LENGTH OF TIME OF BI USE

Table 16 shows the data on years of Business Intelligence (BI) tool usage among respondents. It reveals a range of BI adoption levels, from very recent adopters to those with a decade of usage experience. This diversity in BI experience among respondents provides insights into the organizational maturity and likely BI capabilities across the sample.

Table 16: Distribution of respondents based on the number of years of BI systems use

Years of BI usage			
	Frequency	Percent	Cumulative Percent
1	1	.5	.5
2	2	1.0	1.5
3	13	6.3	7.8
4	28	13.7	21.5
5	36	17.6	39.0
6	28	13.7	52.7
7	38	18.5	71.2
8	24	11.7	82.9
9	17	8.3	91.2
10	18	8.8	100.0
Total	205	100.0	

Source: SPSS, 2024

The most common adoption range of BI usage falls between 4 to 7 years, with a notable peak at 7 years (18.5% of respondents), suggesting that a significant portion of organizations have had BI tools in place long enough to move past the phase of early adoption and into optimisation, standardisation and strategic alignment with their BI processes and practices.

This mid-level experience range (4–7 years) reflect that organizations that have implemented BI systems as part of a broader trend toward data-driven decision-making over the past decade, allowing them to refine their BI capabilities without being as deeply entrenched as those with 10 years of usage.

Organizations with 8 to 10 years of BI usage (accounting for a combined 28.8% of respondents) are likely seasoned in integrating BI into their strategic and operational processes. They represent more mature BI users with advanced analytics processes, established data governance frameworks, data-driven cultures, enabling them to leverage BI more effectively in decision-making and competitive analysis thus aligning with theoretical expectations of BI enabled dynamic capabilities.

In contrast, respondents with 1 to 3 years of BI experience (7.8% of the sample) represent newer adopters who may still be in the initial phases of BI implementation, experiencing learning curves and focusing on establishing foundational practices and achieving early insights.

The variation of BI experience highlights a mixed level of BI maturity within the sample, which influences how these organizations perceive the benefits and challenges of BI. Those with longer usage experience are more mature with BI practices, contributing valuable insights about advanced BI applications, strategic alignment, and data optimization. Organizations with shorter usage periods provide insights on the adoption process, common initial challenges, and the early impact of BI on operations and decision-making.

For industry stakeholders and BI vendors, this distribution suggests the need for support tailored to varying experience levels, from onboarding assistance for newer users to advanced analytical tools for long-time users. This segmentation will help vendors better meet the needs of diverse user groups, enhancing their product offerings and support services. Additionally, for BI teams within organizations, understanding their own maturity relative to industry norms can guide continuous improvement efforts, such as training, infrastructure investment, or advanced analytics, to maximize the strategic impact of BI

5.1.6 ANALYSIS OF RESPONDENTS BASED ON THE SIZE OF THE COMPANY

The data in Table 17 provides insights into the distribution of employee sizes within companies using Business Intelligence (BI) tools. Most BI users in this sample are employed by medium and large-sized companies, indicating a strong BI presence in organizations with substantial workforces, where data analytics can play a critical role in operational and strategic functions.

Table 17: Distribution of respondents based on the size of the company

Size of the company			
	Frequency	Percent	Cumulative Percent
Micro	1	.5	.5
Small	1	.5	1.0
Medium	118	57.6	58.5
Large	85	41.5	100.0
Total	205	100.0	

Source: SPSS, 2024

The data shows that medium-sized companies (defined as those typically employing between 50 and 250 people, depending on industry standards) make up the largest group, representing 57.6% of the sample.

Large companies (generally with over 250 employees) account for 41.5% of the respondents.

In contrast, micro and small companies, with fewer than 10 and 50 employees respectively, each represent only 0.5% of the sample. This low representation suggests that very small companies may find it challenging to adopt or benefit from BI due to resource constraints, limited data needs, or lack of specialized staff to manage and interpret data. For these companies, BI solutions may be viewed as less essential or as investments that may be postponed until the organization grows further.

5.2 PRELIMINARY DATA PRESENTATION (DESCRIPTIVE STATISTICS FOR MEASUREMENT ITEMS)

The descriptive statistics for all measured items across the five main constructs—Business Intelligence (BI), Decision-Making Quality, Connectivity, Information Sharing, and Supply Chain Performance (SCP) provide an initial understanding of how respondents perceive BI-enabled capabilities and supply chain outcomes within Nigerian manufacturing firms. Mean values across constructs range from **approximately 3.06 to 3.92**, no missing values in the data set and 205 respondents (N statistic); indicating generally favourable perceptions, while standard deviations between **1.01 and 1.49** reflect moderate variability in responses. Skewness and kurtosis values fall within acceptable ranges for normality, supporting the suitability of the data for subsequent multivariate analysis and SEM.

Table 18: Descriptive statistics for measurement data

FACTOR	N	MINIMUM STATISTIC	MAXIMUM STATISTIC	MEAN STATISTIC	STANDARD DEVIATION
BI1	205	1	5	3.32	1.307
BI2	205	1	5	3.20	1.334
BI3	205	1	5	3.27	1.383
BI4	205	1	5	3.54	1.300

BI5	205	1	5	3.68	1.237
DM1	205	1	5	3.62	1.380
DM2	205	1	5	3.58	1.347
DM3	205	1	5	3.52	1.338
DM4	205	1	5	3.64	1.416
DM5	205	1	5	3.80	1.187
CONNECT1	205	1	5	3.06	1.486
CONNECT2	205	1	5	3.25	1.432
CONNECT3	205	1	5	3.43	1.547
INFOSHARING1	205	1	5	3.27	1.469
INFOSHARING2	205	1	5	3.46	1.484
INFOSHARING3	205	1	5	3.58	1.336
INFOSHARING4	205	1	5	3.40	1.526
INFOSHARING 5	205	1	5	3.58	1.390
SCI1	205	1	5	3.87	1.166
SCI2	205	1	5	3.60	1.286
SCI3	205	1	5	4.03	1.014
SCI4	205	1	5	3.92	1.244

SCI5	205	1	5	3.65	1.242
SCP1	205	1	5	3.50	1.378
SCP2	205	1	5	3.60	1.378
SCP3	205	1	5	3.84	1.323
SCP4	205	1	5	3.86	1.173
SCP5	205	1	5	3.76	1.291
SCP6	205	1	5	3.88	1.235

5.2.1 BUSINESS INTELLIGENCE

The BI items show mid-to-high mean scores ranging from 3.20 - 3.68 with a standard deviation of 1.23 -1.38, suggesting that respondents perceive BI systems as moderately well adopted and useful within their organisations. The moderate standard deviations indicate non-uniform BI adoption across firms, consistent with known disparities in digital capability within Nigerian manufacturing. Some firms appear highly data-driven, while others remain early-stage BI users.

5.2.2 DECISION MAKING

Decision-making items show consistently positive means ranging from 3.52 – 3.80 with a standard deviation ranging from 1.18 – 1.41, indicating that BI tools are perceived as contributing to improved judgement, faster decisions, enhanced accuracy, and better use of information. The higher mean values relative to other constructs suggest that BI is strongly impacting in the decision-making domain.

5.2.3 CONNECTIVITY

Connectivity shows mean values ranging from 3.06 – 3.41 and standard deviation values of 1.43 – 1.49. Though these means are still above the neutral midpoint, the values are reflective of the technical and infrastructural constraints remain significant barriers to seamless connectivity within supply chains in Nigeria.

5.2.4 INFORMATION SHARING

Information sharing exhibits mean scores ranging from 3.27 – 3.58 with standard deviation values ranging from 1.33 – 1.48, signalling moderate but uneven openness of the respondents in communicating operational data within and across organisations. Highest means appear in items relating to sharing relevant and timely information, while lower scores relate to complete and sensitive communication. In Nigeria's manufacturing environment, characterised by supplier unreliability, and general documentation inconsistency and secrecy around information sharing challenges are well-documented. Thus, the descriptive findings reinforce why BI is positioned in your model as a *driver* of information sharing, rather than an outcome.

5.2.5 SUPPLY CHAIN INTEGRATION

Supply chain integration presents with mean values ranging from 3.60 – 4.03 with standard deviation values ranging 1.01 – 1.24 and these values suggest that firms perceive a reasonable degree of alignment and collaboration both internally (across functional units) and externally (with supply partners). However, the variability reflected in the standard deviations indicates that the maturity and effectiveness of integration practices differ significantly across organisations.

5.2.6 SUPPLY CHAIN PERFORMANCE

Supply chain performance items exhibit some of the highest mean values across the dataset with values ranging 3.50 - 3.88 and standard deviation values ranging 1.17 – 1.37, especially on indicators related to risk management, delivery reliability, and cost efficiency. The combination of high means and moderate variability suggests that firms perceive themselves as performing well despite systemic constraints.

5.3 INSTRUMENT VALIDATION

The reliability and validity assessment was conducted to ensure that the scales used to measure Business Intelligence (BI), Decision-Making Quality, Connectivity, Information Sharing, Supply Chain Integration (SCI), and Supply Chain Performance (SCP) were statistically sound and conceptually consistent with the theoretical underpinnings of the study. The results indicate a measurement model with satisfactory internal consistency, convergent validity, and discriminant validity across most constructs. More importantly, these results confirm that the constructs operate as theoretically expected within the Nigerian manufacturing context.

5.3.1 INTERNAL CONSISTENCY RELIABILITY

Reliability analysis is the process of evaluating the consistency and validity of any measurement instrument across measurement items. It is important to ensure any measurement scale consistently measures the intended construct (Tavakol and Dennick, 2011). Reliability is commonly measured using Cronbach's alpha. Cronbach's alpha reliability test assesses the internal consistency of the latent indicators of the major constructs. An Alpha value of 0.7 or above is typically considered acceptable, indicating that the items measure a single construct effectively (Nunally and Bernstein, 1994).

Table 19: Reliability statistics (Cronbach's alpha)

Variables	**No. of items**	**Alpha Coefficients**
Business Intelligence	5	0.769
Connectivity	3	0.730
Information Sharing	5	0.755

Decision making	5	0.741
Supply Chain Integration	5	0.788
Supply Chain Performance	6	0.864

As seen in the table above, business intelligence has a Cronbach's Alpha of 0.769 suggesting a moderate but stable level of internal consistency, consistent with the understanding of BI maturity levels in Nigerian manufacturing. This value implies that the Business Intelligence construct reliably represent BI functionalities in generally consistent ways but with some variability likely due to BI experience, integration challenges etc.

Connectivity achieves a Cronbach's Alpha of 0.730, indicating that the items within this construct are consistent in measuring aspects related to connectivity. Although it has fewer items than other constructs, the Alpha value surpasses the standard threshold, affirming that it is a reliable measure.

Information Sharing has a Cronbach's Alpha of 0.755, which also demonstrates solid internal consistency. This means that the items intended to capture the concept of information sharing in the context of the study are aligned and provide reliable data.

Supply Chain Integration has a Cronbach's Alpha of 0.788 for 5 items. This slightly higher alpha value reflects a reliable consistency among the items related to integration within the supply chain, confirming that this construct is measured reliably and can be considered consistent in capturing participants' perceptions of supply chain integration.

Supply Chain Performance has the highest Cronbach's Alpha of 0.864 across 6 items, signifying excellent internal consistency. This indicates that the items collectively capture the various dimensions of supply chain performance in a way that is both reliable and coherent.

The high alpha value suggests that responses across the 6 items are consistent, providing strong evidence of the construct's reliability.

Overall, the Cronbach's Alpha values for these constructs indicate that each one exhibits substantial reliability, with all values meeting or exceeding the accepted threshold for consistency. This reliability reinforces the validity of the constructs and ensures confidence in the inclusion of the constructs for confirmatory factor analysis (CFA) and structural equation modelling (SEM).

5.3.2 MEASUREMENT MODEL VALIDITY

The measurement model in this study is reflective, and the theoretical path of causality is from constructs to items. In the reflective model, latent variables affect the manifest variables. As Fornell and Bookstein (1982) indicated the reflective construct is often seen as giving rise to its indicators.

As referred to in the methodology chapter, confirmatory factor Analysis was conducted for the variables BI, Supply Chain Integration, Supply Chain Performance, Connectivity, Decision Making, and Information Sharing to validate measurement models prior to SEM.

Table 20: Standardised CFA Loadings

FACTORS	ITEMS	FACTORS LOADINGS
BUSINESS INTELLIGENCE	BI1	0.692
	BI2	0.710
	BI3	0.666
	BI4	0.558
	BI5	0.423
CONNECTIVITY	CONNECT1	0.761
	CONNECT 2	0.753
	CONNECT3	0.547

DECISION MAKING	DM1	0.708
	DM2	0.756
	DM3	0.817
	DM4	0.687
	DM5	0.508
INFORMATION SHARING	IF 1	0.622
	IF 2	0.807
	IF3	0.764
	IF4	0.740
	IF5	0.773
SUPPLY CHAIN INTEGRATION	SCI 1	0.521
	SCI2	0.681
	SCI3	0.589
	SCI4	0.716
	SCI5	0.701
SUPPLY CHAIN INTEGRATION	SCP1	0.846
	SCP2	0.766
	SCP3	0.683
	SCP4	0.742
	SCP5	0.588
	SCP6	0.738

All items loaded significantly ($p < .001$) on their respective constructs, with loadings ranging between 0.423 and 0.846, demonstrating strong relationships between items and latent variables. This supports the construct dimensionality in line with SEM expectations (Fornell & Larcker, 1981).

5.3.2.1 COMPOSITE RELIABILITY

Composite Reliability (CR) is a measure of internal consistency that evaluates how well the items for each construct correlate with each other. This is calculated by squaring the factor loadings and averaging them, and based on the high factor loadings observed, the data demonstrates good composite reliability. The high factor loadings suggest that the **composite reliability** of the constructs is strong. The composite reliability values for all the constructs exceeded the recommended 0.70 threshold which indicate strong internal consistency and confirm that the constructs exhibit adequate reliability beyond Cronbach's alpha. The high CR further supports their suitability for inclusion in the structural model.

Table 21: Composite Reliability Values

Reliability

Factor	Coefficient
BI	0.775
DM	0.739
CN	0.701
SCI	0.785
SCP	0.807
IF	0.769

5.3.2.2 AVERAGE VARIANCE EXTRACTED (AVE) AND CONVERGENT VALIDITY

The Average Variance Extracted (AVE) measures the amount of variance captured by a construct relative to the variance due to measurement error. Convergent Validity refers to the degree to which items that are intended to measure the same construct correlate with each other. In this case, the items for Information Sharing, Business Intelligence, Decision Making, and other constructs load strongly on their respective components, indicating that these items are measuring the same underlying construct.

Table 22: Average variance extracted values

FACTOR	AVE
BI	0.544
DM	0.418
CN	0.521
SCI	0.565
SCP	0.662
IF	0.460

From table 22, the AVE values range from 0.418 to 0.662 and several constructs exceeded the recommended threshold of 0.50 and the remaining constructs fell slightly short. It is important to note that although some AVE values fall below the ideal cut-off, convergent validity is not automatically rejected. Hair et al. (2019) gives a provision that when CR values are high (≥ .70**)**, convergent validity can still be considered acceptable even if AVE is marginally below 0.50. This pattern is typical in multi-dimensional behavioural constructs, where Indicators capture diverse conceptual aspects (which is true of the concepts, as BI, Information sharing etc, are fairly connected and multifaceted and have some overlap), Constructs reflect broad managerial processes, Contextual variation is high (the variability that exists in levels of BI maturity across the companies, as well as variation in levels of supply chain integration, and performance due to infrastructure and varying levels of automation). It is important to note that the AVE is representative of the real-world complexity of the Nigerian manufacturing sector.

5.3.2.3 DISCRIMINANT VALIDITY

Discriminant Validity assesses whether constructs are sufficiently distinct from each other, meaning that items from different constructs should load on separate components. From the data in table 23, it can be observed that the items for different constructs, such as Information Sharing and Business Intelligence, load on separate components.

There are various methods of estimating discriminant validity and one of such is the Fornell and Larcker criterion, which suggests that constructs are considered to have good discriminant validity, if the square root of AVE of each latent variable is higher than its correlation with any other constructs, (Hair et al, 2012) pointed out that (However, Henseler et al. (2015) argued that a new criterion called the Heterotrait-Monotrait ratio (HTMT) is a better evaluation indicator of discriminant validity. The ratio is calculated based on the average value of the correlations between different aspects of the model structure. This study utilised HTMT criterion to test discriminant validity, the results show that the HTMT ratio among paired structures is lower than 0.90 (Table 23).

Table 23: Heterotrait-monotrait ratio (Discriminant Validity)

BI	DM	CN	SCI	SCP	IF
0.572					
0.755	0.669				
0.628	0.614	0.678			
0.419	0.749	0.511	0.642		
0.834	0.701	0.805	0.728	0.591	

It can be seen in table 21 that construct pairs particularly involving Business Intelligence, and Information Sharing are especially close the HTMT threshold of <0.85 (strict) 0.90

(liberal). This suggests conceptual overlap. This overlap is explained in the fact the constructs have close theoretical relationships as BI, Information Sharing, and Decision-Making and connectivity are tightly interrelated concepts. According to the Dynamic Capabilities Theory, operational capabilities (like decision-making and information sharing) often exhibit interdependence because they participate in the same sensing–seizing–transforming mechanisms (Teece, 2007).

Thus, the observed HTMT levels reflect high coherence between BI-enabled managerial processes, the integrated nature of digital supply chain capabilities, realistic organisational dynamics in Nigerian manufacturing.

5.3.2.5 KAISER-MEYER-OLKIN AND BARTLETT'S TEST OF SPHERICITY

The Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity were conducted to assess the strength of relationships among the variables and determine the suitability of the dataset for factor analysis.

Table 24: KMO and Bartlett's test of sphericity

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.870
Bartlett's Test of Sphericity	Approx. Chi-Square	3361.347
	df	465
	Sig.	.000

KAISER-MEYER-OLKIN (KMO)

The KMO value obtained was 0.870, which exceeds the commonly accepted threshold of 0.7, indicating that the sampling adequacy is "meritorious" and supports the use of factor analysis. KMO values range from 0 to 1, with values above 0.5 considered acceptable for factor analysis. The value of 0.870 suggests a strong correlation among the variables and confirms that the dataset is appropriate for further analysis.

BARTLETT'S TEST OF SPHERICITY

The results of Bartlett's Test of Sphericity show a chi-square value of 3361.347, with 465 degrees of freedom and a significance level (p-value) of 0.000. This p-value is highly significant ($p < 0.05$), leading to the rejection of the null hypothesis, which states that the sample is not adequate for factor analysis. In other words, the test confirms that the correlation matrix is not an identity matrix and that there are meaningful correlations among the variables, making the data suitable for factor analysis. These results indicate that the data is well-suited for factor analysis. The KMO value of 0.870 reflects strong sampling adequacy, while the highly significant result from Bartlett's Test ($p <0.001$) confirms that the variables are sufficiently correlated for meaningful factor extraction. Thus, both tests provide strong evidence for the appropriateness of the data set for factor analysis.

5.4 MODEL DATA ANALYSIS

5.4.1 STRUCTURAL EQUATION MODEL (SEM) ANALYSIS

Structural Equation Modelling (SEM) was chosen as the analytical method for this study due to its effectiveness in validating theoretical models quantitatively. As noted by Schumacker and Lomax (2010), SEM has become the preferred method for confirming or disconfirming theoretical models because of its ability to simultaneously examine complex relationships among multiple variables. Unlike traditional regression techniques, SEM integrates both factor analysis and regression modelling, allowing researchers to account for measurement errors and assess both direct and indirect relationships between constructs. This makes it particularly useful in studies involving latent variables—constructs that cannot be directly observed but are inferred from multiple indicators.

The process of conducting SEM follows a structured sequence of five key steps: model specification, model identification, model estimation, model testing, and model modification. These steps, as outlined by Kline (2004), Schumacker and Lomax (2010), and Wang and Wang (2012), provide a systematic approach to developing and refining a model to ensure that it accurately represents the relationships between variables.

The first step, model specification, involves translating theoretical assumptions into a statistical model. This requires defining the relationships between observed and latent variables, specifying which variables are exogenous (independent) and which are endogenous (dependent). The process is guided by prior empirical research and theoretical frameworks, ensuring that the model is logically sound. Typically, researchers use path diagrams to visually represent the assumed relationships between constructs, which helps in structuring the model effectively. Once the model is specified, the next step is model identification, which determines whether the model can be estimated based on the available data. This step assesses whether there are enough degrees of freedom to produce unique parameter estimates.

A model can be under identified, just identified, or overidentified. An under identified model has more parameters than data points, making estimation impossible. A just- identified model has exactly enough data to estimate all parameters, but it lacks flexibility for testing model fit. An overidentified model, which is preferred, has more data points than required for estimation, allowing for statistical validation of the model's goodness of fit.

Following identification, model estimation is conducted to compute parameter values that best reproduce the observed data while adhering to the theoretical structure. Various estimation methods can be used, including Maximum Likelihood Estimation (MLE), Generalized Least

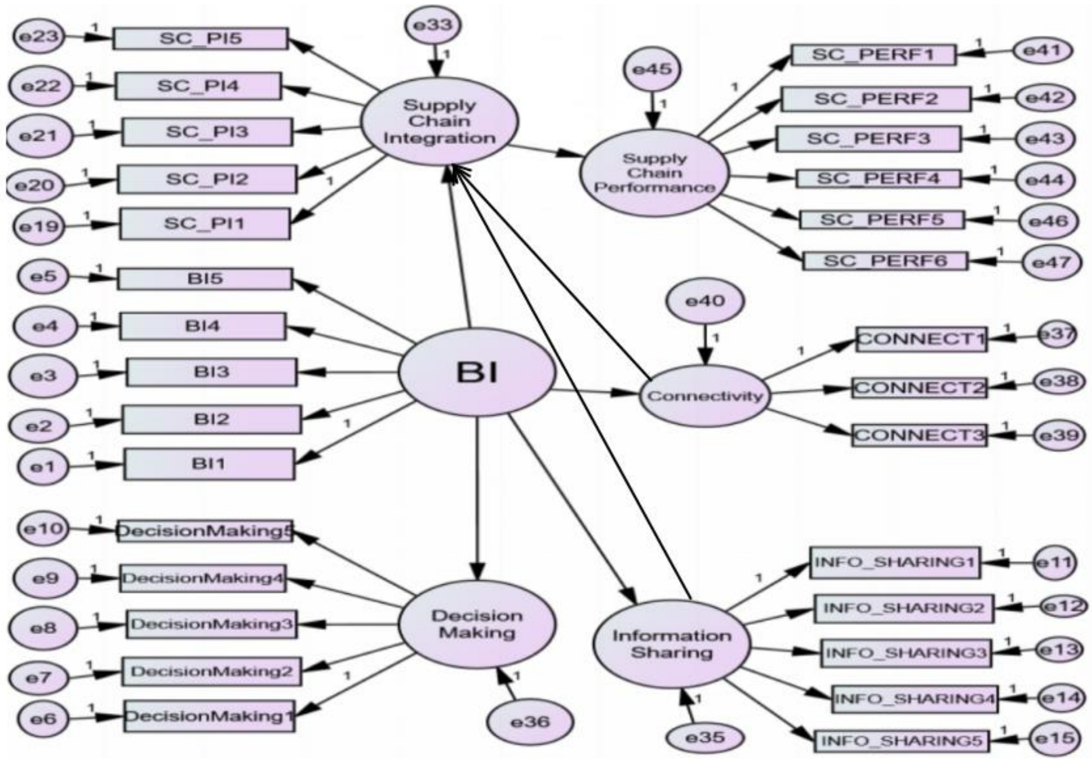
Squares (GLS), and Bayesian Estimation. MLE is the most used method, as it assumes multivariate normality and provides reliable estimates under most conditions. The goal of estimation is to derive the optimal parameter values that minimize discrepancies between the observed data and the hypothesized model.

Various estimation methods can be used, including Maximum Likelihood Estimation (MLE), Generalized Least Squares (GLS), and Bayesian Estimation. MLE is the most used method, as it assumes multivariate normality and provides reliable estimates under most conditions. The goal of estimation is to derive the optimal parameter values that minimize discrepancies between the observed data and the hypothesized model. Goodness-of-fit indices are used to assess this fit, including the Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), and Chi-Square (χ^2) test. RMSEA values below 0.08 indicate an acceptable fit, while CFI and TLI values above 0.90 suggest a well-fitting model. The Chi-Square test assesses whether the estimated model significantly deviates from the observed data, with lower values indicating a better fit. If the model does not achieve an acceptable fit, further modifications may be necessary.

SEM provides a comprehensive framework for testing theoretical models by systematically specifying, estimating, testing, and refining relationships between variables. When applied rigorously, SEM enhances the validity of research findings by offering a precise representation of complex interactions, contributing to both theoretical advancements and practical applications in various fields.

5.4.2 THE HYPOTHESIZED MODEL

Figure 3: *Path diagram for the hypothesised model*



The hypothesized model, the model depicted in Figure 3, was tested as SEM-A. Following Hair et al (2006) recommendation, The model-fit indices for the hypothesized model are: Root Mean Square Error of Approximation (RMSEA) = ≤ 0.05 indicates a good fit,, Comparative Fit Index (CFI) = ≥ 0.960 indicates a good fit, Tucker-Lewis index (TLI)=TLI ≥ 0.953 indicates a good fit, and Normed Fit Index (NFI) = NFI ≥ 0.950 indicates an acceptable fit, Goodness of Fit Index (GFI) = ≥ 0.901 is the threshold for an acceptable fit., Akaike Information Criteria (AIC) = 456.004 and Log likelihood (Chi-Square Value) = 978.18. Following Hair et als (2006) recommendation, The model-fit indices for the hypothesized model are: Root Mean Square Error of Approximation (RMSEA) = ≤ 0.05 indicates a good fit,, Comparative Fit Index (CFI) = ≥ 0.960 indicates a good fit, Tucker-Lewis index (TLI)=TLI ≥ 0.953 indicates a good fit, and Normed Fit Index (NFI) = NFI ≥ 0.950 indicates an acceptable fit, Goodness of Fit Index (GFI) = ≥ 0.901 is the threshold for an acceptable fit., Akaike Information Criteria (AIC) = 456.004 and Log likelihood (Chi-Square Value) = 978.18

The path diagram along with the analysis results for model SEM-A are provided in Figure 3 above.

Table 25: Model fit indices for hypothesised model SEM-A

Goodness of fit indices	Results	Recommended range
RMSEA	0.06	< 0.05 Indicative fit (Hu & Bentler, 1998) 0.05 to 0.08 fair fit (Hu & Bentler, 1998) 0.08 to 0.10 Mediocre fit (Hu & Bentler, 1998) (Hooper et al., 2008)
CMIN/DF	1.268	< 2 Good fit (Cangur & Ercan, 2015) < 3 Good (Ryu et al., 2009) < 5 Acceptable (Hooper et al., 2008
TLI	.953	> 0.9 Good fit (Iacobucci, 2010)
CFI	0.960	> 0.9 Good fit (Sharma et al., 2005)

5.4.3 GOODNESS OF FIT INDICES

The data displayed in the table 25 above provides insights into the model fit for three different models: the Default model, the Saturated model, and the Independence model. Each of these models reflects different degrees of fit between the observed data and the predicted outcomes, with implications for how Business Intelligence (BI), Supply Chain Integration, and Supply Chain Performance are managed in practice.

The Default model shows a moderate Root Mean Square Residual (SRMR) value of 0.401, indicating that the residuals (differences between observed and predicted data) are relatively small and suggest that the model explains the data reasonably well. The Goodness of Fit Index (GFI) of 0.901 is a strong indicator of a good fit, since values closer to 1.0 represent an ideal model fit. The Adjusted Goodness of Fit Index (AGFI) of 0.910 reinforces this finding, showing that the model explains a substantial amount of the variance in the data, while also adjusting for the degrees of freedom. Additionally, the Parsimony Goodness of Fit Index (PGFI) of 0.754 indicates that the model strikes a balance between complexity and fit, suggesting it is both effective and efficient in explaining the data.

the Default model has a CMIN value of 451.814 and a CMIN/DF ratio of 1.268, which is within the acceptable range (typically ≤ 3.0 or ≤ 5.0). This suggests a reasonable fit between the model and the observed data, implying that the system in place is capturing the real-world operations of the supply chain effectively. With a statistically significant p-value of 0.050, this model indicates that the supply chain is functioning well, and the integration of business intelligence (BI) tools is aligned with the actual performance of the supply chain.

The hypothesised model reflects a system that is reasonably well-aligned with actual data and performs efficiently, providing useful insights through business intelligence and fostering good integration across the supply chain. The Saturated model, while reflecting an idealized scenario of perfect fit and integration, is unrealistic in practice and should be seen as a benchmark rather than a goal.

The given data for Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) provide valuable insights into the fit of various models in explaining supply chain dynamics, business intelligence, and supply chain performance. The Default model shows impressive fit indices with a CFI of 0.960 and a TLI of 0.953. Both values are well above the commonly accepted threshold of 0.90, which suggests that the hypothesized model closely represents the observed data. In business terms, this indicates that the system used to analyse the supply chain is functioning effectively. Business intelligence (BI) tools, in this case, are providing accurate and actionable insights.

ROOT MEAN SQUARE ERROR OF APPROXIMATION (RMSEA)

The Root Mean Square Error of Approximation (RMSEA) is a measure used to evaluate the goodness of fit of a model in structural equation modelling (SEM). It assesses how well a model approximates the observed data, with lower values indicating a better fit. The ideal RMSEA value is typically below 0.08, while values closer to 0 indicate an excellent fit.

The Default model shows an RMSEA value of 0.06, which is well within the acceptable threshold of 0.08, indicating a good fit between the hypothesized model and the observed data. Additionally, the confidence interval for the RMSEA (ranging from 0.034 to 0.068) suggests that the model's fit is consistent and stable. The PCLOSE value of 0.850 further supports this conclusion, as it is above the typical threshold of 0.05, indicating that the model fits the data well and there is no significant lack of fit.

AKAIKE INFORMATION CRITERIA

The Akaike Information Criterion (AIC), along with other model fit indices such as BCC, BIC, and CAIC, provides valuable insights into the effectiveness of a model in balancing fit and complexity. In the context of this study, these metrics help to assess whether the model appropriately captures the relationships and dependencies between various variables while maintaining parsimony and accuracy.

For the model, the AIC is 456.004, which is the lowest among the three models presented. This suggests that the model strikes an optimal balance between fitting the data well and avoiding unnecessary complexity. The relatively low BCC of 467.908 and BIC of 520.100 further support the idea that the Default model is effective in explaining the data while penalizing complexity. The CAIC value of 530.101 also indicates that the model fits well relative to its complexity. In the context of business intelligence, this means that the model provides insights that are actionable, accurate, and relevant to decision-makers without overloading them with unnecessary details. The Default model helps in generating reliable forecasts and optimizing business strategies with a clear, data-driven approach.

The regression results provide strong evidence that Business Intelligence has a positive and significant impact on key organizational constructs, including Supply Chain Integration, Decision Making, Information Sharing, and Connectivity. Additionally, Supply Chain Integration plays a crucial role in improving Supply Chain Performance. These findings underscore the strategic importance of BI in optimizing supply chain efficiency and overall business operations.

The findings indicate that BI positively influences Supply Chain Integration, as evidenced by a regression weight of 0.663, a critical ratio (C.R.) of 7.252, and a statistically significant p-value. Similarly, BI has a positive influence on Decision Making, with a regression coefficient of 0.600 and a critical ratio of 6.077. Additionally, the analysis shows that BI significantly enhances Information Sharing, as indicated by a regression estimate of 0.983 and a C.R. of 7.818.

Connectivity is another crucial aspect influenced by BI, with the highest regression weight in the model at 0.779 and a critical ratio of 10.066.

Furthermore, the relationship between Supply Chain Integration and Supply Chain Performance is both positive and significant, with a regression coefficient of 0.741 and a critical ratio of 5.523

5.4.4 MEDIATION ANALYSIS

This section provides an in-depth discussion of the mediation analysis results presented in Table 26 focusing on the indirect and serial mediation pathways through which Business Intelligence (BI) influences Supply Chain Integration (SCI) and Supply Chain Performance (SCP) in the Nigerian manufacturing sector. The mediation analysis was conducted using bootstrapped confidence intervals, enabling inference regarding the presence or absence of mediation effects. The discussion is grounded in the theoretical foundations of information processing theory, dynamic capabilities theory, and supply chain integration literature, while also reflecting the contextual realities of manufacturing firms operating in emerging economies.

The results demonstrate that mediation within the proposed model is selective rather than universal. Specifically, connectivity emerges as a central transmission mechanism linking BI to integration and performance outcomes, while information sharing does not exhibit a statistically significant mediating role. This pattern offers important theoretical, methodological, and practical insights into how BI-enabled capabilities are operationalised within Nigerian manufacturing supply chains.

Table 26: Mediation results

Indirect effects

	Estimate	Std. Error	z-value	p	95% Confidence interval	
					Lower	Upper
BI → CN → SCI	0.770	0.722	2.451	.014	0.355	3.185
BI → CN → SCI → SCP	0.725	0.523	2.342	.019	0.200	2.251
BI → IF → SCI	-0.694	1.120	-0.619	.536	-2.890	1.502
BI → IF → SCI → SCP	-0.480	0.775	-0.620	.535	-1.999	1.038
CN → SCI → SCP	0.826	0.466	2.415	.016	0.212	2.040
IF → SCI → SCP	-0.579	0.933	-0.621	.535	-2.408	1.249
BI → SCI → SCP	0.792	0.638	-0.458	.647	-1.543	0.959

Table 27: Mediation results

Total effects

	Estimate	Std. Error	z-value	p	95% Confidence interval	
					Lower	Upper
BI → SCI	0.654	0.067	9.764	< .001	0.523	0.785
BI → SCP	0.453	0.068	6.702	< .001	0.320	0.585
BI → CN	0.788	0.077	14.173	< .001	0.938	1.239
BI → IF	0.829	0.078	10.598	< .001	0.676	0.983
BI → DM	0.478	0.078	6.109	< .001	0.325	0.632
CN → SCI	0.626	0.646	2.518	< .001	0.360	2.892
CN → SCP	0.426	0.466	2.415	< .001	0.212	2.040

Total effects

	Estimate	Std. Error	z-value	p	95% Confidence interval	
					Lower	Upper
IF → SCP	-0.579	0.933	-0.621	< .001	-2.408	1.249
IF → SCI	-0.837	1.350	-0.620	< .001	-3.483	1.810
SCI → SCP	0.692	0.099	7.005	< .001	0.499	0.886

Mediation analysis was employed to move beyond the examination of direct relationships and to uncover the mechanisms through which BI exerts its influence on downstream supply chain outcomes. While structural equation modelling established the overall relationships among latent constructs, the mediation analysis provided additional clarity regarding *how* and *through which pathways* BI translates into integration and performance benefits.

The model examined both single-step mediation (e.g., BI → Connectivity → SCI) and (BI →SCI → SCP) as well as serial mediation (e.g., BI → Connectivity → SCI → SCP). Bootstrapping was used to assess the statistical significance of indirect effects, with mediation supported when the 95% confidence interval did not include zero. This approach aligns with best practice in contemporary mediation analysis and avoids the limitations associated with traditional causal-step approaches.

5.4.5 THE RELATIONSHIP BETWEEN BI CONNECTIVITY AND SUPPLY CHAIN INTEGRATION

One of the most important findings from the mediation analysis is the significant indirect effect of BI on SCI through connectivity. The pathway BI → Connectivity → SCI is statistically significant, with a bootstrapped confidence interval that excludes zero. This result provides strong evidence that connectivity mediates the relationship between BI and supply chain integration.

Conceptually, this finding suggests that BI does not enhance integration directly by itself. Rather, BI strengthens the technological and informational linkages that connect internal functions and external supply chain partners, and these enhanced linkages subsequently enable more effective integration. Connectivity, in this sense, represents the infrastructural and systems-level capability that allows BI outputs to be embedded into operational processes.

5.4.6 THE RELATIONSHIP BETWEEN BI CONNECTIVITY SUPPLY CHAIN INTEGRATION AND SUPPLY CHAIN PERFORMANCE

The most substantial contribution of the mediation analysis lies in the identification of a significant serial mediation pathway linking BI to supply chain performance through connectivity and supply chain integration. The indirect effect BI → Connectivity → SCI → SCP is statistically significant, providing clear evidence that BI influences performance through a sequence of operational mechanisms rather than through a single direct pathway.

This serial mediation result indicates that BI-enabled analytics first enhance connectivity by improving system interoperability, data accessibility, and real-time information exchange. Improved connectivity then facilitates deeper supply chain integration, characterised by coordinated planning, aligned processes, and collaborative decision-making. Finally, this enhanced integration translates into improved supply chain performance outcomes, including responsiveness, reliability, and cost efficiency.

Importantly, these finding challenges simplistic assumptions that BI adoption automatically leads to superior performance. Instead, it underscores the idea that performance gains are contingent on the successful embedding of BI within broader supply chain capabilities. BI serves as an enabling resource, but its value is realised only when it is transformed into integration through connectivity.

5.4.7 THE NON-SIGNIFICANCE OF INFORMATION SHARING AS A MEDIATOR

In contrast to connectivity, information sharing does not emerge as a significant mediator in any of the tested pathways. Neither the BI → Information Sharing → SCI pathway nor the serial pathway BI → Information Sharing → SCI → SCP is statistically significant, as the corresponding confidence intervals include zero.

This finding warrants careful interpretation. Rather than indicating that information sharing is unimportant, the results suggest that information sharing does not function as an independent transmission mechanism in the presence of connectivity and integration. In other words, information sharing may be embedded within, or subsumed by, broader connectivity-enabled processes.

From a methodological perspective, the non-significance of information sharing also aligns with earlier discriminant validity findings that indicated substantial overlap between BI and information sharing. The mediation results reinforce the conclusion that information sharing, as measured in this study, does not operate as a distinct causal mechanism but is closely intertwined with BI-enabled connectivity.

5.4.8 REGRESSION ANALYSIS: HYPOTHESIS TESTING

The hypotheses were tested to examine the relationships between the study variables, assessing both the direction and strength of these relationships. Specifically, the analysis aimed to determine whether the associations among the variables were statistically significant, providing empirical support for the proposed theoretical framework. Statistical significance was assessed based on p-values and confidence intervals, ensuring that the findings were robust and generalizable.

The following sections present a detailed discussion of the hypotheses tested, including the estimated path coefficients, standardized regression weights, and their corresponding significance levels. These results provide insights into the nature of the relationships between the key constructs and their implications for the study's theoretical contributions and practical applications.

The structural equation modelling (SEM) analysis examined the relationships among Business Intelligence (BI), Supply Chain Integration (SCI), Decision-Making (DM), Information Sharing (IS), Connectivity (C), and Supply Chain Performance (SCP). The results indicate that Business Intelligence (BI) significantly influences key supply chain processes, which in turn drive overall performance. The estimated path coefficients, standard errors, critical ratios, and significance values are presented in the analysis below

Table 28: Regression Coefficients

Regression coefficients

Outcome	Predictor		Estimate	Std. Error	p
CN	BI	A	0.779	0.127	< .001
DM	BI	B	0.600	0.075	< .001
IF	BI	C	0.834	0.078	< .001
SCI	CN	D	0.746	0.092	< .001
	IF	E	0.671	0.122	< .001
	BI	F	0.663	0.091	< .001
SCP	SCI	G	0.826	0.104	< .001

HYPOTHESIS ONE

H_1: The use of Business Intelligence within supply chain processes significantly influences decision-making.

The influence of BI on Decision-Making (DM) was found to be significant, with a path coefficient of 0.600, an S.E. of 0.075, and a C.R. of 6.077 ($p < 0.001$). This finding confirms that BI contributes to improved decision-making by providing actionable insights and data-driven intelligence, allowing supply chain managers to make informed and strategic choices.

The first hypothesis (H_1) proposed that the use of Business Intelligence (BI) within supply chain processes significantly optimizes decision-making. The results of the statistical analysis, as presented in table 27 demonstrate a positive linear relationship between Business Intelligence and decision-making in supply chain processes. Specifically, the regression estimate ($\beta = 0.600$, $p < 0.001$) indicates that Business Intelligence has a statistically significant influence on supply chain decision-making. Since the p-value is less than 0.05, supports the hypothesis (H_1), which asserts that Business Intelligence positively affects decision-making within supply chain processes. The regression coefficient of 0.600 suggests that a one-unit increase in Business Intelligence corresponds to a 0.600 standard deviation increase in supply chain decision-making effectiveness. This finding underscores the importance of leveraging Business Intelligence tools and technologies to enhance decision-making

The confirmation of a significant relationship between Business Intelligence and supply chain decision-making has several practical and theoretical implications. From a strategic decision-making perspective, businesses should prioritize investments in Business Intelligence tools, as they directly contribute to better decision-making capabilities within supply chain processes. Decision-makers should leverage BI to gain real-time operational insights, enabling them to optimize inventory management, demand forecasting, and supplier collaboration

The acceptance of H_1 provides strong empirical evidence that Business Intelligence significantly optimizes decision-making within supply chain processes. The positive linear relationship ($\beta = 0.600$, $p < 0.001$) confirms that organizations that investment in BI solutions benefit from better strategic planning, improved operational efficiency, and enhanced responsiveness to market changes.

HYPOTHESIS TWO

H_2: The use of Business Intelligence within supply chain processes significantly influences connectivity.

The findings also reveal a strong positive association between BI and Connectivity (C), as reflected by a path coefficient of 0.779, an S.E. of 0.127, and a C.R. of 10.066 ($p < 0.001$). This suggests that the adoption of BI significantly strengthens supply chain connectivity, ensuring better linkages between supply chain partners and systems.

The Influence of Business Intelligence on Connectivity within Supply Chain Processes. The second hypothesis (H_2) proposed that the use of Business Intelligence (BI) has a positive influence the creation of connectivity within supply chain processes. However, the results of the statistical analysis, as presented in (SEM-A), reveal a positive linear relationship between Business Intelligence and connectivity within supply chain processes.

Specifically, the regression estimate ($\beta = 0.779$, $p = 0.000$) indicates that Business Intelligence has a statistically significant effect on supply chain connectivity. Since the p-value is less than 0.05, supporting the alternative hypothesis (H_2), which asserts that Business Intelligence plays a critical role in enhancing connectivity within supply chains. The regression coefficient of 0.779 suggests that a one-unit increase in Business Intelligence results in a 0.779 standard deviation increase in connectivity within supply chain processes. This substantial positive impact underscores the essential role of Business Intelligence in fostering seamless integration and communication among supply chain entities.

Connectivity in supply chains refers to the seamless integration and communication between different stakeholders, including suppliers, manufacturers, distributors, and customers. Business Intelligence enhances this connectivity by providing real-time data insights, automating information flows, and fostering efficient collaboration. The strong positive relationship observed between BI and connectivity within supply chains can be attributed to several key factors: Business Intelligence systems facilitate the instantaneous exchange of data across different nodes of the supply chain. By integrating cloud-based BI tools, organizations can ensure that suppliers, manufacturers, and logistics partners have synchronized access to inventory levels, order statuses, and demand forecasts. This real-time data exchange minimizes delays, enhances coordination, and improves decision-making accuracy.

The confirmation of a significant relationship between Business Intelligence and supply chain connectivity has several strategic and operational implications for businesses, policymakers, and supply chain managers. The positive linear relationship ($\beta = 0.779$, $p < 0.001$) highlights the vital role BI plays in fostering seamless communication, collaboration, and integration across supply chain networks.

HYPOTHESIS THREE

H_3: The use of Business Intelligence has an impact on information sharing within a supply chain process

The relationship between BI and Information Sharing (IS) was highly significant, with a path coefficient of 0.834, an S.E. of 0.078, and a C.R. of 7.818 ($p < 0.001$). This result indicates that BI enhances information sharing mechanisms within the supply chain, facilitating seamless communication among stakeholders and reducing inefficiencies caused by lack of transparency.

The findings from SEM-A reveal a significant positive relationship between Business Intelligence (BI) and information sharing within supply chain processes. The regression estimate ($\beta = 0.843$, $p < 0.001$) confirms that as Business Intelligence adoption increases, information sharing also improves in a statistically significant manner. Given the p-value of 0.000, which is well below the conventional significance threshold of 0.05, This result validates the hypothesis, affirming that Business Intelligence plays a crucial role in enhancing the flow of information across supply chain networks.

The regression coefficient of 0.834 suggests that a one-unit increase in Business Intelligence corresponds to a 0.834 standard deviation increase in information sharing.

The strong positive relationship between BI and information flow underscores the value of data-driven decision-making in supply chain management. Businesses that effectively leverage BI tools will be better positioned to enhance operational efficiency, strengthen collaboration, and maintain a competitive advantage in an increasingly complex and dynamic market environment.

HYPOTHESIS FOUR

H_4: The use of Business Intelligence within supply chain processes positively influences supply chain integration.

The path coefficient for the relationship between Business Intelligence (BI) and Supply Chain Integration (SCI) was 0.663 with a standard error (S.E.) of 0.091 and a critical ratio (C.R.) of 7.252, which was statistically significant at $p < 0.001$ (***). This result suggests that BI plays a crucial role in enhancing supply chain integration, meaning that organizations leveraging BI effectively are likely to achieve better synchronization of supply chain activities.

The fourth hypothesis (H_4) proposed that the use of Business Intelligence within supply chain processes positively influences supply chain integration. However, the results of the statistical analysis, as presented in table 27 indicate a positive linear relationship between Business Intelligence and supply chain integration. Specifically, the regression estimate ($\beta = 0.663$, $p < 0.001$) demonstrates that Business Intelligence has a statistically significant effect on supply chain integration. Given that the p-value is below the 0.05 significance threshold, it supports the hypothesis (H_4), which confirms that Business Intelligence contributes to improved supply chain integration.

The regression coefficient of 0.663 suggests that a one-unit increase in Business Intelligence results in a 0.663 standard deviation increase in supply chain integration. This finding underscores the essential role of Business Intelligence in fostering coordination and synchronization across supply chain entities, leading to more seamless and efficient operations. Supply chain integration involves the effective collaboration and synchronization of various entities, including suppliers, manufacturers, distributors, and retailers. Business Intelligence enhances this integration by improving data visibility, enabling real-time collaboration, and facilitating automated decision-making processes.

One of the primary ways in which Business Intelligence strengthens supply chain integration is through enhanced data synchronization. By aggregating and standardizing data from multiple sources, Business Intelligence ensures consistency across supply chain partners, reducing data discrepancies and improving coordination. Additionally, Business Intelligence provides real-time decision support by offering timely insights into supply chain operations. This allows organizations to detect potential disruptions early and implement corrective measures before they escalate into inefficiencies.

Seamless communication and collaboration among supply chain stakeholders are also facilitated through Business Intelligence platforms, which provide cloud-based dashboards and predictive analytics. Enhanced communication minimizes conflicts and redundancies, thereby improving operational efficiency. Furthermore, Business Intelligence improves the coordination of demand and supply by leveraging predictive analytics and AI-driven forecasting. This ensures that supply aligns with fluctuating demand patterns, reducing stockouts and excess inventory while optimizing resource allocation.

The positive linear relationship, indicated by the regression estimate ($\beta = 0.663$, $p < 0.001$), highlights the pivotal role of Business Intelligence in improving coordination, communication, and efficiency within supply chains. As organizations strive to maintain resilience and competitive advantage in an interconnected global marketplace, the adoption of Business Intelligence-driven supply chain integration will be crucial for optimizing processes, reducing inefficiencies, and improving overall business performance.

HYPOTHESIS FIVE

H_5: There is a significant relationship between connectivity and supply chain integration.

A key finding of the study is the significant relationship between connectivity and Supply Chain Integration (SCI), with a path coefficient of 0.746, an S.E. of 0.092, and ($p < 0.001$). This result indicates that higher levels of connectivity lead to supply chain integration which ultimately lead to improved supply chain performance (serial mediation effect), reinforcing the importance of collaborative planning, process alignment, and information sharing in achieving operational efficiency.

The fifth hypothesis (H_5) proposed that connectivity within supply chain processes positively influences supply chain integration. However, the results of the statistical analysis, as presented in table 28 indicate a positive linear relationship between connectivity and supply chain integration. Specifically, the regression estimate ($\beta = 0.746$, $p < 0.001$) demonstrates that connectivity has a statistically significant effect on supply chain integration. Given that the p-value is below the 0.05 significance threshold, it supports the hypothesis (H_5), which confirms that connectivity contributes to influencing supply chain integration.

HYPOTHESIS SIX

H_5: There is a significant relationship between information sharing and supply chain integration.

A key finding of the study is the significant relationship between information and Supply Chain Integration (SCI), with a path coefficient of 0.671, an S.E. of 0.122, and ($p < 0.001$). This result indicates that higher levels of information sharing leads to supply chain integration reinforcing the importance of information sharing in achieving operational efficiency.

The fifth hypothesis (H_6) proposed that information sharing within supply chain processes positively influences supply chain integration. However, the results of the statistical analysis, as presented in table 28 indicate a positive linear relationship between information sharing and supply chain integration. Specifically, the regression estimate ($\beta = 0.671$, $p < 0.001$) demonstrates that information sharing has a statistically significant effect on supply chain integration. Given that the p-value is below the 0.05 significance threshold, it supports the hypothesis (H_6), which confirms that connectivity contributes to influencing supply chain integration.

HYPOTHESIS SEVEN

H_5: The use of Business Intelligence and the achievement of supply chain process integration significantly influence supply chain performance.

A key finding of the study is the significant relationship between Supply Chain Integration (SCI) and Supply Chain Performance (SCP), with a path coefficient of 0.741, an S.E. of 0.134, and a C.R. of 5.523 ($p < 0.001$). This result indicates that higher levels of supply chain integration led to improved supply chain performance, reinforcing the importance of collaborative planning, process alignment, and information sharing in achieving operational efficiency.

The table presents the indirect effects of Business Intelligence (BI), Supply Chain Integration, and Supply Chain Performance on various dependent variables within the structural model. The findings indicate that BI has no indirect effect on Supply Chain Integration, Connectivity, Information Sharing, or Decision Making, as all corresponding values are .000. However, BI exhibits a notable indirect effect on Supply Chain Performance, with an effect size of .942. This suggests that BI indirectly influences Supply Chain Performance through other mediating variables, likely enhancing operational efficiency and responsiveness. Additionally, no indirect effects are observed for Supply Chain Integration or Supply Chain Performance on any of the other constructs. These results emphasize the direct nature of most relationships within the model, except for the indirect impact of BI on Supply Chain Performance.

Business Intelligence has an indirect effect on supply chain performance, as indicated by the regression estimate ($\beta = 0.942$). This positive linear relationship suggests that as Business Intelligence increases, supply chain performance also improves. Given that the regression coefficient is greater than 0.3, the relationship can be considered strong. The statistical analysis confirms that there is a significant relationship between Business Intelligence within supply chain processes and overall supply chain performance.

The regression coefficient of 0.942 implies that a one-unit increase in Business Intelligence leads to a 0.942 standard deviation increase in supply chain performance. This finding highlights the indirect influence of Business Intelligence on supply chain efficiency, responsiveness, and overall effectiveness. By leveraging Business Intelligence tools, organizations can gain deeper insights into supply chain operations, leading to improved decision-making, risk management, and process optimization.

Table 29: Summary of hypothesis

HYPOTHESIS	RELATIONSHIPS	BETA (β)	p-VALUES	RESULTS
H1	BI→ DECISION MAKING	0.600	< 0.001	Supported
H2	BI→ CONNECTIVITY	0.779	< 0.001	Supported
H3	BI→INFORMATION SHARING	0.834	< 0.001	Supported
H4	BI→ SUPPLY CHAIN INTEGRATION	0.663	< 0.001	Supported
H5	CONNECTIVITY→ SUPPLY CHAIN INTEGRATION	0.746	< 0.001	Supported
H6	INFORMATION SHARING → SUPPLY CHAIN INTEGRATION	0.671	< 0.001	Supported
H7	BI→ SUPPLY CHAIN INTEGRATION → SUPPLY CHAIN PERFORMANCE	0.942	< 0.001	Supported via indirect effects

CHAPTER SIX: DISCUSSION OF THE FINDINGS

6.0 INTRODUCTION

This chapter provides a comprehensive discussion of the findings presented in the previous chapter, which focused on data analysis. The results obtained from the tested hypotheses are critically examined and interpreted in relation to relevant theoretical frameworks and practical implications. This discussion aims to establish meaningful connections between the study's empirical findings and existing literature, highlighting consistencies, discrepancies, and new insights. Furthermore, the chapter explores how the results contribute to the broader understanding of the research topic, addressing both academic and practical perspectives.

6.1 OVERVIEW OF THE KEY FINDINGS OF THE STUDY

As previously established, the main aim of this study was to explore the effect Business Intelligence had on Supply chain performance in the Nigerian manufacturing sector through the lenses of other important factors such as decision making, connectivity and information sharing. As such, hypotheses were created to answer this central question. This study demonstrates through the findings from data analysis that the influence Business Intelligence on supply chain performance is indirect through intermediary capability-building process especially through connectivity and integration which emerge as the critical mechanisms through which BI is translated into performance outcomes. It can also be seen that information sharing does not function as a mediating mechanism between BI and supply chain performance

6.1.1 BUSINESS INTELLIGENCE AS AN ENABLING RESOURCE

Business Intelligence exhibited a strong and statistically significant impact on all downstream constructs. The mean of most items in this group indicates a moderate agreement among respondents about the current state of BI usage, suggesting the use of digital tools and connectivity and information infrastructure are pivotal for their supply chains performance. It can also be inferred that the respondents feel confident in their decision-making frameworks thus confirming its strategic value in enhancing managerial judgment and strategic planning.

In an environment where market instability, currency volatility, and regulatory unpredictability prevail as is the case in Nigeria, data-driven decision-making equips managers with foresight and agility.

6.1.1.1 BUSINESS INTELLIGENCE AND DECISION MAKING

The findings of the study show that business intelligence (BI) has a significant positive influence on decision making. It is noted in literature that one of the most significant advantages of BI is its ability to enhance decision accuracy and speed through real-time data analytics and this study emphasises these findings. It can be seen in literature that the integration of Business Intelligence (BI) into supply chain processes has revolutionized decision-making by providing organizations with the ability to analyze large volumes of data and derive actionable insights that were previously difficult to access (Bahrami and Shokouhyar, 2021). BI tools, such as data mining, predictive analytics, and real-time dashboards, enable supply chain managers to make more informed, timely, and accurate decisions (Bahrami, Shokouhyar and Seifian, 2022).

Also, a study by Ozdemir et al. (2022) on supply chain resilience during the pandemic found that companies with mature BI capabilities were better equipped to respond to disruptions, adapting their operations and maintaining customer service levels. Similarly, Sangari and Razmi (2015) demonstrated through their empirical research that BI adoption significantly enhances the agility of supply chains, enabling companies to adjust more swiftly to market changes and improve their operational performance. The evidence suggests that BI adoption not only improves decision-making.

Theoretically, these findings support the conceptualisation of BI as a foundational resource that funnels into other capabilities and it reinforces works like Abioro and Odunlami (2021), BI tools provide predictive insights that enable supply chain managers to forecast demand, optimize inventory, and mitigate risks which aligns with the Resource-Based View (RBV) theory, which emphasizes the strategic value of leveraging internal resources, such as advanced

BI tools, to gain a competitive advantage. In dynamic market environments, where rapid responses are critical, the application of BI ensures that organizations remain agile and adaptive. Moreover, BI tools have been shown to reduce costs and operational errors by identifying inefficiencies and bottlenecks. Agarwal (2018) report that BI-driven dashboards led to a 20% reduction in transportation costs and increased customer satisfaction by streamlining logistics operations. This reflects the principles of the Dynamic Capabilities Theory, which emphasizes an organization’s ability to identify and address inefficiencies to adapt to changing market conditions. This finding is interesting in the Nigerian manufacturing context where decision making is heavily reliant on past experience or intuition

6.1.1.2 BUSINESS INTELLIGENCE AND CONNECTIVITY

The findings show that business intelligence (BI) has a significant positive influence on connectivity which refers to the seamless integration and interaction of various components within a supply chain, including suppliers, manufacturers, distributors, and customers (Chen and Pearl, 2014). These findings suggests that BI influences the technological linkages that support system interoperability. The use of Business Intelligence (BI) in supply chain management has been widely recognized for its potential to enhance connectivity across supply chain processes, and the findings continue to support that school of thought.

Empirical studies in the supply chain and information systems literature consistently support the view that BI adoption is positively associated with improvements in system interoperability, real-time data exchange, and digital linkages across the supply chain. Prior research has shown that BI facilitates the integration of disparate data sources, improves system compatibility, and supports cross-functional visibility, all of which are core dimensions of connectivity. Studies focusing on digital supply chains similarly argue that analytics-driven platforms strengthen connectivity by enabling seamless communication between internal functions and external partners, thereby supporting coordination and responsiveness. One of such research, Christopher and Holweg (2011) states, BI systems facilitate the sharing of actionable insights across supply chain partners, thereby breaking down information silos and fostering stronger. collaboration. By providing a centralized platform for data sharing, BI tools enable supply chain partners to coordinate effectively, reducing delays and improving decision-making (Evtodieva et al., 2020). Hazen et al. (2016) also observed that organizations using BI experienced a significant improvement in collaborative planning and execution, as stakeholders felt more confident in shared data accuracy.

It is important to note that this relationship between BI and connectivity is understood through the lenses of theory which emphasise the value of analytical tools to enhance system linkages and eliminate siloed operations, which is why the resource-based view (RBV) and its extensions into dynamic capabilities theory further frame this relationship. Within this framework, BI can be conceptualised as a valuable but non-rare technological resource whose competitive value depends on complementary capabilities. Connectivity represents one such complementary capability, enabling firms to integrate BI systems with enterprise resource planning (ERP), supplier platforms, and customer-facing systems. Dynamic capabilities theory suggests that firms gain advantage not from possessing resources alone, but from their ability to reconfigure and align these resources in response to environmental demands. BI enhances sensing and analytical capabilities, while connectivity enables these insights to be embedded into operational routines and inter-organisational interactions (Ghadge et al., 2020).

However, the strength and nature of the BI–connectivity relationship are highly context-dependent. In developed economy settings, high baseline levels of digital infrastructure often obscure the enabling role of BI, leading studies to focus on higher-order outcomes such as integration or performance. In contrast, in emerging economy contexts—such as Nigerian manufacturing—connectivity constraints remain a salient challenge. Fragmented IT systems, limited interoperability between organisational platforms, and uneven digital maturity across supply chain partners mean that BI investments often represent a critical driver of connectivity improvements rather than merely an analytical enhancement. In such contexts, BI initiatives frequently serve as catalysts for system integration projects, data standardisation efforts, and the establishment of digital interfaces with suppliers and distributors.

The findings of this study align with and extend this body of literature by demonstrating that BI has a strong and significant influence on connectivity. This suggests that BI adoption in Nigerian manufacturing firms contributes directly to strengthening the technological and informational linkages that underpin connected supply chain operations. Rather than functioning solely as a decision-support tool, BI appears to play a foundational role in enabling digital connectivity, supporting the argument that BI should be conceptualised as an infrastructural capability rather than a standalone analytical application.

Theoretically, this reinforces the position that BI operates at the lower levels of the capability hierarchy, enabling higher-order capabilities such as integration and performance improvement. Connectivity acts as the immediate outcome of BI deployment, translating analytical potential into accessible, interoperable, and timely information flows. This interpretation challenges linear models that assume BI directly drives operational or performance outcomes and instead supports staged models of value creation in which BI first enhances connectivity before enabling more complex supply chain capabilities.

Overall, the relationship between BI and connectivity highlights the importance of viewing BI as part of a broader digital capability system. The findings underscore that in environments characterised by infrastructural and coordination challenges, the primary contribution of BI lies in its ability to connect systems, actors, and information flows, thereby laying the foundation for integrated and high-performing supply chains.

6.1.1.3 BUSINESS INTELLIGENCE AND INFORMATION SHARING

The findings from the study indicate that Business Intelligence has a strong and positive influence on information sharing which refers to the exchange of timely, accurate, and relevant data between supply chain partners within manufacturing supply chains in Nigeria. This suggests that firms with more developed BI capabilities tend to experience greater availability and exchange of information across organisational units and supply chain partners.

This finding is consistent with prior studies that identify BI and analytics as key enablers of information availability and transparency in supply chains (Trkman et al., 2010; Wamba et al., 2017). Research in information systems similarly suggests that BI platforms facilitate information sharing by improving data accessibility and reducing information asymmetry (Popovič et al., 2012). Additionally, BI promotes transparency and trust within the supply chain by providing a single source of truth. Transparent information sharing reduces uncertainty and enhances collaborative efforts. Modgil, et al. (2021) demonstrated that organizations using BI tools experienced improved supply chain visibility, allowing stakeholders to monitor key performance indicators (KPIs) and share forecasts, thus fostering alignment of objectives. However, while many studies implicitly assume that increased information sharing will automatically lead to coordination and performance improvements, the present findings suggest that the effects of information sharing may be more limited when considered in isolation.

BI enhances a firm's ability to collect, analyse, and disseminate data, thereby increasing the volume and timeliness of information available for sharing. BI systems consolidate data from multiple sources and present insights through dashboards, reports, and alerts, which naturally increases the flow of information within and across organisational boundaries. In this sense, BI functions as an information-enabling capability that expands informational visibility, even if it does not directly alter how information is operationalised. BI acts as a lever to harness the value of information, making it accessible and actionable for all stakeholders. This perspective aligns with the Resource-Based View (RBV), which emphasizes that information is a strategic resource, and its effective utilization can provide a competitive advantage.

In the Nigerian manufacturing context, BI adoption often improves access to information without fundamentally changing coordination structures. Information sharing may remain informal, person-dependent, or episodic, particularly where inter-firm relationships rely on trust-based communication rather than system-level integration. As a result, while BI increases the amount of shared information, this does not necessarily translate into structured, process-level integration across the supply chain.

Theoretically, this finding supports the view that information sharing represents an intermediate informational outcome of BI rather than a standalone mechanism for supply chain transformation. It reinforces the distinction between information availability and information embeddedness, suggesting that BI-driven information sharing is a necessary but insufficient condition for deeper integration or performance improvement.

6.1.1.4 SUPPLY CHAIN INTEGRATION AND CONNECTIVITY

The findings show that connectivity has a significant positive effect on supply chain integration. This indicates that stronger technological and informational linkages between systems and partners are associated with higher levels of coordinated supply chain processes.

This finding aligns strongly with the supply chain integration literature, which consistently identifies connectivity and IT integration as critical antecedents of internal and external integration (Rai et al., 2006; Flynn et al., 2010). Studies on digital supply chains further argue that connectivity enables integration by facilitating joint planning, collaborative decision-making, and cross-functional coordination (Zhu et al., 2018). Unlike studies that treat integration as a direct outcome of analytics adoption, the present findings highlight connectivity as a necessary intermediary capability.

Drawing on resource-based view, connectivity enhances a firm's capacity to process information across organisational and inter-organisational boundaries. Connectivity enables real-time data exchange, system interoperability, and aligned information standards, which are essential for synchronising planning, execution, and monitoring activities. From a dynamic capabilities' perspective, connectivity provides the infrastructural foundation that allows firms to reconfigure processes and align supply chain activities in response to environmental demands.

In Nigerian manufacturing firms, fragmented IT infrastructures and heterogeneous system architectures often constrain integration efforts. Under such conditions, improvements in connectivity such as ERP–BI linkage, shared databases, or digital interfaces with suppliers represent a critical step toward integration. Without these linkages, firms may possess information but lack the structural means to coordinate activities effectively across the supply chain.

Theoretically, this finding reinforces the conceptualisation of supply chain integration as a **higher-order operational capability** that depends on underlying infrastructural capabilities. Connectivity emerges as a foundational enabler that transforms informational potential into coordinated supply chain action.

6.1.1.5 SUPPLY CHAIN INTEGRATION AND INFORMATION SHARING

The findings of this study, contrary to expectations show that information sharing does not have a significant effect on supply chain integration. This suggests that the exchange of information alone does not necessarily lead to integrated supply chain processes.

From a theoretical standpoint, information sharing represents the transmission of data, whereas integration requires the alignment of processes, decision rights, and operational routines. Information processing theory suggests that information must be not only shared but also structured, interpreted, and embedded within coordinated processes. Without supporting infrastructures and governance mechanisms, shared information may fail to drive integration.

While prior studies frequently report positive relationships between information sharing and supply chain integration (Li et al., 2005; Cao & Zhang, 2011), more recent research has questioned the sufficiency of information sharing as a standalone driver of integration. Some studies suggest that information sharing yields integration benefits only when supported by compatible systems, formal coordination mechanisms, and aligned incentives (Rai et al., 2006; Wong et al., 2011). The present findings contribute to this emerging view by empirically demonstrating the limits of information sharing in isolation.

In the Nigerian manufacturing context, information sharing is often informal and relationship-driven, relying on phone calls, emails, or personal networks rather than integrated platforms. Such forms of sharing may improve visibility but do not necessarily support process alignment or joint execution. This helps explain why information sharing does not translate into integration in the absence of strong connectivity and system-level coordination.

Theoretically, these finding challenges universal assumptions about the integrative power of information sharing. It suggests that information sharing should be conceptualised as an **embedded dimension of connectivity and integration**, rather than as an independent causal mechanism

6.1.1.6 SUPPLY CHAIN INTEGRATION AND SUPPLY CHAIN PERFORMANCE

The findings demonstrate that supply chain integration has a strong positive effect on supply chain performance. This indicates that higher levels of coordinated supply chain processes are associated with superior operational and performance outcomes.

From a resource-based and dynamic capabilities perspective, integration enables firms to leverage complementary resources across the supply chain. Integrated processes support demand–supply alignment, reduce redundancies, and enhance responsiveness. Integration allows firms to transform information and connectivity into coordinated execution, which directly affects cost efficiency, reliability, and responsiveness.

This finding is strongly supported by extensive empirical evidence linking supply chain integration to performance improvements (Flynn et al., 2010; Schoenherr & Swink, 2012). Prior research consistently shows that integrated supply chains outperform fragmented ones in terms of flexibility, delivery performance, and cost control. The present study reinforces this relationship within an emerging economy manufacturing context.

For Nigerian manufacturers operating in volatile and resource-constrained environments, integration plays a particularly critical role. Integrated supply chains enable firms to manage uncertainty, coordinate limited resources, and respond more effectively to infrastructure and demand shocks. This amplifies the performance benefits of integration relative to less integrated operating environments.

Theoretically, this finding confirms supply chain integration as a **central performance-driving capability**. It reinforces staged models of capability development in which infrastructural and informational capabilities ultimately generate value through integrated execution.

6.1.2 CONNECTIVITY AS A KEY MEDIATOR

The findings of this study provide clear evidence that connectivity plays a central mediating role in the relationship between Business Intelligence and downstream supply chain outcomes. Rather than exerting a direct influence on supply chain integration or performance, Business Intelligence operates through a sequence of intermediary capabilities, with connectivity emerging as the primary transmission mechanism. This highlights the importance of understanding BI not as a standalone performance-enhancing tool, but as an enabling capability whose value is realised only when embedded within appropriate infrastructural and process-level mechanisms.

From an **information processing theory** perspective, connectivity represents the structural capacity that allows BI-generated insights to be disseminated, accessed, and utilised across organisational and inter-organisational boundaries. While BI enhances a firm's analytical capacity, it is connectivity that determines whether this capacity can be mobilised across the supply chain. Connectivity facilitates system interoperability, real-time data exchange, and aligned information standards, thereby reducing information silos and enabling coordinated decision-making. In this sense, BI expands the *potential* for information processing, but connectivity determines its *reach* and operational relevance.

The mediation results indicate that connectivity significantly mediates the relationship between Business Intelligence and supply chain integration. This suggests that BI improves integration primarily by strengthening the digital and informational linkages that connect internal functions with external supply chain partners. This finding is consistent with prior research that identifies IT connectivity and system integration as critical antecedents of supply chain integration (Rai et al., 2006; Flynn et al., 2010). However, the present study extends this literature by positioning connectivity not merely as an IT characteristic, but as a dynamic capability that transforms analytical insights into coordinated supply chain action.

6.1.2.1 THE SERIAL MEDIATION: BI → CONNECTIVITY → SCI → SCP

More importantly, the results reveal a serial mediation pathway, whereby Business Intelligence influences supply chain performance through connectivity and subsequently through supply chain integration. This sequential mechanism underscores that BI-driven value creation is not instantaneous or linear. Instead, BI first enhances connectivity, which enables integration, and it is this integration that ultimately drives performance improvements. Such a staged process aligns with dynamic capabilities theory, which emphasises that competitive advantage arises from the orchestration and layering of complementary capabilities rather than from isolated resource investments. BI contributes to sensing and analytical capabilities, connectivity enables the reconfiguration of information flows, and integration operationalises these capabilities through coordinated execution.

This serial mediation finding challenges simplified models that assume a direct relationship between BI and performance. While some studies conducted in developed economies report direct BI–performance effects, these findings suggest that such relationships may obscure underlying capability-building processes. In contexts where digital infrastructure is less mature, the enabling role of connectivity becomes more salient. In the Nigerian manufacturing environment, fragmented IT systems, heterogeneous platform adoption, and uneven digital maturity across supply chain partners mean that BI initiatives often function as catalysts for connectivity improvements rather than immediate performance drivers. Without adequate connectivity, BI insights remain localised and fail to translate into integrated supply chain practices.

6.1.3 INFORMATION SHARING AS A NON-MEDIATOR

In contrast to connectivity, information sharing does not emerge as a significant mediator in the relationship between Business Intelligence and either supply chain integration or performance. Although BI has a strong and positive effect on information sharing, information sharing does not transmit this effect onward in a way that enhances integration or performance outcomes. This distinction is critical. It indicates that while BI increases the availability and exchange of information, the mere sharing of information is insufficient to drive coordinated supply chain action.

The non-mediating role of information sharing can be understood by distinguishing between information *availability* and information *embeddedness*. Information processing theory suggests that information must be structured, interpreted, and embedded within organisational routines to influence behaviour. Information sharing, particularly when informal or unstructured, may improve visibility without altering decision rights, process alignment, or execution mechanisms. Prior studies that report positive effects of information sharing on integration often assume the presence of supporting infrastructures and governance mechanisms (Li et al., 2005; Cao & Zhang, 2011). The present findings suggest that in the absence of strong connectivity and system-level integration, information sharing alone lacks the causal power to drive integration or performance.

This result is further reinforced by the measurement evidence, which indicates substantial conceptual overlap between Business Intelligence and information sharing. Such overlap suggests that respondents may perceive information sharing as an embedded outcome of BI-enabled systems rather than as a distinct capability. Consequently, information sharing may function as an informational by-product of BI rather than as an independent transmission mechanism. This helps explain why information sharing receives BI's influence but does not pass it on in a way that materially affects integration or performance.

Contextual factors within Nigerian manufacturing further illuminate this finding. Information sharing in many firms remains relationship-driven and person-dependent, relying on informal communication channels rather than integrated platforms. While such sharing may enhance awareness, it does not necessarily support coordinated planning, joint execution, or process standardisation. As a result, information sharing improves visibility but does not translate into system-level integration unless it is embedded within connected and interoperable infrastructures.

6.1.4 SUPPLY CHAIN PERFORMANCE AS AN OUTCOME

The use of Business Intelligence (BI) in achieving supply chain process integration has emerged as a critical factor influencing supply chain performance. Business Intelligence systems offer advanced analytical tools and real-time data processing capabilities that enhance decision-making, streamline operations, and foster collaboration across supply chain stakeholders. This connection can be better understood through the lens of several theoretical frameworks, including the Resource-Based View (RBV) Manufacturing firms in Nigeria often grapple with high operational costs, inefficient logistics, and suboptimal service delivery (Okonjo-Iweala, 2021). Integrated supply chain operations facilitate the alignment of activities, reduce duplication, and enhance customer service levels. This aligns with the resource-based view (Barney, 1991), which posits that capabilities such as supply chain integration yield competitive advantages when they are rare, valuable, and difficult to imitate.

From a practical standpoint, firms that engage in collaborative planning, joint inventory management, and integrated performance monitoring are better positioned to meet customer expectations and sustain profitability. Nigerian manufacturers frequently operate under volatile conditions (e.g., fluctuating exchange rates, logistics delays). Yet, these results suggest that many firms still perceive their performance as relatively strong, possibly due to adaptive strategies like local sourcing or vertically integrated operations. This presents a nuanced picture— while the external environment might be challenging, internal operational strategies are helping firms cope.

The use of Business Intelligence (BI) in achieving supply chain process integration has emerged as a critical factor influencing supply chain performance, for example, a study by Zhang et al. (2024) highlights how companies with well-integrated BI platforms report higher levels of on-time delivery, reduced costs, and greater customer satisfaction, supporting the argument that BI-driven integration improves supply chain performance. Jafari et al. (2023) emphasize the importance of BI in enhancing SC performance, asserting that BI has the most substantial impact on SC flexibility and integration. By incorporating BI technologies, organizations can achieve greater SC flexibility, enabling them to adapt to changing market conditions, mitigate risks, and formulate innovative SC strategies.

6.2 SUMMARY OF CHAPTER

Taken together, these findings highlight the centrality of connectivity as the key mediator through which Business Intelligence generates supply chain value. They demonstrate that BI-driven performance improvements occur through a **serial capability-building process**, in which connectivity enables integration, and integration drives performance. At the same time, the absence of a mediating role for information sharing challenges assumptions about its universal effectiveness and underscores the importance of distinguishing between informational and operational capabilities.

Theoretically, this section contributes to the literature by reframing BI as a foundational, enabling capability whose impact is contingent on complementary infrastructural and operational capabilities. Connectivity emerges as the critical bridge between analytics and execution, while supply chain integration represents the mechanism through which value is ultimately realised. Information sharing, although enhanced by BI, does not independently drive integration or performance, highlighting the need for more nuanced conceptualisations of information-related capabilities in emerging economy supply chains.

CHAPTER SEVEN: CONCLUSION AND RECCOMENDATIONS

7.0 INTRODUCTION

This study has explored the pivotal role of Business Intelligence (BI) in enhancing decision-making within supply chain processes and its consequent influence on supply chain performance. The integration of BI tools and systems has transformed how organizations manage their supply chains, enabling data-driven decisions that improve efficiency, responsiveness, and overall competitiveness. By examining various dimensions of BI application—including its impact on information sharing, connectivity, and integration—the research provides a comprehensive understanding of how advanced analytics and real-time data access contribute to improved performance outcomes. This chapter synthesizes the key findings of the study, highlighting the theoretical and practical implications for supply chain management. It also identifies the limitations encountered during the research and offers recommendations for future studies and industry practices. Finally, the section underscores the significance of adopting BI technologies as a strategic enabler for achieving superior supply chain performance in an increasingly complex and dynamic global business environment.

7.1 SUMMARY OF EMPIRICAL FINDINGS

The study employed a quantitative research design and structural equation modelling to test hypothesised relationships among BI, enabling supply chain capabilities, integration, and performance. Overall, the findings indicate that BI constitutes an important enabling capability in Nigerian manufacturing supply chains, primarily influencing performance through intermediate mechanisms rather than direct effects.

The findings highlight three overarching patterns. First, BI strengthens supply chain performance by improving integration-related processes, particularly via enhanced connectivity and integration across functions and partners. Second, SCI operates as a key transmission mechanism linking BI-driven capabilities to performance outcomes. Third, the

Nigerian manufacturing context which is characterised by infrastructural constraints, fragmented supply chain structures, and data inconsistencies, amplifies the importance of visibility and decision-making support provided by BI systems

7.2 CONCLUSIONS

This study set out to examine the role of Business Intelligence (BI) in shaping supply chain processes and performance within the Nigerian manufacturing sector. Drawing on the resource-based view and dynamic capabilities theory, the study conceptualised BI not merely as a technological investment but as an enabling organisational capability that supports information-driven coordination and integration. The empirical findings provide strong evidence that BI creates value in Nigerian manufacturing supply chains primarily through intermediate mechanisms that strengthen process integration rather than through direct or standalone efficiency effects.

A key conclusion of the study is that BI enhances supply chain outcomes by enabling the foundational capabilities of **connectivity and information sharing**, which are critical in contexts where information flows are typically fragmented. Within Nigerian manufacturing supply chains—often characterised by weak infrastructure, data inconsistencies, and limited inter-organisational visibility—BI supports the consolidation, standardisation, and accessibility of operational information required for coordinated planning and decision-making. The study therefore concludes that BI effectiveness in this context is tied less to advanced analytics sophistication and more to the extent to which BI supports reliable communication and information exchange across internal functions and external partners.

The study further concludes that **supply chain integration (SCI)** constitutes the central transmission mechanism through which BI-enabled capabilities influence supply chain performance. The findings indicate that the capacity to align procurement, operations, and logistics activities, and to coordinate processes with supply chain partners, represents a strategic capability that translates information-enabled coordination into measurable operational outcomes. In this sense, integration is not simply a structural feature of supply chains but a capability that emerges through effective information processing, shared visibility, and coordinated action—capacities that BI supports. This conclusion strengthens the argument that SCI is essential for achieving performance improvement in Nigerian manufacturing firms operating under supply-side disruptions and demand volatility.

i. To what extent are companies utilizing Business Intelligence in their supply chain processes for decision-making?

The study reveals a growing trend among companies in adopting BI technologies to support data-driven decision-making within their supply chain processes. BI tools such as dashboards, predictive analytics, and real-time data visualization enable businesses to make informed decisions, streamline operations, and respond proactively to market dynamics. Wang et al. (2016) provide evidence that these tools allow for real-time monitoring of supply chain activities, aiding operational and strategic decision-making. Specifically, in Nigeria, the research shows that companies are leveraging BI to enhance demand forecasting, identify potential supply chain disruptions, and mitigate risks. However, the extent of BI utilization varies depending on organizational size, industry focus, and resource availability, indicating the need for targeted strategies to support smaller firms in adopting BI systems.

ii. How effectively are companies leveraging Business Intelligence to create connectivity between their internal departments and supply chain partners?

The findings indicate that BI is instrumental in fostering connectivity within organizations and with external supply chain partners. Connectivity is achieved by breaking down silos and enabling seamless communication through the integration of systems like ERP and supply chain management software. Wieland (2021) emphasizes that connectivity is vital for synchronized operations, as it ensures that all stakeholders work towards shared objectives. The study’s case examples from Nigerian companies demonstrate that BI tools have significantly improved collaboration across departments and supply chain networks. By providing real-time data and insights, BI enables stakeholders to make collective decisions, aligning their efforts to optimize supply chain efficiency and resilience.

iii. To what degree is Business Intelligence being used to facilitate information sharing between companies, their departments, and supply chain partners?

This study underscores that BI significantly enhances information sharing by creating a centralized platform where data is accessible, accurate, and timely. Zeng et al. (2022) point out that BI systems improve transparency and trust by providing stakeholders with reliable insights. The research highlights how Nigerian companies have adopted BI tools to facilitate real-time information exchange, which aligns departmental goals with those of their supply chain partners. This streamlined flow of information not only reduces redundancies and miscommunication but also enables partners to respond quickly to market changes and customer demands. The ability of BI systems to provide a unified data source ensures that decisions are based on accurate and consistent information.

iv. What is the relationship between the use of Business Intelligence and the integration of supply chain processes within companies, particularly in the Nigerian context?

The conclusion confirms that BI plays a pivotal role in supply chain integration by harmonizing processes across procurement, production, and distribution functions. According to Upadhyaya and Kakkad (2020), BI systems provide actionable insights that facilitate the alignment of processes, improving the overall efficiency of the supply chain. In the Nigerian context, companies that integrate BI tools have shown higher levels of coordination among supply chain activities, resulting in reduced operational bottlenecks and improved supply chain agility. For instance, BI enables real-time tracking of inventory and shipments, which helps companies to synchronize their logistics and production schedules effectively.

v. How does the use of Business Intelligence for decision-making and supply chain process integration impact overall supply chain performance?

The study concludes that BI positively influences supply chain performance by enhancing responsiveness, agility, and cost efficiency. Empirical evidence from Wang et al. (2016) and Zoubi et al. (2023) supports the notion that BI adoption correlates with improved operational metrics such as shorter lead times, better demand fulfillment rates, and reduced costs. The research also finds that Nigerian companies utilizing BI report enhanced customer satisfaction, better supplier collaboration, and greater overall competitiveness. These outcomes underscore the strategic value of BI in achieving performance excellence within supply chain networks. By addressing these research objectives and questions, the study demonstrates how BI is a transformative tool in modern supply chain management. It bridges gaps in decision-making, connectivity, information sharing, and integration, ultimately driving superior supply chain performance. The findings provide a robust foundation for organizations aiming to leverage BI for sustained competitive advantage and operational excellence in their supply chains.

7.3 CONTEXT SPECIFIC IMPLICATIONS FOR NIGERIAN MANUFACTURING SUPPLY CHAINS

The Nigerian manufacturing industry operates under supply chain conditions that differ significantly from assumptions embedded in much of the BI and SCM literature derived from developed economies. Key contextual features include weak logistics infrastructure, inconsistent energy supply, limited data standardisation, and fragmented supply networks. Under these conditions, the ability to generate integrated insights and coordinate decisions becomes a strategic necessity.

Accordingly, this study demonstrates that BI value in Nigeria is best understood as an enabling capability that supports decision-making and integration rather than simply a technological investment. BI contributes to manufacturing supply chain competitiveness by strengthening coordination capacity under uncertainty and enabling structured information sharing across supply chain actors.

7.4 CONTRIBUTIONS OF THE STUDY

7.4.1 THEORETICAL CONTRIBUTION

This research significantly enriches the theoretical landscape of BI by contextualizing its application within supply chain management (SCM), particularly in emerging economies. It positions connectivity, information sharing as intermediate capabilities that are useful within supply chains that are like Nigeria. It also advances the literature beyond the prevalent direct effect assumptions in prior BI research. The research extends foundational theories such as the Resource-Based View (RBV), and the dynamic capabilities theory to the Nigerian context. By demonstrating how BI facilitates supply chain integration and enhances performance, the study highlights the dynamic capabilities that organizations can develop through technological adoption. Moreover, the findings propose an expanded conceptual framework that links BI adoption, supply chain connectivity, and organizational agility, offering a foundation for future theoretical explorations.

7.4.2 CONTEXTUAL CONTRIBUTION

Empirically, this study adds to the growing body of evidence on the impact of BI in supply chain processes in the Nigerian manufacturing sector. The inclusion of responses from Nigerian companies provides novel insights into the practical application of BI in an emerging market context. This research reveals how BI fosters data-driven decision-making, facilitates real-time information sharing, and enhances connectivity between supply chain partners. Unlike previous studies focused predominantly on developed economies, this work sheds light on the unique challenges and opportunities associated with BI adoption in Nigeria, providing empirical data on how companies use BI for demand forecasting, risk management, and collaborative planning

7.4.3 METHODOLOGIAL CONTRIBUTION

Methodologically, the study contributes by developing and empirically testing a structural equation model integrating BI, enabling capabilities, SCI, and SCP within a developing-country manufacturing context. The multidimensional operationalisation of constructs such as BI and SCI provides a robust approach to capturing complex supply chain capabilities.

7.5 RECOMMENDATIONS

This study underscores the transformative potential of Business Intelligence (BI) in optimizing supply chain processes, particularly in the areas of decision-making, connectivity, information sharing, integration, and overall performance. Based on the findings, several actionable recommendations are proposed to maximize the benefits of BI:

7.5.1 RECOMMENDATIONS FOR NIGERIAN MANUFACTURING FIRMS

1. Prioritise BI capabilities that enable integration, not only reporting**.** Firms should invest in BI tools that support data integration across procurement, production, and logistics, including shared dashboards and performance metrics. The findings show that connectivity and integration are key value creations from BI for performance outcome realisation, so it tracks for priority to be given to these capability

2. Develop BI governance structures for cross-functional decision-making. Establish BI steering committees including procurement, operations, logistics, finance and IT to ensure shared interpretation and coordinated action. These structures are essential for firms in Nigeria as decision making is usually hinged on inconsistent reporting standards, fragmented databases and manual record systems.

3. Adopt phased digital integration strategies**.** Given infrastructural constraints, firms should prioritise scalable BI integration that can operate under low bandwidth and accommodate legacy systems.

4. Organizations are encouraged to make investment in advanced BI tools and technologies. These systems offer significant advantages in enabling data-driven decision-making, predictive analytics, and real-time monitoring. By adopting state-of-the-art BI solutions, companies can enhance their operational efficiency and gain a competitive edge in the market. This is especially important in dynamic business environments, where agility and responsiveness are key to maintaining market relevance. It is seen from the study that BI solutions build capacities that have an effect on performance outcomes and because the study shows that this application is effective although not widespread. Thus, the need to make such an investment is clear

7.5.2 RECOMMEDATION FOR SUPPLY CHAIN MANAGERS

5. Use BI to reduce disruption impact. BI is such an adaptable tool and can be used to track disruption signals that exist in the country such as fuel price changes, Fx fluctuations, port congestion delays, this visibility can enable them to make contingency integration plans for switching suppliers, or making buffer stock decisions, switching distribution channels.

6. Organizations should strive for the comprehensive data integration of BI systems across all functional areas of their supply chains i.e. consolidating procurement, inventory, sales, logistics data. Such integration facilitates seamless connectivity between departments and external partners, streamlining operations and promoting cohesive decision-making. BI-driven integration ensures that all supply chain activities, from procurement to logistics, are aligned and optimized for maximum efficiency. This data integration is so useful in the context of Nigeria where there is high fragmentation.

7.5.3 RECOMMENDATIONS FOR GOVERNMENT AND POLICY INSTITUTIONS

7. Strengthen digital infrastructure for industrial competitiveness. Targeted investments in broadband coverage and stable energy supply will amplify BI effectiveness.

8. Implement incentives for BI-enabled manufacturing upgrading. Tax reliefs or subsidised financing for BI-enabled ERP adoption should be expanded through agencies such as BOI.

9. Establish sector-focused BI and analytics training programmes. Partnerships between government, MAN, and universities should develop supply chain analytics capacity.

7.5.4 SUMMARY TABLE: KEY FINDINGS TO RECOMMENDATION

Table 30:Summary table: Key findings to recommendation

Key Empirical Conclusion	**Interpretation**	**Recommendation**	**Stakeholder**	**Expected Effect**
BI strengthens enabling capabilities	BI improves data access and visibility	Invest in BI integration dashboards	Manufacturing firms	Reduced uncertainty
Information sharing supports SCI	Shared data improves coordination	Formal partner information protocols	SC managers	Higher integration
Connectivity enables coordination	IT linkages support responsiveness	Strengthen IT integration	Firms / Providers	Better planning
SCI improves SCP	SCI drives performance outcomes	BI-enabled S&OP processes	SC managers	Higher SCP

7.6 PRACTICAL IMPLICATIONS

The practical implications of this research are far-reaching, offering valuable insights for managers, policymakers, and technology providers:

1. This study equips managers with a clear roadmap for implementing BI tools within their supply chain operations. The findings emphasize the role of BI in improving operational efficiency, enhancing collaboration, and driving agility. Managers can leverage these insights to justify investments in BI technologies and design effective implementation strategies tailored to their organizational needs.

2. The research highlights the importance of policy frameworks that support BI adoption. Policymakers can use these findings to develop initiatives that foster digital transformation, particularly within supply chains. Incentives such as tax breaks, funding for digital infrastructure, and training programs can accelerate the adoption of BI technologies, ensuring that businesses are equipped to compete in a digital economy.

3. The study identifies critical gaps in BI adoption, such as cost and usability, which are particularly pronounced in emerging economies. Technology providers can use these insights to design solutions that address these challenges, creating affordable, user-friendly BI tools that cater to the needs of small and medium-sized enterprises (SMEs). By focusing on accessibility and functionality, providers can drive greater adoption and deliver value across diverse markets.

7.7 LIMITATIONS OF THE STUDY

Although the study provides valuable findings, some of the limitations encountered should be acknowledged.

1.Cross-sectional data limits causal inference over time, as the responses only capture the existing reality at the time.

2. The study focuses on Nigerian manufacturing, which may limit direct generalisability to other sectors.

3. the samples were generated from the Manufacturers registered with the MAN, who fit the criteria for the study (i.e. BI users) and this might not be representative of all the companies in the manufacturing sector.

7.8 RECOMMENDATION FOR FURTHER STUDY

Building on the findings of this research, several key areas for future exploration have been identified to deepen the understanding of Business Intelligence (BI) and its role in supply chain management (SCM). These suggestions aim to address existing gaps and provide a foundation for advancing both theoretical and practical knowledge:

1. Future research could focus on examining the long-term effects of BI adoption on supply chain performance through longitudinal studies. Such studies would provide valuable insights into how organizations evolve their BI strategies over time. This approach would reveal patterns in the sustained usage of BI tools, highlighting their impact on supply chain efficiency, interdepartmental connectivity, and overall performance. Understanding these dynamics could offer practical guidance for companies seeking to adapt BI to their changing needs.
2. Small and medium-sized enterprises (SMEs) face significant barriers to BI adoption, including high costs, limited technical expertise, and infrastructure constraints. Future research could focus on identifying and addressing these challenges, with particular emphasis on developing scalable and cost-effective BI solutions tailored to the needs of SMEs. This line of inquiry could provide actionable recommendations for

policymakers, technology providers, and SME managers, ensuring more inclusive access to BI technologies.

3. Lastly, the role of cultural and regional factors in BI adoption and utilization warrants further investigation. Future studies could explore differences in BI implementation between developed and emerging economies or among various cultural contexts. This research could reveal how regional attitudes toward technology, infrastructure availability, and regulatory environments influence BI adoption and effectiveness, providing insights into tailoring BI strategies for global applicability. By addressing these areas, future research can build upon the findings of this study, advancing the theoretical, empirical, and practical understanding of BI in supply chain management and contributing to more effective and innovative supply chain strategies worldwide.

4. Although this study briefly touches on risk mitigation, further research could delve deeper into how BI tools help organizations identify, assess, and manage risks within supply chains. This includes examining the role of BI in proactive risk management, such as predicting supply disruptions or responding to geopolitical uncertainties. Such studies would contribute to a comprehensive understanding of how BI strengthens supply chain resilience.

5. The influence of organizational culture on the successful implementation and use of BI systems in supply chains remains an underexplored area. Future studies could investigate how factors such as leadership styles, employee attitudes, and openness to innovation affect the adoption and integration of BI tools. Understanding these cultural dimensions would provide valuable insights into fostering an environment conducive to maximizing BI’s potential.

7.9 SUMMARY OF CHAPTER

This chapter presented conclusions and recommendations derived from empirical findings on BI-enabled supply chain processes in Nigerian manufacturing. The findings indicate that BI supports performance primarily through enabling connectivity, information sharing, and SCI. Practical recommendations were provided for firms, managers, technology providers, and policy makers, emphasising integration-focused BI investment as a pathway to improved manufacturing supply chain competitiveness in Nigeria.

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APPENDICES

APPENDIX A: QUESTIONNAIRE DOCUMENT

TITLE: EXPLORING THE IMPACT OF BUSINESS INTELLIGENCE FOR DECISION MAKING WITHIN SUPPLY CHAIN PROCESSES AND THEIR INFLUENCE ON SUPPLY CHAIN PERFORMANCE

A) DEMOGRAPHIC DATA

- Type of manufacturing company –
- Position in the company –
- What state does your company operate in –
- What Business Intelligence (BI) systems are used in your company ** –
- How long have you been using BI systems in your company –
- Company size – (A) Micro (1-10 employees) (B) Small (11-35 employees) (C) Medium (36-100) (D) large (101 and above)

** BI refers to any automation system a company uses in the process of data collection, analysis, and presenting information in the form of reports that create business actions, enabling management to make fundamental business decisions. such as Power BI, SAP, Qlik, Oracle or other in house created systems.

B) VARIABLE DATA

STATEMENT	STRONGLY AGREE	AGREE (2)	NEUTRAL (3)	DISAGREE (4)	STRONGLY DISAGREE

	(1)				(5)
BUSINESS INGTELLIGENCE (BI): Business intelligence refers to any automation system that a company uses in the process of data collection, analysis, and presenting information in the form of reports that create business actions, enabling management to make fundamental business decisions. **Such as Power BI, SAP, Qlik, Oracle or other in house created systems. The respondents are expected to agree or disagree (according to the scale) to the statements below.**					
Your company's BI system enables easy information sharing across all supply chain departments					
Your company's BI system analyses past supply chain data (i.e. sales or logistics) to identify forecasting trends.					
Your company's BI system provides relevant and timely information that improves the ability to perform your role					
Your company's BI system tracks supply chain changes thereby reducing risk					
Your company's BI system helps evaluate supply chain processes. i.e. the effectiveness of delivery processes					
DECISION MAKING (DM): Decision making (regarding decision making) is the process resulting in the selection of a course of action among several possible alternatives, aimed at achieving desired business goals and improving organizational performance					
Your company's systems allow you to leverage existing data for business decision making					
Your company's systems allow you to adequately problem solve using your existing data					
Your company's systems allow you align your strategies with your existing data					
Your company's systems allow you to reduce bias indecision making					

Your company's systems allow you to achieve organizational objectives					
CONNECTIVITY: This section establishes what the level of connectivity (i.e. the amount of interconnectedness) within each company is. As such respondents are required to agree or disagree to the statements (according to the scale)					
Your company's BI systems meet the communication requirements for supply chain operations					
Your Company's BI systems are well-integrated into your supply chain, enabling seamless information flow					
Your company's BI system links with your supply chain partners for collaboration and data sharing.					
INFORMATION SHARING: This section establishes what the level of information sharing within each company and their external supply partners. As such respondents are required to agree or disagree to the statements below					
Your company exchanges relevant information with supply chain partners					
Your company exchanges timely information with supply chain partners					
Your company exchanges accurate information with supply chain partners					
Your company exchanges complete information with supply chain partners					
Your company exchanges sensitive information with supply chain partners					
SUPPLY CHAIN PROCESS INTEGRATION: Supply chain integration refers to the situation whereby the processes, parties involved in a company's supply chain are integrated into a single system. The process involves					

a high level of coordination, seamless information and flow of resources that ensures that all the parties are always working towards the same goal					
Your company's supply chain processes are integrated well enough to plan strategies aligned to company goals.					
Your company integrates applications across different processes of the supply chain					
Your company's supply chain processes are well-integrated, allowing for seamless data sharing across processes					
Your company's departments work together on processes and decision-making for supply chain operations					
Your company uses cross-functional teams within the supply chain to drive new product/process development					
SUPPLY CHAIN PERFORMANCE: Supply Chain Performance (SCP) refers to the ability of a company's supply chain to meet their end - customer requirements by way of ensuring product availability, on-time delivery, and having all the necessary inventory and capacity in their supply chain to deliver those requirements in a responsive manner					
Your company has full visibility of its own supply chain.					
Your company appropriately manages its supply chain risk.					
Your company minimizes product cost to customers.					
Your company's supply chain delivers products on-time to final customers.					
Your company's supply chain delivers zero-defect products to final customers.					
Your company's supply chain minimizes waste across your supply chain.					

APPENDIX B: SUPPORTING LETTER FROM THE MANUFACTURERS ASSOCIATION OF NIGERIA (MAN)

MAN
MANUFACTURERS ASSOCIATION OF NIGERIA

MAN House, 77 Obafemi Awolowo Way, Ikeja, Lagos, Nigeria ● P.O. Box 3835, Marina, Lagos State, Nigeria
Telephone: +234 (1) 4542700 - 2 ● Email: man@manufacturersnigeria.org ● Website: www.manufacturersnigeria.org

Date: September 05, 2024

To: All Members of MAN

SUBJECT: **REQUEST FOR COMPLETION OF SURVEY ON EXPLORING THE IMPACT OF BUSINESS INTELLIGENCE FOR DECISION MAKING WITHIN THE SUPPLY CHAIN PROCESSES AND THEIR INFLUENCE ON SUPPLY CHAIN PERFORMANCE**

On behalf of Miss Homamenim Elizabeth Ile, a PhD candidate at Bournemouth University, I kindly request your support in completing a survey titled "Exploring the Impact of Business Intelligence for Decision Making within the Supply Chain Processes and Their Influence on Supply Chain Performance."

Miss Homamenim is conducting this survey as part of her doctoral research, and she has sought our assistance in reaching out to our members. The survey consists of a 4-page questionnaire focused on understanding the impact of automation on supply chain performance. The questionnaire has been reviewed and it is clear that it is intended solely for academic purposes. As such it does not seek any financial details or sensitive information.

To maintain the integrity of the data collection process and ensure a representative sample, we have recommended that Miss Homamenim collaborate with our trusted research consulting firm, "*Sampling & Investment Analysis Nigeria Limitea.*" They will be conducting the fieldwork and administering the questionnaires.

We kindly ask for your cooperation in completing the survey and returning it promptly. Your participation is crucial for the successful completion of this research and will provide valuable insights into supply chain performance.

Rest assured that your identity, company details and information provided will be treated with the utmost confidentiality and used for the intended purpose.

Thank you for your cooperation and support.

Segun Ajayi-Kadir, mni
Director General