**To Investigate how the evolution of logistics and supply chain management contributes to strategic differentiation and operational effectiveness in the engineering industry, Case studies of Julius Berger Nigeria and Atkins.**

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**Research Dissertation**

**Submission Date:22 May 2023**

# Acknowledgement

I would want to take this opportunity to thank my supervisor Dr Rasha Mohammad for never giving up on me during both the good and the bad parts of this research process and for always being kind and encouraging. Also, many thanks to my tutor, Mr Austin Karibo, for always being there to help when I needed it. Your encouragement and support have been much appreciated throughout the whole procedure. I appreciate your compliments despite the changes. Finally, I would want to publicly thank my parents and other family members for their unwavering support during this time. My family was really helpful in getting this project finished. They provided me with modest time, a favorable environment, and resource assistance up till the conclusion of my research endeavor.

# Declaration

I hereby attest that no part or element of this dissertation project has been taken without the authors' consent from published or unpublished research materials, and that all secondary sources and research papers used to complete this study have been properly cited and credited.

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This dissertation has been forwarded for review, with my permission as the designated supervisor, this research

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# Abstract

***Background:*** Logistics and supply chain management are fundamental components of any organization that deals in the production and delivery of products and services. These two disciplines have increased in overall importance as most businesses seek to improve customer satisfaction, reduce operational costs and streamline operations.

***Methodology:*** to achieve the objectives of this research, secondary research was adopted.

***Results and findings:*** Logistics and supply chain management have greatly evolved, and many companies in the digital era are using logistics and supply chain management technologies. Atkins and Julius Berger Nigeria are examples of companies that are using logistics and supply chain management technologies. The supply chain management and logistics technologies used by Atkins include the Internet of Things (IoT), data analytics, blockchain, warehouse management system, enterprise resource planning (ERP) system, and cloud computing. The supply chain management and logistics technologies being used by Julius Berger Nigeria include cloud computing, on-demand warehousing, weighing and shipping technologies, data analytics, and the Internet of Things (IoT). Implications of the evolution of logistics and supply chain management evolution on the operational effectiveness of Julius Berger are cost management, profitability, increased productivity, and improved inventory management.

***Recommendations:*** Increase visibility of the supply chain management and logistics in the company, Automate supply chain processes, Adopt current technologies, Use real-time supply chain data.

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# Chapter 1 - Introduction

## Background and context

Logistics and supply chain management are fundamental components of any organization that deals in the production and delivery of products and services. These two disciplines have increased in overall importance as most businesses seek to improve customer satisfaction, reduce operational costs and streamline operations. The evolution of logistics and supply chain management over the past decades has impacted all industries and the engineering sector is not an exception as it heavily relies on the efficient management of its supply chain operation and logistics (Fugate et al., 2010). The term logistics refers to the process of planning, implementing, and controlling the movement of products and services from the producers/manufacturers to the final consumers. It incorporates all the activities of storage, transportation, and distribution of goods. Pettit et al. (2019) define supply chain management as the coordination of the activities involved in the sourcing, procurement, production, and delivery of goods and services. These two disciplines have greatly evolved in the past two decades due to increased technologies and innovation such as the digital automation of processes that many companies enjoy nowadays.

Julius Berger Nigeria is a prominent and leading Engineering and Construction Company based in Abuja, Nigeria, and has been in operation for the past five decades. The Company is popular in Nigeria offering various services such as design, planning, engineering, and construction operations. Julius Berger has considerably benefited from the evolution of logistics and supply chain management. By leveraging technologies like automated warehouses, GPS tracking, and inventory management systems, the Company has enhanced the optimization of its logistics and supply chain operations hence improving efficiency and reducing costs (Huo et al., 2014). During the past two decades the company has seen the adoption of novel technologies in its logistics and supply chain management some of the technologies implemented are blockchain, big data analysis, on-demand warehousing, and more (Chang et al., 2019). The evolution of these disciplines and the adoption of its innovation by Julius Berger makes it a competitive company with unique differentiation strategies and improved operations effectiveness.

Atkins is a global engineering and design consultancy company based in Epsom, United Kingdom with over 18,000 employees across the globe. It provides a range of services to its clients in the transportation, energy, and infrastructure sectors, including engineering design, project management, and technical consultancy (Mangan and Lalwani, 2016). As a result of its operations, the company heavily relies on efficient management of its supply chain activities and logistics. Atkins has leveraged technologies including RFID tagging – attaching electronic tags to products and packages to enable tracking throughout the supply chain. It has greatly improved its inventory management, reduced product theft, and improved supply chain visibility. Apart from RFID tagging, Atkins leverages cloud-based logistics platforms and predictive analytics. Cloud-based logistics software allows the company to manage its supply chain activities and logistics from a centralized platform providing real-time visibility, shipment status, etc. Besides, the application of predictive analytics using statistical algorithms, data, and machine learning has helped predicts future events and identify patterns (Carter and Liane Easton, 2011). All these technologies help the company streamline logistics, reduce costs, forecast demand, and optimize inventory levels among other benefits.

## Problem definition

The engineering industry heavily relies on the efficiency of supply chain management and logistics operations. In recent years, there has been significant evolution driven by advancements in technology, globalization, and the need to improve operational efficiency. According to (Miguel and Brito, 2011), despite these advancements, there are still issues facing the industry which hinder the achievement of operational effectiveness and strategic differentiation. One of the problems is the lack of standardization in the supply chain management and logistics practices since many companies have different approaches leading to inefficiencies and inconsistencies in operations. This leads to reduced customer satisfaction, increased operational costs, and delays. Besides, there is a challenge in managing global supply chains; as businesses increase cross-border operations, managing global chains becomes complex and many issues arise including customs regulations, cultural differences, etc., (Ninlawan et al., 2010). Additionally, disruptions like geopolitical events, natural disasters, or pandemics also impact the supply chains highlighting the need for effective risk management strategies.

Moreover, businesses need to embrace emerging technologies such as artificial intelligence, blockchain, and the Internet of Things (IoT) to optimize their supply chain operations and logistics (Witkowski, 2017). However, implementation of these technologies is faced with various challenges like high costs, lack of technical expertise, data security, privacy concerns, etc. Therefore, despite the evolution of logistics and supply chain management, the engineering sector still faces some challenges in achieving desired operational effectiveness and strategic differentiation. Mostly due to difficulties in managing global supply chains, lack of standardization, and the increased need for adopting emerging technologies (Tjahjono et al., 2017). The research study aimed to investigate how the challenges could be addressed via a case study of Julius Berger Nigeria and Atkins to improve operational effectiveness and strategic differentiation.

## Rationale

This research study aimed to explore the role of logistics and supply management in achieving operational effectiveness and strategic differentiation in the engineering industry. With the continued evolution of globalization and technology, these disciplines have become crucial components in the success of businesses in this industry. Therefore, it was important to understand how these factors contribute to the overall success of businesses and how they could be optimized to achieve strategic differentiation and operational effectiveness (Yu et al., 2016). By conducting a case study analysis of Atkins and Julius Berger Nigeria this research aimed to provide insights into how these companies leverage logistics and supply chain management to achieve their strategic objectives. Besides, it aimed to identify problems the engineering industry faces in optimizing logistics and supply chain management and proposed strategies to address the challenges. However, the findings of this research can have considerable implications for businesses in this sector by helping them understand how supply chain management and logistics can be used to achieve operational effectiveness and strategic differentiation (Collins et al., 2010). Additionally, this research contributes to the academic literature by developing insights into the importance of supply chain management and logistics in the success of businesses in the engineering industry.

## Aims and objectives

The key aim of this study was to investigate how the evolution of logistics and supply chain management contributes to strategic differentiation and operational effectiveness in the engineering industry mainly focused on Julius Berger Nigeria and Atkins. However, the specific objectives of the research were:

* To determine the evolution of logistics and supply chain management
* To evaluate the impacts associated with the evolution of logistics and supply chain in operational effectiveness and strategic effectiveness of Julius Nigeria and Atkins
* To examine how Atkins and Julius Berger Nigeria could benefit from supply chain management and logistics evolution.

## Study organization

There will be six chapters in this research study. The study's first chapter will provide a thorough overview of the study's background and context, the research issues, as well as the research questions, aims, and objectives. This chapter will also outline the study's justification. The second chapter offers critiques of earlier academic studies are related to the research study topic. Chapter two also includes a summary of various theoretical frameworks and theories related to the subject of the investigation. The research methodology, which consists of the research philosophies and techniques as well as the study design, is examined in the third chapter. This chapter provides an overview of the processes and procedures used in data collection. Additionally, ethical issues and analytical methods are covered. The obtained results and findings are described in the fourth chapter. An extensive discussion is provided in Chapter 5, and that same chapter also presents interpretations of the results. The study's findings and a precise conclusion are summarised in the final chapter. In this chapter, suggestions for future research projects are offered.

# Chapter 2 – Literature Review

## Introduction

This study's chapter has reviewed a number of findings from earlier research study works that have looked into the topic; evolution of logistics and supply chain management and Impacts of the logistics and supply chain management evolution in operational effectiveness and strategic differentiation in the engineering industry. The reviewed articles have been selected in relation to the research objectives and aims.

According to Ganbold et al., (2021) Logistics and Supply Chain Management (SCM) can be distinguished as they are two different terms. Although there is a slight distinction between the two, supply chain management (SCM) and logistics are frequently used interchangeably in literature. While logistics is primarily focused on operations, supply chain management (SCM) is more strategically oriented (Ganbold et al., 2021). While supply chain management (SCM) focuses more on the connections within the chain, agreements and relationships, choosing suppliers, information and financial flows in addition to material flows, building new facilities like plants, warehouses and distribution centres, and broader issues like society, economy, government, and environment, the scope of logistics is largely limited to the routine task of transporting and storing goods. But if one thinks at it carefully, supply chain management (SCM) is really all about logistics, and if logistics goes wrong, the whole chain breaks (Huo et al., 2014).

## Evolution of logistics and supply chain management

According to Huo et al., (2014) the evolution of supply chain management is a concept that describes the operations of the production-distribution system and the integration of the key variables that influence the transformation and flow of goods and raw materials from the supplier to the end user. As a concept of coordination of the fundamental SCM functions, supply chain principles were first developed. Most organizations have developed supply chain in order to gain a significant competitive advantage over rivals.

According to (Ballou, 2007).It is important to understand that during the past 50 years, the ideas of logistics and the supply chain have changed. Research and studies have adhered to a particular ranking that is provided in chronological order by decade in an effort to be logistically accurate. But first, a crucial disclaimer: this viewpoint is solely that. It doesn't necessarily incorporate the most significant logistical historical data either. But it also contains those from the 1950s to the present that some authors felt were significant (Ballou, 2007).

Bujak, (2015) argues that the movement of raw materials into an organisation, specific internal processes for turning raw materials into finished goods, and the movement of finished goods out of the organisation and towards the end-consumer are all managed as part of the supply chain management approach, which spans multiple functions. Organisations lessen their ownership of raw material sources and distribution networks as they work to concentrate on their core strengths and become more adaptable. These tasks are increasingly being delegated to other organisations that can carry them out more efficiently or more affordably (Bujak, 2015). As a result, more businesses are involved in meeting customer demand, while management oversight of ongoing logistical operations is diminished. Supply chain management ideas were developed as a result of less control and more supply chain partners. The goal of supply chain management is to increase cooperation and confidence among stakeholders in the chain, which will increase inventory visibility and movement velocity. In supply chain management, there are four main decision-making areas: Location, Inventory, Production, and Transportation (distribution)

According to Wallenburg and Weber, (2005)Supply Chain Management is thought to have evolved in three stages. The first stage of Supply Chain Management, physical distribution management, was introduced in the 1960s and involves physically moving finished goods from the manufacturer to a network of distributors through the management of warehouse locations, order processing, shipping, and e-commerce fulfilment. In order to better serve potential customers, this stage of supply chain management concentrated on strategically distributing merchandise that is sent through a fulfilment network (Wallenburg and Weber, 2005). The second step of SCM, logistics management, was adopted into supply chain procedures in the 1970s. Real-time inventory transit, storage, and procurement from the starting point to the final destination are all part of logistics management. Getting the goods to the correct place, managing resources and inventory, and managing inventory data are the main actions involved in the logistic management stage. Inventory control, order fulfilment, network design, warehousing materials handling, inbound transportation, third-party logistics, and outbound transportation are all included in the engineering sector's logistics management, which is frequently used to improve the quality of delivery services and inventory management (Southern, 2011).

Southern, (2011) argues that since the system was extremely fragmented in the 1960s, this tendency was highlighted as a significant area for future efficiency improvements. Supply chain management has evolved by enhancing the integration of various jobs. The 1970s and 1980s saw the initial consolidation of logistics duties into two distinct functions linked to materials management and physical distribution, despite the fact that these tasks have remained largely the same (Southern, 2011). As globalisation sparked functional convergence and the genuine birth of logistics in the 1990s, this process advanced. The entire supply chain was integrated into a single management viewpoint.

Acciording to Islam et al., (2013) with the help of blockchain technology, big data analytics, and artificial intelligence (AI), Julius Berger Inc. is one of the leading businesses that uses logistics management to optimise the construction operations in Nigeria's infrastructure development. The most recent development in supply chain management, which began in the late 1880s, is modern supply chain management (Islam et al., 2013). SCM refers to the complete manufacturing process of a product, from the procurement of raw materials through logistics operations and finally to the actual delivery to the customer. Storage, purchasing, and product delivery are the three main components of SCM, and they are categorically coordinated to enhance customer satisfaction, increase operational effectiveness, and reduce supply chain costs.

According to a study by Nguyen et al. (2018), a number of factors, including the increased utility of AI, global pandemics, robotics, and sophisticated technology for business solutions, environmental considerations of SCM practises, and self-driving technology, are responsible for the evolution of logistics in the fourth industrial revolution. The growth of e-commerce, which enables customers to shop from home and receive their desired products in a set amount of time, has accelerated the evolution of logistics. By continuously monitoring and managing the client's inventory, logistics involves the actual purchase, manufacture, and distribution of resources and goods in precise quantities to precise targets. It requires the appropriate choice of transportation options, warehousing tasks, and inventory delivery. IoT, ML, cloud computing, blockchain technology, data analytics, weighing, and shipping technologies (Nguyen et al., 2018).

According to Wang et al., (2016) in order to remove obstacles and inconsistent e-commerce platforms, modern SCM uses cloud computing to centralise communication activities between different suppliers, customers, and vendors. In Atkins, sensors are utilised to acquire inventory data using the Internet of Things (Wang et al., 2016). This makes it possible to track inventory in real time, giving customers a flawless experience. The use of robotics in contemporary supply chain management is also very common. In warehouses, collaborative robotics is used to organise picking and shipping routes. For faster, more dependable, and more effective inventory delivery, modern logistics operations also incorporate autonomous driving, drones, and electric vehicles (Wang et al., 2016).

However, Wong et al., (2011) argues that the development of supply chain management made a more thorough integration only conceivable with information and communication technology practicable. This opens the door to a new spectrum of production and distribution systems by enabling the integrated administration and control of information, financial, and commodities flows. Supply chain management has developed into a complicated series of tasks aimed at competitiveness and value capture (Wong et al., 2011). More recently, the evolution of physical distribution and materials management has been significantly influenced by the rising amount of automation in supply chains. This digitalization is especially noticeable in distribution centres where areas like storage, materials handling, and packaging have seen a considerable push towards automation. Automated delivery cars may one day be available.

According to Collins et al., (2010), as information and communication technology advanced, the assembly line's two ends were included into the logistics of the supply chain. Early examples of logistical engineering included high rack storage, which subsequently became automatically operated, and the internal transportation of goods by flat robots. Initially, the activities of supplying, warehousing, production, and distribution made up logistics; the majority of these activities were largely independent (Collins et al., 2010). Firms adopted a more integrated strategy with the new organisational and management concepts, thereby meeting the impending demand for flexibility without increasing costs. At the same time, numerous businesses used offshoring and outsourcing to benefit from fresh manufacturing prospects in developing nations. Activities involved in managing production consolidated as it grew more dispersed.

For example, Tijan et al. (2019) found that construction, service delivery, design, and logistics companies such as Atkins Co. utilises updated technology such as blockchain technology and the weighing and shipping technologies for delivery of quality products. Predictive analytics is used in industries such as the construction industry to generate solutions to real-time problems by analysing past and present events for patterns and predictive outcomes. By guaranteeing that the proper quantities of goods are packaged and transported, weighing technology, as utilised in the construction and design sectors, improves the dependability of inventory delivery (Büttner and Renn, 2016). Blockchain technology is also used by Julius Berger to enhance data security and protect client information. By making it hard to replicate a transaction record or circumvent computer network security, blockchain technology does this (Tijan et al., 2019).

## Impacts of the logistics and supply chain management evolution in operational effectiveness and strategic differentiation in the engineering industry

According to Hofmann et al., (2012), in supply chain management, the primary function of logistics is to raise the overall value of each delivery, which is measured by customer satisfaction. This means that maintaining a particular degree of high-quality customer service must be linked to the optimisation and reduction of labour resources. This issue is resolved by both implementing automation solutions and lowering the overall labour force (mainly by removing unused chain links) (Hofmann et al., 2012). One of the major expense areas in logistics management is transportation costs. Generally speaking, transportation costs rise with distance, batch size, and product damage exposure. On lengthy trips, however, the cost of transportation per unit of weight reduces as the size of the lot grows. Therefore, maximising transportation volume consolidation can aid in lowering transportation expenses. A huge lot designed for a long run, or a greater distance, can be created by combining many little ones (Hofmann et al., 2012).

For example, Kirchoff et al., (2016) in their study argue that many products come with RFID tags today so that both the manufacturer and the end customer can track whether all storage conditions are being observed during the transportation of the goods. The speed of delivery of the goods to the end-user, as well as their transportation in proper conditions and within the permitted time limits, have a significant impact on the quality of service. reduction of potential hazards as well as actual losses is another impact of SCM and logistics in any organization. A firm is profitable if the value it generates outweighs the expenses incurred in carrying out its operations (Kirchoff et al., 2016). A corporation must either perform these tasks at reduced costs or perform them in a way that will result in differentiation and price increases in order to gain a competitive edge. To properly address this issue, it is first necessary to lessen the losses brought on by returns of items. The routes by which the items are delivered back to the warehouse or to the establishments for their disposal are just as crucial to arrange as the ones that take them to the distributor or the final user. The effective planning of business resources, which reduces the possibility of damage to or loss of goods or components used in manufacturing on the route from the collection of raw materials to the transportation of the final product or service to the end-user, is the second aspect that affects risk reduction (Golicic and Smith, 2013).

Golicic and Smith, (2013) in their study state that SCM and logistics helps inreducing the need for intermediary services. The majority of the expense associated with putting supply chains into place goes towards intermediary services (such as transportation, storage, marketing, recycling, etc.). For effective logistics management, knowledgeable logisticians design routes that minimise the need for outside assistance. Logistics and SCM prompt reaction to shifting market demands. Advanced logistics models also assist in fast adapting to shifting market demands in order to maintain leading positions against rivals and continue to be in high demand among the target market (Golicic and Smith, 2013).

According to Wang et al. (2017), Logistics and supply chain management changes have a significant impact on operational efficiency and strategic differentiation. As logistical influences change, so do the methods used to manage the movement of products and services. (Golicic and Smith, 2013)contend that as technology advances, manual handling systems' limitations are being broken, enabling businesses to use tools like shipping track systems and the Internet of Things to exchange system designs, fix damaged equipment, store and distribute spare inventory, and more. Engineering firms have used new technology in the modern era to enhance their supply chain management and logistics systems. Blockchain, big data analytics, the Internet of things, cloud computing, shipping track systems, and weighing and storage technologies are a few of these technologies (Park, 2020). Blockchain technology, according to Wang et al. (2017), gives engineering companies security methods to track all transactions securely and openly. The engineering industry uses blockchain-based tracking systems to trace items' initial routes from their source to their final destination. When a product is repaired, redesigned, or changes direction, blockchain systems offer new information (Sundarakani et al., 2021). Blockchain technology ensures that supply chain management systems are effective in reducing fraud, theft, and inaccurate inventory records. For instance, Atkins has integrated blockchain technology into its supply chain systems, which allows it to complete transactional development projects with clients directly and without the need for a middleman. Atkins has access to flexible routes for communication that guarantee a constant stream of information between them and the clients (Zhang et al., 2022).

The blockchain technology has also improved the integration of logistical and financial services, ensuring real-time customer interaction and influencing client confidence to finish building projects (Zhang et al., 2022). However, blockchain has improved accountability and reduced any illicit activity that would erode customers' faith in the business. In the construction business, processes for weighing, storing, and transporting materials have been made simpler by weighing and shipping systems. Logistics procedures have become safer and more accurate thanks to weighing technologies such onboard truck scales, weighbridge bridge scales, portable truck scales, and vehicle and axle scales (Zhang et al., 2022). The versatility of these scales allows them to quickly weigh a variety of trucks, providing flexibility and convenience to the loading and unloading areas. To weigh building materials offloading at construction sites, Julius Berger building Company employs board trucks and temporary truck sales (Karakas et al., 2021). These scales assist in tracking essential building supplies, like concrete ingredients and other products, to preserve the durability of construction equipment.

The adoption of digitalized, networked, and distributed settings through intelligent and automated systems is reshaping global supply chain management. By reducing cycle times, preserving quality, elevating the customer experience, and removing duplicate manufacturing and running costs, this technology transition will enhance corporate performance (Karakas et al., 2021). While many firms have already used these technologies and benefit from increased overall business performance, supply chain and logistics are going through a considerable transition.

Construction trucks and storage facilities are linked through the Internet of things, a key technology in supply chain systems that allows for real-time supply chain monitoring. (Karakas et al., 2021)claim that the Internet of Things has accelerated the management of the construction industry in this decade. IoT technology is used by Atkins' fleet and warehouse management to monitor the construction site's supply of building materials. Through a GPS connection, fleet managers may track the whereabouts of vehicles in real-time and determine whether they are in danger of being hijacked or having construction materials stolen (Karakas et al., 2021). Additionally, environmental sensors collect meteorological data from the vicinity of construction materials, such as pressure and humidity, to identify any conditions that could jeopardise their existing condition. To increase the efficiency of loading and unloading heavy materials from trucks and to provide flexibility in inventory management operations, Julius and Berger have combined IoT technology with supply chain systems to locate the location of items in construction warehouses. Atkins analyses meteorological information and travel routes using IoT and data analytics to find potential dangers like hijacking and accidents (Sharma and Shishodia, 2022). Fleet managers can determine the most efficient routes to convey building materials to the job sites thanks to this data. The upgrading of fresh supplies and on-delivery materials are among the automated warehousing procedures made possible by the Internet of things. Fleet managers have access to construction equipment inventory records in real-time. The supply chain operations at Julius and Berger have been automated, which has shortened delivery times and construction deadlines.

Inventory management has been simpler because to the use of data analytics in supply chain systems, which has also enhanced decision-making. Important ideas like capacity planning, business intelligence, and demand forecasting have been introduced by data analytics to the engineering sector (Tiwari et al., 2018). To assess the construction capability of various projects in accordance with market demand, Atkins Construction Company has applied data analytics. In order to design effective inventory management procedures, warehousing strategies, and logistical procedures for a specific construction project, it analyses the construction market. Time and production costs are reduced as a result. These insights also aid the business in preparing for potential market scenarios that could influence building procedures and undermine customer confidence in it.

The ability of a company to establish a competitive edge over rivals is known as competitive advantage (Calabrese et al., 2013). It is the result of crucial managerial choices and consists of characteristics that allow an organisation to set itself apart from its rivals. Price/cost, quality, delivery, and flexibility have all been mentioned often in the empirical research as crucial competitive capabilities. Additionally, time-based competition has been identified as a crucial competitive priority in recent studies. According to Calabrese et al., (2013), time is the next source of competitive advantage. Organizational performance is also another impact caused by use of supply chain management practices and logistics. The effectiveness with which an organisation achieves both its financial and market-oriented aims is referred to as organisational performance. While SCM's long-term goals are to enhance market share and profitability for all participants in the supply chain, its short-term goals are primarily to boost productivity, decrease inventory, and shorten cycle times. Financial indicators have been used as a comparison tool and to assess how an organisation has changed over time. Supply chain management, among other organisational initiatives, should ultimately result in improved organisational performance.

The success and accomplishments of an organisation are evaluated using organisational performance, which is regarded as a multidimensional entity (Kumar et al., 2017). The long-term viability of an organisation may suffer if it just focuses on financial performance indicators, so organisations should develop a wide range of performance measurements. Business or operational performance are two ways to gauge an organization's success. While business performance refers to an organization's financial success in terms of profitability and investment return, operational performance demonstrates improvements in an organization's reaction to a dynamic environment in comparison to its competitors. Selecting the best performance indicator has proven challenging for certain businesses because of the innate complexity and dependency of supply chains.

Engineering companies nowadays are continuously in fierce competition to produce high-quality goods in the shortest amount of time at the lowest possible cost, even in the most unpredictable economic conditions. Businesses are constantly searching for fresh approaches to create sustainable competitive advantage due to competitive challenges like cost reduction and improved customer service. Due to their increased awareness of the expanding rivalry and its crucial role in establishing leadership in their sectors, many industry leaders are continuously looking for new tactics that will allow them to reinvent themselves as agile organisations (Khanuja and Jain, 2022).

Businesses need to have strong supply chain strategies and technologies that can streamline operations engaged in both internal and external processes if they want to be more responsive to customer requirements, cut costs, and improve performance. To improve company performance, it is essential to establish integrated cross-functional activities within the organisation and connect them successfully with business partners, suppliers, and customers on the outside utilising appropriate supply chain strategies and technology (Gunasekaran et al., 2004).

In reality, supply chain integration will boost organisational performance by including suppliers and customers in the value creation process (Kumar et al., 2017). In order to be more competitive and adaptable in the environment, effective organisations actually integrate their internal to external operations with the appropriate supply chain strategies and technology. As a result, supply chain integration is a vital dynamic talent that can lead to performance differentiation. Supply chain integration is one of the key trends that will profoundly change how supply networks function in the future. As a result, effective supply chain integration management can lead to both short-term financial gains and a long-term competitive advantage.

## Conclusion

The study topic's various elements have been covered throughout the chapter. The chapter has identified what other authors have written on the problems with supply chain management and logistics in engineering companies through the review of various peer-reviewed articles. The authors have identified how evolution of the SCM and logistics in the engineering sector and its impact to the companies operating in this industry.

# Chapter 3 – Methodology

## Introduction

Since it provides a researcher with a strong background to adopt the right methodologies and theoretical analysis in order to acquire a thorough understanding of the selected issue, research methodology has been positioned as a concern in the field of study. It's remarkable that the researcher must take into account how the preferred research methods match methodologically with the preceding work, the goals and objectives of the study, and the research questions. An overview of the research methodologies, philosophies, study design, and methods used for data collecting and analysis are included in this chapter. Additionally, several aspects, such as validity, reliability, and ethical considerations, will be outlined in the data collection processes.

## Research Philosophy

The study was guided by a philosophical position, which also heavily influences the data collecting, analysis, and follow-up tasks. The interpretivist research paradigm was be applied to this investigation (Alharahsheh and Pius, 2020). This research philosophy was applied mostly because of the qualitative nature of the study. According to the interpretivist research theory, nature is a perception-based, subjective concept. To lay the groundwork for comprehending the objectives of the study and the methods used to gather data, this study employed an interpretivism philosophy. This philosophy's main presumption is that the results of the study are influenced by other people's opinions, beliefs, and attitudes on supply chain resilience. (Rahi, 2017)asserts that the interpretivism school of thinking favours incorporating the viewpoints and opinions of research subjects in order to draw informative conclusions. This strategy was chosen because it involves compiling data from many sources and analysing already collected data. Qualitative data sources were favoured above quantitative data sources in light of the research's objectives. Qualitative data gathering techniques are more consistent with the interpretivism worldview because they give participant judgements and intuitions more weight (Romani et al., 2018). The interpretivism approach was used to study and investigate the data gathered from journal articles in order to fully and completely fulfil the research goals. The interpretivism approach is best suited for the study's qualitative research methods. This approach teaches researchers the need of weighing alternative viewpoints before passing judgement.

Qualitative research method was used to explore the processes, activities, and events connected to the data (Yilmaz, 2013). Additionally, qualitative research gives the researcher the chance to comprehend the data being analysed in great detail, which helps them obtain deeper comprehension and understanding of the data. However, utilising this approach has the drawback of compromising data privacy because the researcher digs deeply into the data, including the personal information, and it can also be expensive. In light of this, the interpretivism school of thought, a subset of doxology, was used by the researcher to produce the results (Yilmaz, 2013). The concept of interpretivism is founded on the idea that the researcher has a substantial impact on data collecting and interpretation.

## Research strategy

Due to its many benefits and compatibility with secondary sources, the secondary research approach was used in the research. In order to explore a phenomenon from both a broad and in-depth perspective, secondary research methodologies combine qualitative and quantitative data (Rahman, 2020).The quantitative analysis was not sufficient to investigate the broad topic of how AI and data analytics have affected digital activism, thus the study used both qualitative and quantitative methodologies to analyse the data acquired from secondary data sources. Due to the study's small sample size and inadequate comparison data, the qualitative analysis did not satisfactorily address the study's needs (Rahman, 2020).

To fill up the gaps in the qualitative data that were absent and get rid of the comparative weakness, secondary research approaches were applied. Additionally, the researcher was helped by the secondary research in developing the hypothesis and coming to the correct findings by adding more descriptions and details to the quantitative analysis. The conceptualization of both numerical data and the conclusions gained from the statistical data made this process simple (Rahman, 2020). The validation of the study's conclusion is strengthened, which is a key factor in why secondary research methods were adopted. The convergence of quantitative and qualitative data, or triangulation, aids the development of relationships and meaning for the numerical values. This makes the research findings more credible.

The secondary research technique made it easier to triangulate secondary data sources, which might be ambiguous and contain both relevant and unrelated data. However, the researcher clearly outlined the objectives, which guided the entire study and helped uncover qualitative and quantitative data sources that would later be used to develop perceptive conclusions about the research issue (Goldenberg et al., 2015). The flexibility of the research design was another advantage that the research strategy provided for the study. Open-ended and closed-ended data sets are used in mixed techniques, which allow for the most thorough investigation of the study topic. The research's goals and objectives were clearly stated, and data sets for both qualitative and quantitative analysis were selected.

## Study design

The methods and procedures used to gather and analyse the data for a specific study make up the study design. The method a researcher uses to combine different aspects of a study in a sound and logical way, ensuring that the research challenge is successfully addressed, is known as research design. study designs come in a variety of forms, including experimental, descriptive, explanatory, and exploratory study designs. According to (Goldenberg et al., 2015) the exploratory design enables the collection of a wealth of information, explaining each distinct component and how it relates to the research issue. However, the conclusion of all significant features is not possible with this kind of research approach. To investigate how the evolution of logistics and supply chain management contributes to strategic differentiation and operational effectiveness in the engineering industry, with the key focus being on Julius Berger Nigeria and Atkins, and to develop a general understanding of this topic, data were methodically gathered from a number of qualitative investigations that were undertaken in the past by different experts.

In relation to the research topic and the study's key goals, the research design also helped identify workable data sources. This was also helpful for analysing the quantitative data, which was large and lumped together and needed integrated analytic approaches to pinpoint the issues with the several research that served as the study's sources (Largan and Morris, 2019). Additionally, the strategy supported qualitative data analysis, expanding the spectrum of study goals. The researcher was able to synthesise the research topic and needs, identify theoretical views from the available data, and create an overview for the timeline of the many issues mentioned thanks to the study's focus on individual results. This strategy was combined with text analysis to make it easier to comprehend different data properties. These include recurring themes, phrases, and word associations that helped statistically analyse quantitative data and more fully express the already-existing notions.

## Research approach

In order to identify the patterns and their relationships, the study used an inductive research methodology. Inductive research, as opposed to deductive research, assesses the information and findings from the study (Woiceshyn and Daellenbach, 2018). It creates theories that explain the research's findings and results using the data. On the other hand, the deductive research methodology develops a theory that is put to the test by the research's data collection. To find patterns in the facts and create explanations and theories by testing hypotheses, inductive research use inductive reasoning. Because there were no observations to analyse and identify patterns from at the start of the study process, inductive reasoning was not the best approach (Woiceshyn and Daellenbach, 2018).

Additionally, using inductive reasoning at the start of the research process would change its course. This study used an inductive research methodology that was clear and concise (Woiceshyn and Daellenbach, 2018). Data pertinent to the research interest were first gathered for the study. The researcher began data analysis by checking the observations and foreseeable patterns in the observations after confirming the relevancy of the data. To find patterns in the observations, the researcher employed inductive reasoning. The researcher then went on to formulate ideas that account for these patterns by performing a hypothesis on the data. Starting with a unique set of data, the procedure leads to a more general hypothesis about those experiences. Simply put, the process moves from a certain focus level of data collection. It's important to note that the inductive method did not ignore the theories that were applied to create the study objectives and questions. To create a hypothesis for the study, inductive reasoning focuses on experiences, patterns, and similarities (Woiceshyn and Daellenbach, 2018). The use of inductive reasoning greatly aided the study.

The strategy caused the research to go through a downward thought process, which produced helpful outcomes. In order to define the importance of the research process and address the research problem, theories from the research process are helpful. Furthermore, the study procedure took less time than was anticipated. All necessary information for inductive investigation was gathered by the researcher (Azungah, 2018). Furthermore, it was simple to analyse and identify trends in the secondary data. The research was useful for gathering information, creating theories, and identifying patterns in the observations. The researcher was able to address the research issue thanks to inductive reasoning. The research's result is excellent for further research. The results, assumptions, and conclusions of this study can be used as a foundation for future investigations into artificial intelligence and online activism. The strategy caused the research to go through a downward thought process, which produced helpful outcomes. In order to define the importance of the research process and address the research problem, theories from the research process are helpful. Furthermore, the study procedure took less time than was anticipated (Azungah, 2018). All necessary information for inductive investigation was gathered by the researcher. Furthermore, it was simple to analyse and identify trends in the secondary data. The research was useful for gathering information, creating theories, and identifying patterns in the observations. The researcher was able to address the research issue thanks to inductive reasoning. The research's result is excellent for further research. The results, assumptions, and conclusions of this study can be used as a foundation for future investigations into artificial intelligence and online activism (Spector et al., 2014).

## Data collection method

Primary and secondary sources are the two basic types of data used in research. The study environment determines the data source, and the researcher may employ either one or both to gather data. Primary sources come from individuals who have first-hand knowledge of the data gathered (Johnston, 2014). Most quotes from primary sources are used in secondary sources, and additional information is provided to help explain the primary data. In this study, secondary sources was used to gather data, and a qualitative technique was used in the data analysis. The sources included scholarly and relevant publications, blogs, and articles. The research used case studies from 2 distinct companies in 2 separate countries, which is the fundamental justification for selecting this approach of data collection. In comparison to primary materials, this approach is therefore the most suitable. Comparatively speaking to the original source, this method has the advantages of being less expensive and time-consuming. However, it is simple to gather pertinent data from a variety of online sites regarding the examined topic. The main disadvantage of utilising this method is that the information is not from the original source, so there may be twists in it that lower the value of the data (Johnston, 2014). Additionally, data from Julius Berger and Atkins businesses that might be accessible online will be gathered for the study. The references section will list all of the secondary sources used in the study.

Since this study was based on secondary research, secondary data was gathered in order to meet the study's goals. The information was gathered from secondary sources, including studies and peer-reviewed journals on vocation education. The secondary sources were found online in a variety of databases, including Google Scholar, PubMed, IEEE, CINHAL, and ProQuest (Gusenbauer and Haddaway, 2020). In order to ensure that only pertinent articles and studies were chosen, the researcher thoroughly evaluated all of the searches' articles and papers. Additionally, extensive vetting was done to confirm the reliability of the chosen research and articles. (Johnston, 2014) notes that because secondary data is affordable, researchers typically finish their work with little financial impact. Researchers are able to gather a lot of data through secondary research, which is important for achieving the study's aims and objectives. This is due to the fact that there are a sizable number of papers and articles available online that are publicly sourced. Despite the fact that secondary research offers many benefits, it is not without drawbacks. According (Moser and Korstjens, 2018)**,** secondary data is dependent on the information already available from previously published studies. If such studies that are published in the past have any problems or errors, they are undoubtedly passed to the study that was undertaken. Due to a number of benefits associated with secondary research, academics prefer to employ it more frequently than primary research.

## Data analysis

In the study, both thematic and descriptive analysis were used. Analysing qualitative data required thematic analysis, whilst analysing quantitative data required descriptive analysis. Through a combination of analytical techniques, the descriptive and thematic categories were applied to the secondary data sources (Castleberry and Nolen, 2018). Finding themes, patterns, and other connections between the gathered data is done through thematic analysis. When researching people's perspectives, ideas, and experiences in relation to a social phenomena, it is incredibly effective. Thematic analysis was used in the study to flexibly examine the experiences and opinions of other participants and researchers related to the research issue. In order to produce reliable and accurate results, thematic analysis depends on problems with the raw data and looks for connections and knowledge gaps in secondary data. The procedures involved are familiarisation, coding, theme generating, reviewing and defining themes, and a systematic presentation of the themes examined. These procedures make it easier to examine semi-structured data sources and concentrate on the usefulness and frequency of theme concerns. The primary themes emerging from the research objectives were summarised by conclusions, which also included the research findings.

Descriptive analysis, on the other hand, is concentrated on the numerical presentation of results to illustrate the theoretical underpinnings of theme concerns. To create correlations, trends, and patterns between data sets and enable a thorough study of statistical data, the descriptive analysis makes use of both recent and historical data (Sundler et al., 2019). It was utilised in the study to gather data on the variables, establish links between them, and determine any potential correlations. Descriptive analysis therefore summarises thematic analysis, and the two together are necessary to produce a thorough, in-depth, and precise examination of themes. To test various hypotheses, descriptive methods can be used, such as means, quartiles, cross-tabulations, and standard deviation. This method draws attention to the variations and continuities among diverse data subgroups. This study design also enables the separation of research goals, the production of precise and trustworthy results, and the testing of hypotheses. Insights into the raw data are provided by the descriptive analysis through the use of tables, while the subjectivity of objective data, such as the variables influencing particular responses, such as cultural differences, may be investigated through random variation and statistical conclusions.

Descriptive analysis has a lot of benefits. First, by using multiple variables to examine a single event, the study supplied a broad lens for investigating the research aims. Additionally, the descriptive analysis' impartiality and neutrality minimised the possibility of bias and accuracy while enabling the study to be free from the researcher's emotions and personal interests. Additionally, using inferential and experimental approaches to further analyse the hypothesis, the descriptive analysis enabled the study to lower its margin of error and identify underlying themes (Vaismoradi et al., 2013). Thematic analysis made it easier to find themes in statistical data and to extract several themes from small amounts of data. The use of both thematic and descriptive analysis encouraged the investigation of both quantitative and qualitative data, allowing the study to make accurate conclusions.

## Ethical considerations

The achievement of the study's goals and objectives is dependent on research ethics. In the field of research, the importance of research ethics is currently taking hold. It is crucial to make sure that the research works are authentic and legitimate because research is currently becoming more competitive and compromising (Ponterotto, 2013). The use of secondary data is a crucial ethical problem. The secondary study will help to make the most of the public domain data that is already available and the investment made in data collection. Additionally, as it permits the replication of numerous outcomes and findings from previously published publications and studies, it will lessen the strain on the human participants. Utilising secondary data is most useful when the advantages of secondary research outweigh the hazards. Some of the ethical requirements for this study are that the data be de-identified before the researchers can access it, that it is reasonable to assume that study participants have given their consent, that the analysis' results should prevent the participants in the prior study from being reidentified, and that using secondary data shouldn't result in any harm or distress (Thompson et al., 2021).

Participants' data was reused throughout the investigation. This needed determining who owned the datasets and consulting the owner to see if they could agree on behalf of the participants. The study took care to make sure that none of the data it accessed from different sources revealed any private information about the participants. To protect the participants' anonymity, the data were handled with the utmost secrecy. Secondary data were used in the research. The study adhered to the BERA's ethical standards for confidentiality, anonymity, and personal data. The research takes into account a number of factors, including the sensitivity of the data, who developed it, the intended audience and participants of the data makers, the original purpose of the data, and its intended uses in the research (Govil, 2013).

## Conclusion

This chapter's major goal was to examine the research methodology that was used for the study. There was a lot of discussion about the research philosophy used for the study. To assist in solving the research problem, interpretivist research was used. Additionally, the methodologies and research strategy used were thoroughly described. The research's goals and objectives were obtained through the collection of primary data. The adopted data analysis approach was also described, along with the justifications for it. This particular chapter investigated validity and reliability. Finally, this chapter also brought up a number of ethical considerations that were taken into consideration. The results and conclusions will be outlined in the following chapter.

# Chapter 4 - Results and Findings

## Introduction

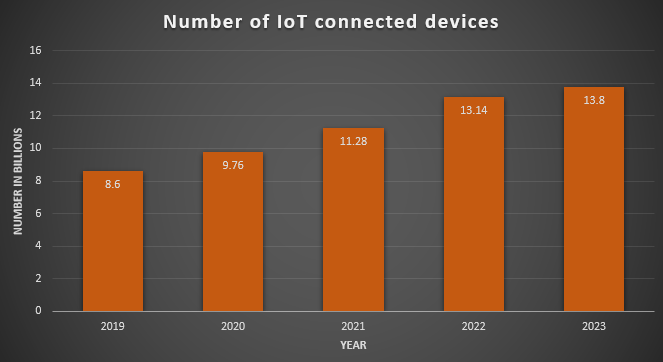
This study aimed to investigate how the evolution of logistics and supply chain management contributes to strategic differentiation and operational effectiveness in the engineering industry, with the key focus being on Julius Berger Nigeria and Atkins. To be able to achieve this aim and the specified research objectives, it was important to collect data and analyze it. The data required in this study was collected from secondary sources of data where various sources of data were used, including journals, books, the company's website, and blogs. The collected data was then analyzed using thematic analysis, which helped identify the main themes/findings.

This chapter of the study aims to achieve three key main objectives. The first objective is to present the results of the study, and the second one is to present the thematic analysis performed. The third and final objective is to summarize the key findings.

## Results

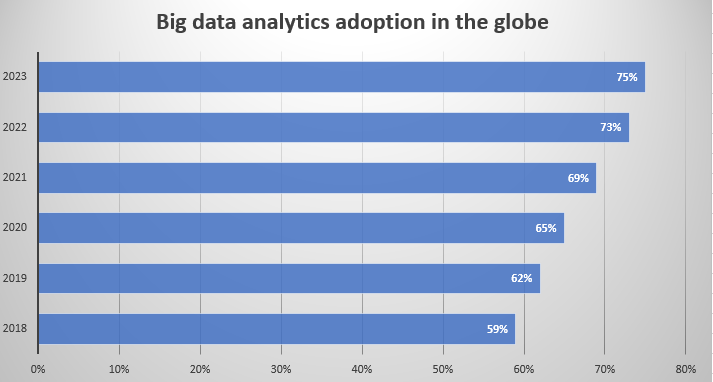
From the secondary sources of data used, it is clear that logistics and supply chain management have evolved, and many companies have started utilizing logistics and supply chain management technologies. As of 2023, more than 65% of the companies in the globe are using at least one logistics and supply chain management technology (Amini and Jahanbakhsh Javid, 2023). Julius Berger Nigeria and Atkins are examples of the company’s using logistics and supply chain management technologies, as evidenced by the secondary sources of data.

### Logistics and supply chain management technologies used by Atkins

One of the most used logistics and supply chain management technology is the Internet of Things (IoT) (Ryalat et al., 2023). The number of IoT-connected devices has increased significantly from 8.6 billion in 2019 to approximately 13.8 billion in 2023, as shown in the figure below. 

***Figure 4.1: Number of IoT-connected devices from 2019 to 2023***

This is an indication that the popularity of IoT has greatly increased, and it is one of the most used technologies when it comes to supply chain management in Atkins (Atkins, 2023). The other most used technology in Atkins is blockchain technology which has helped facilitate the movement of products. Data analytics is yet another key logistics and supply chain management technology being used by Atkins, as discovered from the secondary sources of data (Smith, 2022). The adoption of big data analytics has greatly increased since 2018, as shown in the graph below.

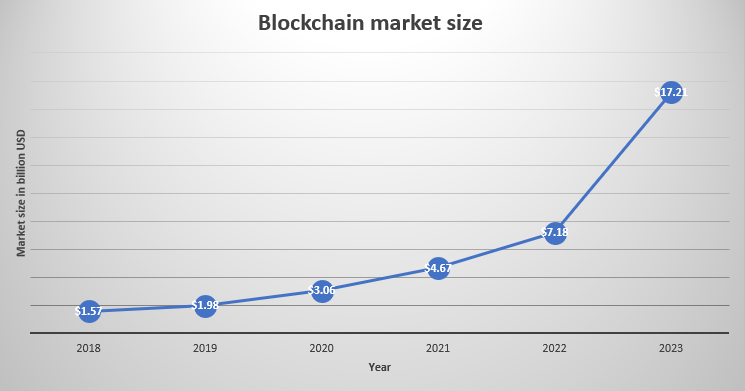


***Figure 4.2 Adoption of big data analytics since 2018***

Atkins is also using warehouse management systems which have helped it improve its inventory operations. The company further uses ERP, which refers to an enterprise resource planning system (Atkins, 2023). This system has also been very useful in improving inventory operations. The company is also using cloud computing to manage data related to supply chain management and logistics operations.

**4.2.2 Logistics and supply chain management technologies used by Julius Berger Nigeria**

As discovered from the secondary sources of data used, Julius Berger Nigeria is using several logistics and supply chain management technologies. Blockchain is one of the technologies being used by this company (Alaba, 2020). Blockchain technology has become more popular in the past few years, as evidenced by its market growth shown in the figure below.

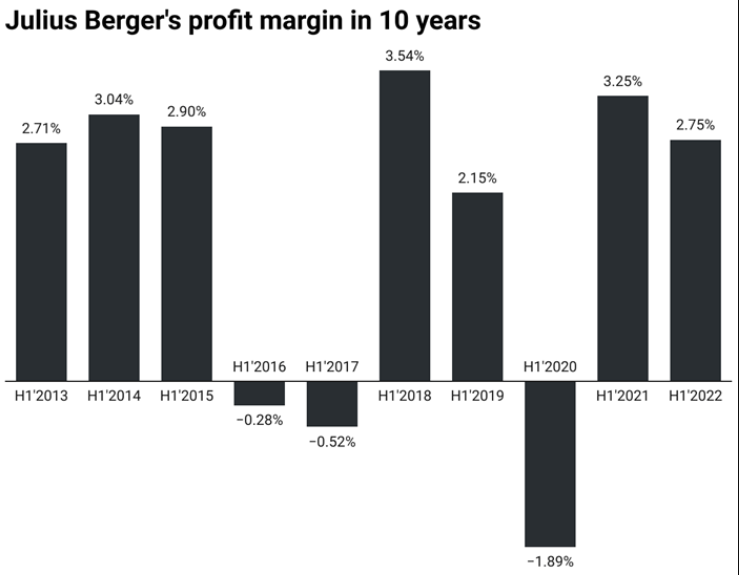


***Figure 4.3 Blockchain Market size from 2018 to 2023***

Many companies, including Julius Berger Nigeria, have been using this technology to ensure that there is supply chain visibility. Julius Berger Nigeria's on-demand warehousing is a supply chain management technology that allows companies to access shared warehousing and even logistic services (Alaba, 2020). The company is also using weighing and shipping technologies which have helped the company improve accuracy and efficiency in supply chain management and logistics. The company is further using the Internet of Things and data analytics, which are also part of logistics and supply chain management technologies.

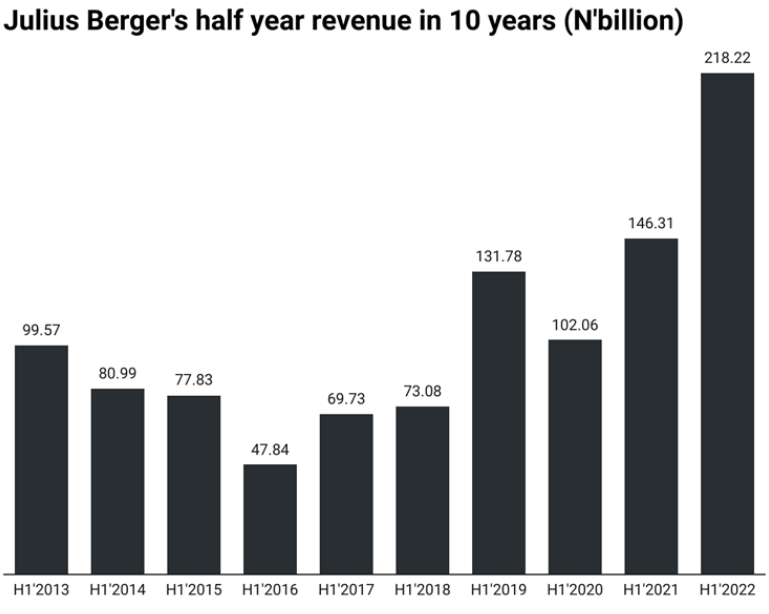
### Impacts of logistics and supply chain evolution on operational effectiveness and strategic effectiveness of Julius Berger

There are several implications of the evolution of supply chain technologies on the operational effectiveness of Julius Berger. Firstly, it has led to cost-effectiveness through cost-saving techniques. From secondary sources, the company recorded a 9.6% profit increment in the year 2022 and has been making significant profits for the past 10 years, as shown below (Berger, 2021).



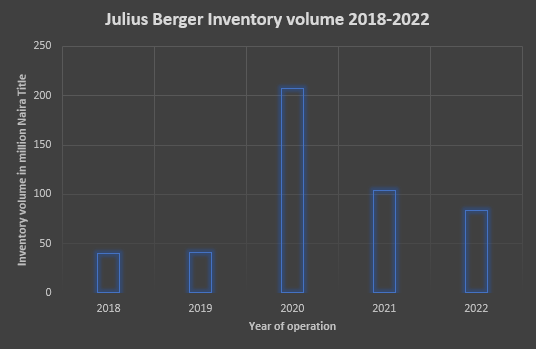
***Figure 4. Julius Berger profit margin 2013-2022***

Profitability is a key indicator of operational effectiveness, as it shows the rate of turning assets into revenues (Brekalo and Albers, 2016). Another major implication is the increased efficiency of operations. A key indicator for efficiency is waste management, operations efficiency, and streamlined productivity. The evolution of supply chain technologies has significantly improved the productivity of Julius Berger largely, as illustrated below.



*Figure 4. Julius Berger half-year revenues for 2013-2022*

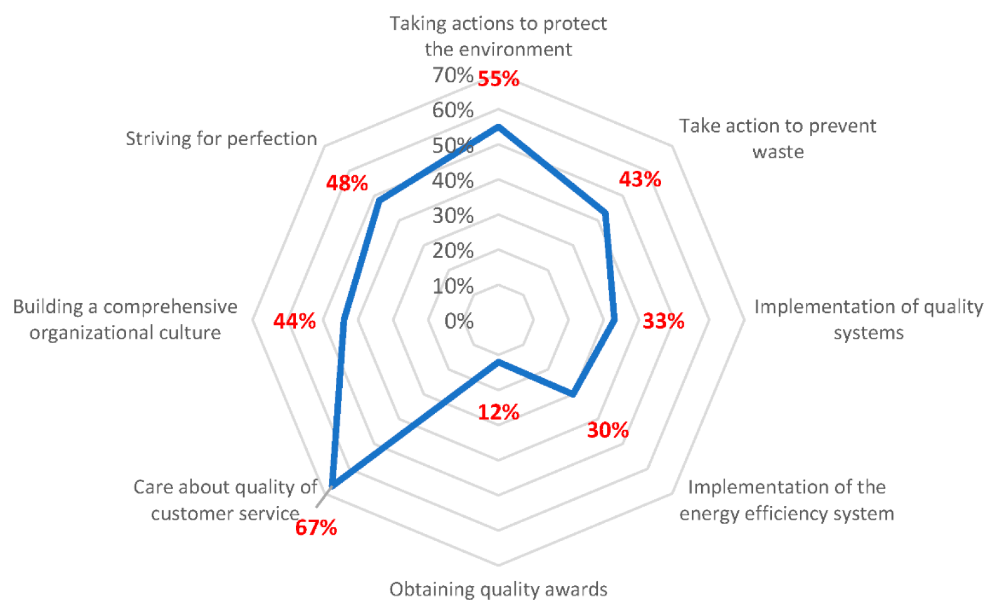
Moreso, this innovation has also led to improved inventory management systems that streamline the operations at Julius Berger. Inventory management has led to significant rises in inventory volume, despite the Covid-19 issues that adversely impacted almost all business organizations, as illustrated below.



Strategic effectiveness includes increased competitive advantage, which currently is at 53.05%, beating closest rivals. The cutting-edge technology has also contributed to the highly competitive advantage of Julius Berger against SETRACO, Saidi Nigeria, and Adold Engineering. The company also has achieved high sustainability and adherence to corporate social responsibility strategies. From the 2022 annual report, the company achieved a 40% revenue rise from the contribution to green energy innovation and sustainable economic growth (plc, 2023). Julius Berger has also greatly minimized its perceived risks after the innovation of supply chain technologies. For example, it has reduced disruptions caused by poor service quality, such as contingency planning and outsourcing, and prevented the injury ratio of workers. From the 2021 annual report, the company's current injury frequency rate is 0.19 (Berger, 2021).

### Impacts of Logistics and supply chain evolution on operational effectiveness and strategic effectiveness of Atkins

Operational effectiveness for Atkins has been improved in various ways by the evolution of logistics and supply chain technologies. Firstly, customer satisfaction has been greatly improved by the innovation of agile technologies such as IoT, blockchain technologies, and data analytics (Yu et al., 2016).



*Figure 4. Impacts of IoT and blockchain technology on Atkins Co.*

Also, this innovation has boosted supplier relationships and increased the supplier volume to over 300 suppliers. Effective communication and the utility of automation have facilitated the efficiency of the supply chain. Enhanced operating efficiency by use of automated technology warehouse management systems and enterprise resource planning. From annual warehouse management statistics for 2023, warehouse innovation has led to 48% increased efficiency out of 85% of businesses utilizing automation and warehouse technology (Abdalsam, 2023).

Strategic effectiveness may include cost management, inventory management systems, and agility of operations. 60% of warehouses have the utility of mobility band real-time inventory tracking systems, which has led to a compound annual growth rate increment of 8.5% for Atkins Co. The company has also increased profit margins significantly from the innovation of technology in its operations, attaining a peak revenue of over $5.7B and a 5.8% yearly rise in profit margins from 2015 (SNC.LAVALIN, 2022). This, compared to previous years, is a key indicator of cost management effectiveness practices that arise from automation and logistics technology, such as real-time tracking of inventory. Lastly, the evolution of advanced and automated technology has increased the agility of operations in Atkins Co. From secondary sources, the agility and efficiency of the operations have increased by over 60% with the new technological adoptions in supply chain management (Tse et al., 2016).

## Thematic Analysis

It was important to conduct a thematic analysis in this research, considering that it helped identify themes/key findings. The themes identified are summarized in the thematic analysis table below.

|  |  |  |
| --- | --- | --- |
| Theme Number | Theme | Sub-Themes |
| 1.0 | Evolution of logistics and supply chain management | * Logistics and supply chain management have greatly evolved. * Many companies in this digital era have adopted logistics and supply chain management technologies. * Supply chain management and logistics technologies adopted by Atkins; * Internet of Things (IoT) * Data Analytics * Blockchain * Warehouse management system * Enterprise resource planning (ERP) system * Cloud computing * Supply chain management and logistics technologies adopted by Julius Berger Nigeria; * Cloud computing * On-demand warehousing * Weighing and shipping technologies * Data Analytics * Internet of Things (IoT) |
| 2.0 | Impacts associated with the evolution of logistics and supply chain in operational effectiveness and strategic effectiveness of Julius Berger Nigeria and Atkins. | * Implications of the evolution of logistics and supply chain management on the operational effectiveness of Julius Berger include; * Cost management, * Efficiency * Improved inventory management. * Impacts of the evolution of logistics and supply chain management on the strategic effectiveness of Julius Berger include; * Increased competitive advantage * High sustainability * Adherence to corporate social responsibility strategies and minimized perceived risks. * Impacts of the evolution of logistics and supply chain management on the operational effectiveness of Atkins include; * Improved customer satisfaction * Strengthened supplier relationships * Improved operational efficiency. * Impacts of the evolution of logistics and supply chain management on the strategic effectiveness of Atkins include; * Cost-management * Inventory management systems * Agility of operations |

## Summary of the Findings

The key findings are;

* Logistics and supply chain management have greatly evolved, and many companies in the digital era are using logistics and supply chain management technologies.
* Atkins and Julius Berger Nigeria are examples of companies that are using logistics and supply chain management technologies.
* The supply chain management and logistics technologies used by Atkins include the Internet of Things (IoT), data analytics, blockchain, warehouse management system, enterprise resource planning (ERP) system, and cloud computing.
* The supply chain management and logistics technologies being used by Julius Berger Nigeria include cloud computing, on-demand warehousing, weighing and shipping technologies, data analytics, and the Internet of Things (IoT).
* Implications of the evolution of logistics and supply chain management evolution on the operational effectiveness of Julius Berger are cost management, profitability, increased productivity, and improved inventory management.
* Impacts of logistics and supply chain management evolution on strategic effectiveness of Julius Berger Nigeria include increased competitive advantage, high sustainability and adherence to corporate social responsibility strategies, and minimized perceived risks.
* Impacts of logistics and supply chain management evolution on the operational effectiveness of Atkins include improved customer satisfaction, strengthened supplier relationships, and improved operational efficiency.
* Impacts of logistics and supply chain management evolution on the strategic effectiveness of Atkins include cost management, inventory management systems, and agility of operations

## Conclusion

This chapter has presented the study’s results and findings. As discovered from the key findings, logistics and supply chain management has greatly evolved, and many companies in the digital era are using logistics and supply chain management technologies. Atkins and Julius Berger Nigeria are examples of companies that are using logistics and supply chain management technologies. The supply chain management and logistics technologies used by Atkins include the Internet of Things (IoT), data analytics, blockchain, warehouse management system, enterprise resource planning (ERP) system, and cloud computing. The supply chain management and logistics technologies being used by Julius Berger Nigeria include cloud computing, on-demand warehousing, weighing and shipping technologies, data analytics, and the Internet of Things (IoT). These technologies have greatly helped Atkin’s and Julius Berger’s strategic differentiation and operational effectiveness, as evidenced by the study findings.

# Chapter 5 - Discussion

## Introduction

This chapter discusses the key findings that have been summarized in chapter four. The discussions will be supported by academic literature existing in this field of study.

## Evolution of logistics and supply chain management

Logistics and supply chain management have greatly evolved since the 1960s. According to Witkowski (2017), there are numerous logistics and supply chain management technologies that have emerged, and a lot of companies are adopting these technologies. As evident from the study, companies such as Atkins and Julius Berger Nigeria are examples of companies that have implemented various logistics and supply chain management technologies. As discovered in this study Internet of Things (IoT) is one of the technologies that has been implemented by both companies.

The Internet of Things (IoT) has been used by both companies to facilitate operations associated with logistics and supply chain management in various ways. Real-time tracking is one of the ways in which this technology has been used by both Atkins and Julius Berger Nigeria. IoT-based devices with sensors have the capability to track assets and surrounding conditions, including temperature, which is important in supply chain management (Rejeb et al., 2019). Both Atkins and Julius Berger Nigeria are using IoT devices with sensors which have helped them track their assets and surrounding conditions hence being able to avoid unnecessary problems and make accurate decisions regarding their assets. IoT has also been used by both companies to promote supply chain visibility which in return has resulted in improved customer services and enhanced inventory management.

Data analytics is also another logistics and supply chain management technology being used by both Atkins and Julius Berger Nigeria. This technology is being used by both companies for different reasons. One of these reasons is to minimize risks associated with supplier management. Data analytics involves the collection of huge amounts of data and then analyzing the data to come up with informed decisions (Witkowski, 2017). This technology is very useful in supplier management, where a business is able to analyze the data related to suppliers and get to know which suppliers to choose, which risks are involved, and how supplier relationships can be improved, which is the case in both companies (Wang et al., 2016). Data analytics is also being used by these two companies to facilitate demand forecasting, which has helped the companies a lot, especially when it comes to inventory optimization and general planning.

As discovered in the study, both Atkins and Julius Berger Nigeria are using blockchain technology which is very useful in supply chain management. As discussed by Blossey et al. (2019), blockchain technology helps in tracking products via the entire supply chain. This helps in ameliorating transparency, which is key to attaining stakeholders' trust (Blossey et al., 2019). This strategy has helped both Atkins and Julius Berger Nigeria maintain positive relationships with their clients hence being able to maximize their profits.

Cloud computing is yet another supply chain management and logistics technology being used by these two companies. Atkins and Julius Berger Nigeria are using this technology to manage data collected from the entire supply chain. By using this technology, these two companies have been able to collect, analyze and share data across the entire supply chain (Cao et al., 2017). The use of cloud computing technology by both companies has also led to improved warehouse and transportation management. This has been achieved via warehouse and transportation management systems which are based on cloud computing.

Atkins lays more emphasis on warehouse management, and this explains why the company is using a warehouse management system. Julius Berger Nigeria is yet to fully exploit this technology, and this is unfortunate, considering that this technology is very useful when it comes to supply chain management. The warehouse management system (WMS) helps businesses improve the inventory distribution process hence making it possible for a business to meet the high demand (Lee et al., 2018). Atkins has further invested in an enterprise resource planning (ERP) system, which is yet another important supply chain management technology. This technology improves the scalability and efficiency of supply chain processes and also makes the processes easy to manage (Aziz et al., 2018). This technology has the capability to integrate data collected from the entire supply chain and automates some of the processes, which improves general productivity within the supply chain.

In contrast to Atkins, Julius Berger Nigeria has invested in weighing and shipping technologies which are also important in supply chain management. The weighing technologies have the capability to generate accurate weight data, while on the other hand, shipping technologies have the capability to track items and streamline logistic operations (Yazdani et al., 2017). All these operations are important in logistics since they can help in complying with the regulations in place and improving the entire logistic process. Julius Berger Nigeria has further invested in on-demand warehousing, which has helped it reduce operational costs and maximize its profits (Parodos et al., 2022). This has been achieved considering that on-demand warehousing involves shared warehouses that are booked online, and by using shared warehouses, it becomes easier to cut some costs.

## Impacts of Logistics and supply chain evolution on operational effectiveness and strategic effectiveness of Julius Berger

The evolution of logistics and supply chain management has led to operational effectiveness for Julius Berger in various ways. Firstly, it has led to improved profit margins. From the findings of the research, it is evident that since the technological integration and adoption in 2013, the company’s profit margins have gone up, reaching a ratio of 3.4% in 2022 (SNC.LAVALIN, 2022). Automation of the supply chain has improved the efficiency of operations for the company by eliminating waste and time management (Wu et al., 2016). Secondly, this innovation has led to improved inventory management systems. Up-to-date technologies such as blockchain technology, IoT, data analytics, and warehouse management make it easy to track and monitor real tam data pertaining to goods in transit, online ordering, and delivery optimization. The research findings demonstrate an increment in inventory volume following the adoption of automation and advanced logistic technology for the years 2021 and 2022. Another key implication of the evolution of operational effectiveness is increased efficiency of operations. Julius Berger enjoys streamlined operations such as machinery utility in conducting basic tasks such as the movement of materials. The evolution of supply chain management has led to the high efficiency of the activities involved in inventory management, ordering, suppliers' relationships, and communication with customers (Bechtsis et al., 2017). The results of this study show that the company currently operates at a profit of 8.5% compared to the previous year, showing the gradual improvement of its operational efficiency.

The evolution has also led to strategic effectiveness for Julius Berger by improving the competitive advantage of the company. From the results, the company holds a competitive advantage of 53.05%, beating all its competitors, including SETRACO, Saidi Nigeria, and Adold Engineering. The company has utilized supply chain management strategies to optimize its functions, such as customer service, design and management of complex activities, and unifying its approach to construction projects (Gunasekaran et al., 2017). This integration acts as a strength while competing with rivals for the same prospects. Secondly, the results show that the evolution of logistics and supply chain management has led to risk minimization and lowered the injury frequency rate to 0.19. Workers in construction-based workplaces are exposed to physical harm and injury, which arises from human or machine error. However, automated logistics and supply chain management has lowered the perceived risks for workers through the use of sensors, automated risk identification and eradication procedures, and the use of highly efficient machine applications such as data analytics (Muysinaliyev and Aktamov, 2014). This evolution has increased the adherence to CSR strategies and facilitated the sustainability goals achievement for Julius Berger. Technologies such as zero-emission transit of materials and the use of less-nosy and disturbing machinery are also among the sustainability goals for the company. By use of automated supply chain and logistics management, the company has significantly optimized its approach to community-related issues and other global climatic concerns, e.g., the Go Green movement for logistic companies (plc, 2023).

## Impacts of Logistics and supply chain evolution on operational effectiveness and strategic effectiveness of Atkins

The evolution of logistics and supply chain management in Atkins Co. has led to increased efficiency of operations. From the resets, almost 85% of businesses in the UK utilize logistic and chain supply management practices in their operations, which record an average efficiency increment of 46% (Abdalsam, 2023). The evolution has increased the efficiency of warehouse management and enterprise resource planning, respectively. These directly improve the operating efficiency by streamlining tasks and operations and facilitating the integration of certain parts of the task force. The studies also show that the evolution has had greater implications on customer satisfaction. 67% of the functions of logistics and supply chain management services are aimed at facilitating customer service by improving service quality (Frederico et al., 2020). Ordering, delivery, and product customization are among the key benefits enjoyed from the utility of advanced chain supply applications, which have improved the efficiency of Atkins. These services are easily facilitated by blockchain technology, AI, data analytics, and automated technologies such as automated inventory control that make it easy to track and monitor personal inventory. Lastly, the evolution has improved the supplier relations for Atkins Co. The company's supply volume has significantly grown, which is a result of the appropriate usage of agile technologies in logistic operations (Barreto et al., 2017). Features such as real-time tracking of inventory and effective communication strategies make it easy for Atkins to collaborate and strengthen bonds with suppliers.

From the results, there are several strategic implications of logistics and supply chain management evolution in Atkins Co. Firstly; the evolution has increased the profitability of the company. The results of the study show that the company has made an average of 5.8% profit margin increment for the last 5 years and currently operates at 8.5% profit margin (SNC.LAVALIN, 2022). The evolution has not only improved waste management but also eliminated errors related to construction and engineering operations, causing the revenue increment for Atkins to be up to $5.7B (Anca, 2019). The use of IoT sensors to monitor and track inventory reduces the losses incurred during inventory management, hence enhancing the firm's profitability. Another major implication is the agility of operations. According to Brekalo and Albers (2016), most logistic and supply chain advances are aimed at creating flexibility, streamlining, and objectivity in operations. By integrating these applications, Atkins has leveraged most of its operations, attaining a flexible and highly productive workplace. Most of the logistics technology is aimed at eradicating waste and optimizing the quality of transit services. Lastly, the evolution has also led to increased cost management (Brekalo and Albers, 2016). The results of this study show that the company has been making significant profits, and the margins show an increment. Integration of logistics and supply chain management in Atkins has led to the elimination of waste, the increased utilization of resources, and error minimization. The integration also facilitates real-time monitoring of organizational data using data analytics that show possibilities of errors or predict various system failures that can be eradicated before their occurrence.

## Conclusion

This chapter has discussed the key findings of the study. As discussed in this chapter, logistics and supply chain management have greatly evolved, and many companies in the digital era are using logistics and supply chain management technologies. Atkins and Julius Berger Nigeria are examples of companies that are using logistics and supply chain management technologies. Some of the supply chain management and logistics technologies being used include blockchain, data analytics, the internet of Things (IoT), warehouse management system, cloud computing, on-demand warehousing, weighing and shipping technologies, and enterprise resource planning (ERP) systems. The use of these technologies has greatly helped both Atkins and Julius Berger Nigeria, where the companies have been able to improve inventory management, improve efficiency, achieve high sustainability, reduce operational costs, achieve an increased competitive advantage, and adhere to corporate social responsibilities.

# Chapter 6 – Conclusion and Recommendations

## Conclusions

Logistics and supply chain management have greatly evolved, and many companies in the digital era are using logistics and supply chain management technologies. Atkins and Julius Berger Nigeria are examples of companies that are using logistics and supply chain management technologies. The supply chain management and logistics technologies used by Atkins include the Internet of Things (IoT), data analytics, blockchain, warehouse management system, enterprise resource planning (ERP) system, and cloud computing. The supply chain management and logistics technologies being used by Julius Berger Nigeria include cloud computing, on-demand warehousing, weighing and shipping technologies, data analytics, and the Internet of Things (IoT). Implications of the evolution of logistics and supply chain management evolution on the operational effectiveness of Julius Berger are cost management, profitability, increased productivity, and improved inventory management. Impacts of logistics and supply chain management evolution on strategic effectiveness of Julius Berger Nigeria include increased competitive advantage, high sustainability and adherence to corporate social responsibility strategies, and minimized perceived risks. Impacts of logistics and supply chain management evolution on the operational effectiveness of Atkins include improved customer satisfaction, strengthened supplier relationships, and improved operational efficiency. Impacts of logistics and supply chain management evolution on the strategic effectiveness of Atkins include cost management, inventory management systems, and agility of operations

## Recommendations

To ensure engineering companies such as Julius Berger Nigeria and Atkins benefit from the logistics and supply chain management to achieve strategic differentiation and operational effectiveness, the company should adopt the following measures.

* Increase visibility of the supply chain management and logistics in the company. Visibility allows for better tracking of your product as it moves through the supply chain, from finished manufacturing to inventory and warehousing to your team's role in packing and delivering to customers. This entire list is regarded as being a part of the operation of the supply chain. Understanding your inventory levels and delivery efficiency is made easier with visibility. Even deeper understanding of your inventory levels might assist suppliers modify their delivery accordingly.
* Adopt current technologies. Technology advancements are providing businesses with information on each single step of the supply chain. Companies are able to respond to issues immediately because to technology. For instance, a tracking device on each item notifies businesses when a cargo enters a facility. Then, using the data provided by technology, planners can forecast when a load would be late and make necessary modifications.
* Automate supply chain processes. In the company’s technology will help many tasks to be completed automatically, thus saving the company money and reducing errors. Automated technology can complete many tasks with greater speed and precision than humans.
* Use real-time supply chain data. Inefficiencies might appear out of nowhere. Therefore, track supply chain indicators daily or at least weekly, using data that is as "real-time" as feasible. Don't only track them quarterly or even monthly. Real-time information enables you to take immediate action when necessary. Make sure the supply chain software you choose can assist with ongoing.

# References

Abdalsam 2023. Warehouse Management Statistics, Trends And Facts 2023.

Alaba, O. V. 2020. Technological Advancement Strategy and Performance of Listed Construction Company in Nigeria. *International Journal of Trend in Scientific Research and Development (ijtsrd),* 4(5)**,** pp 1080-1088.

Alharahsheh, H. H. & Pius, A. 2020. A review of key paradigms: Positivism VS interpretivism. *Global Academic Journal of Humanities and Social Sciences,* 2(3)**,** pp 39-43.

Amini, M. & Jahanbakhsh Javid, N. 2023. A Multi-Perspective Framework Established on Diffusion of Innovation (DOI) Theory and Technology, Organization and Environment (TOE) Framework Toward Supply Chain Management System Based on Cloud Computing Technology for Small and Medium Enterprises. *Organization and Environment (TOE) Framework Toward Supply Chain Management System Based on Cloud Computing Technology for Small and Medium Enterprises (January 2023). International Journal of Information Technology and Innovation Adoption,* 11(1217-1234.

Anca, V. 2019. Logistics and supply chain management: an overview. *Studies in Business and Economics,* 14(2)**,** pp 209-215.

Atkins 2023. Atkins embraces innovation to solve the infrastructure productivity challenge.

Aziz, M. A., Ragheb, M. A., Ragab, A. A. & El Mokadem, M. 2018. The impact of enterprise resource planning on supply chain management practices. *The Business & Management Review,* 9(4)**,** pp 56-69.

Azungah, T. 2018. Qualitative research: deductive and inductive approaches to data analysis. *Qualitative research journal,* 18(4)**,** pp 383-400.

Ballou, R. H. 2007. The evolution and future of logistics and supply chain management. *European business review*.

Barreto, L., Amaral, A. & Pereira, T. 2017. Industry 4.0 implications in logistics: an overview. *Procedia manufacturing,* 13(1245-1252.

Bechtsis, D., Tsolakis, N., Vlachos, D. & Iakovou, E. 2017. Sustainable supply chain management in the digitalisation era: The impact of Automated Guided Vehicles. *Journal of Cleaner Production,* 142(3970-3984.

Berger, J. 2021. Annual reports & Consolidated financial statemets 2021. 81(

Blossey, G., Eisenhardt, J. & Hahn, G. 2019. Blockchain technology in supply chain management: An application perspective.

Brekalo, L. & Albers, S. 2016. Effective logistics alliance design and management. *International Journal of Physical Distribution & Logistics Management,* 46(2)**,** pp 212-240.

Bujak, A. 2015. The development of the concept of supply chain management as an example of the evolution of logistics. *The Central European Review of Economics and Management,* 15(1)**,** pp 133-151.

Büttner, J. & Renn, J. 2016. The early history of weighing technology from the perspective of a theory of innovation. *eTopoi: Journal for Ancient Studies,* 6(757-776.

Calabrese, A., Costa, R., Menichini, T., Rosati, F. & Sanfelice, G. 2013. Turning corporate social responsibility‐driven opportunities in competitive advantages: A two‐dimensional model. *Knowledge and Process Management,* 20(1)**,** pp 50-58.

Cao, Q., Schniederjans, D. G. & Schniederjans, M. 2017. Establishing the use of cloud computing in supply chain management. *Operations Management Research,* 10(47-63.

Carter, C. R. & Liane Easton, P. 2011. Sustainable supply chain management: evolution and future directions. *International journal of physical distribution & logistics management,* 41(1)**,** pp 46-62.

Castleberry, A. & Nolen, A. 2018. Thematic analysis of qualitative research data: Is it as easy as it sounds? *Currents in pharmacy teaching and learning,* 10(6)**,** pp 807-815.

Chang, S. E., Chen, Y.-C. & Lu, M.-F. 2019. Supply chain re-engineering using blockchain technology: A case of smart contract based tracking process. *Technological Forecasting and Social Change,* 144(1-11.

Collins, J. D., Worthington, W. J., Reyes, P. M. & Romero, M. 2010. Knowledge management, supply chain technologies, and firm performance. *Management Research Review,* 33(10)**,** pp 947-960.

Frederico, G. F., Garza-Reyes, J. A., Anosike, A. & Kumar, V. 2020. Supply Chain 4.0: concepts, maturity and research agenda. *Supply Chain Management: An International Journal,* 25(2)**,** pp 262-282.

Fugate, B. S., Mentzer, J. T. & Stank, T. P. 2010. Logistics performance: efficiency, effectiveness, and differentiation. *Journal of business logistics,* 31(1)**,** pp 43-62.

Ganbold, O., Matsui, Y. & Rotaru, K. 2021. Effect of information technology-enabled supply chain integration on firm's operational performance. *Journal of Enterprise Information Management,* 34(3)**,** pp 948-989.

Goldenberg, A. J., Maschke, K. J., Joffe, S., Botkin, J. R., Rothwell, E., Murray, T. H., Anderson, R., Deming, N., Rosenthal, B. F. & Rivera, S. M. 2015. IRB practices and policies regarding the secondary research use of biospecimens. *BMC medical ethics,* 16(1)**,** pp 1-8.

Golicic, S. L. & Smith, C. D. 2013. A meta‐analysis of environmentally sustainable supply chain management practices and firm performance. *Journal of supply chain management,* 49(2)**,** pp 78-95.

Govil, P. 2013. Ethical considerations in educational research. *International journal of advancement in education and social sciences,* 1(2)**,** pp 17-22.

Gunasekaran, A., Patel, C. & McGaughey, R. E. 2004. A framework for supply chain performance measurement. *International journal of production economics,* 87(3)**,** pp 333-347.

Gunasekaran, A., Subramanian, N. & Papadopoulos, T. 2017. Information technology for competitive advantage within logistics and supply chains: A review. *Transportation Research Part E: Logistics and Transportation Review,* 99(14-33.

Gusenbauer, M. & Haddaway, N. R. 2020. Which academic search systems are suitable for systematic reviews or meta‐analyses? Evaluating retrieval qualities of Google Scholar, PubMed, and 26 other resources. *Research synthesis methods,* 11(2)**,** pp 181-217.

Hofmann, E., Beck, P. & Füger, E. 2012. *The supply chain differentiation guide: a roadmap to operational excellence*: Springer Science & Business Media.

Huo, B., Qi, Y., Wang, Z. & Zhao, X. 2014. The impact of supply chain integration on firm performance: The moderating role of competitive strategy. *Supply Chain Management: An International Journal*.

Islam, D. M. Z., Meier, J. F., Aditjandra, P. T., Zunder, T. H. & Pace, G. 2013. Logistics and supply chain management. *Research in transportation economics,* 41(1)**,** pp 3-16.

Johnston, M. P. 2014. Secondary data analysis: A method of which the time has come. *Qualitative and quantitative methods in libraries,* 3(3)**,** pp 619-626.

Karakas, S., Acar, A. Z. & Kucukaltan, B. 2021. Blockchain adoption in logistics and supply chain: a literature review and research agenda. *International Journal of Production Research,* 1-24.

Khanuja, A. & Jain, R. K. 2022. The mediating effect of supply chain flexibility on the relationship between supply chain integration and supply chain performance. *Journal of Enterprise Information Management,* 35(6)**,** pp 1548-1569.

Kirchoff, J. F., Tate, W. L. & Mollenkopf, D. A. 2016. The impact of strategic organizational orientations on green supply chain management and firm performance. *International journal of physical distribution & logistics management*.

Kumar, V., Chibuzo, E. N., Garza-Reyes, J. A., Kumari, A., Rocha-Lona, L. & Lopez-Torres, G. C. 2017. The impact of supply chain integration on performance: Evidence from the UK food sector. *Procedia Manufacturing,* 11(814-821.

Largan, C. & Morris, T. 2019. *Qualitative secondary research: A step-by-step guide*: Sage.

Lee, C. K., Lv, Y., Ng, K., Ho, W. & Choy, K. L. 2018. Design and application of Internet of things-based warehouse management system for smart logistics. *International Journal of Production Research,* 56(8)**,** pp 2753-2768.

Mangan, J. & Lalwani, C. 2016. *Global logistics and supply chain management*: John Wiley & Sons.

Miguel, P. L. d. S. & Brito, L. A. L. 2011. Supply chain management measurement and its influence on operational performance.

Moser, A. & Korstjens, I. 2018. Series: Practical guidance to qualitative research. Part 3: Sampling, data collection and analysis. *European journal of general practice,* 24(1)**,** pp 9-18.

Muysinaliyev, A. & Aktamov, S. 2014. Supply chain management concepts: literature review. *IOSR Journal of Business and Management (IOSR-JBM),* 15(6)**,** pp 60-66.

Nguyen, T., Li, Z., Spiegler, V., Ieromonachou, P. & Lin, Y. 2018. Big data analytics in supply chain management: A state-of-the-art literature review. *Computers & Operations Research,* 98(254-264.

Ninlawan, C., Seksan, P., Tossapol, K. & Pilada, W. The implementation of green supply chain management practices in electronics industry. World Congress on Engineering 2012. July 4-6, 2012. London, UK., 2010. International Association of Engineers, 1563-1568.

Park, K. O. 2020. A study on sustainable usage intention of blockchain in the big data era: Logistics and supply chain management companies. *Sustainability,* 12(24)**,** pp 10670.

Parodos, L., Tsolakis, O., Tsoukos, G., Xenou, E. & Ayfantopoulou, G. 2022. Business Model Analysis of Smart City Logistics Solutions Using the Business Model Canvas: The Case of an On-Demand Warehousing E-Marketplace. *Future Transportation,* 2(2)**,** pp 467-481.

Pettit, T. J., Croxton, K. L. & Fiksel, J. 2019. The evolution of resilience in supply chain management: a retrospective on ensuring supply chain resilience. *Journal of Business Logistics,* 40(1)**,** pp 56-65.

plc, J. B. N. 2023. Julius Berger Nigeria Plc (JBERGE.ng) 2022 Annual Report. *African Financials*.

Ponterotto, J. G. 2013. Qualitative research in multicultural psychology: philosophical underpinnings, popular approaches, and ethical considerations.

Rahi, S. 2017. Research design and methods: A systematic review of research paradigms, sampling issues and instruments development. *International Journal of Economics & Management Sciences,* 6(2)**,** pp 1-5.

Rahman, M. S. 2020. The advantages and disadvantages of using qualitative and quantitative approaches and methods in language “testing and assessment” research: A literature review.

Rejeb, A., Keogh, J. G. & Treiblmaier, H. 2019. Leveraging the internet of things and blockchain technology in supply chain management. *Future Internet,* 11(7)**,** pp 161.

Romani, L., Barmeyer, C., Primecz, H. & Pilhofer, K. 2018. Cross-cultural management studies: state of the field in the four research paradigms. *International Studies of Management & Organization,* 48(3)**,** pp 247-263.

Ryalat, M., ElMoaqet, H. & AlFaouri, M. 2023. Design of a smart factory based on cyber-physical systems and internet of things towards industry 4.0. *Applied Sciences,* 13(4)**,** pp 2156.

Sharma, R. & Shishodia, A. 2022. Blockchain Technology Enablers in Physical Distribution and Logistics Management. *Big Data and Blockchain for Service Operations Management.* Springer.

Smith, C. 2022. Innovation showcase | Atkins aims at digital transformation.

SNC.LAVALIN 2022. Annual reports 2022.

Southern, R. N. 2011. Historical perspective of the logistics and supply chain management discipline. *Transportation Journal,* 50(1)**,** pp 53-64.

Spector, P. E., Rogelberg, S. G., Ryan, A. M., Schmitt, N. & Zedeck, S. 2014. Moving the pendulum back to the middle: Reflections on and introduction to the inductive research special issue of Journal of Business and Psychology. *Journal of Business and Psychology,* 29(499-502.

Sundarakani, B., Ajaykumar, A. & Gunasekaran, A. 2021. Big data driven supply chain design and applications for blockchain: An action research using case study approach. *Omega,* 102(102452.

Sundler, A. J., Lindberg, E., Nilsson, C. & Palmér, L. 2019. Qualitative thematic analysis based on descriptive phenomenology. *Nursing open,* 6(3)**,** pp 733-739.

Thompson, A., Stringfellow, L., Maclean, M. & Nazzal, A. 2021. Ethical considerations and challenges for using digital ethnography to research vulnerable populations. *Journal of Business Research,* 124(676-683.

Tijan, E., Aksentijević, S., Ivanić, K. & Jardas, M. 2019. Blockchain technology implementation in logistics. *Sustainability,* 11(4)**,** pp 1185.

Tjahjono, B., Esplugues, C., Ares, E. & Pelaez, G. 2017. What does industry 4.0 mean to supply chain? *Procedia manufacturing,* 13(1175-1182.

Tse, Y. K., Zhang, M., Akhtar, P. & MacBryde, J. 2016. Embracing supply chain agility: an investigation in the electronics industry. *Supply Chain Management: An International Journal*.

Vaismoradi, M., Turunen, H. & Bondas, T. 2013. Content analysis and thematic analysis: Implications for conducting a qualitative descriptive study. *Nursing & health sciences,* 15(3)**,** pp 398-405.

Wallenburg, C. M. & Weber, J. 2005. Structural equation modeling as a basis for theory development within logistics and supply chain management research. *Research methodologies in supply chain management: In collaboration with Magnus Westhaus,* 171-186.

Wang, G., Gunasekaran, A., Ngai, E. W. & Papadopoulos, T. 2016. Big data analytics in logistics and supply chain management: Certain investigations for research and applications. *International journal of production economics,* 176(98-110.

Witkowski, K. 2017. Internet of things, big data, industry 4.0–innovative solutions in logistics and supply chains management. *Procedia engineering,* 182(763-769.

Woiceshyn, J. & Daellenbach, U. 2018. Evaluating inductive vs deductive research in management studies: Implications for authors, editors, and reviewers. *Qualitative Research in Organizations and Management: An International Journal,* 13(2)**,** pp 183-195.

Wong, C. Y., Boon-Itt, S. & Wong, C. W. 2011. The contingency effects of environmental uncertainty on the relationship between supply chain integration and operational performance. *Journal of Operations management,* 29(6)**,** pp 604-615.

Wu, L., Yue, X., Jin, A. & Yen, D. C. 2016. Smart supply chain management: a review and implications for future research. *The International Journal of Logistics Management*.

Yazdani, M., Zarate, P., Coulibaly, A. & Zavadskas, E. K. 2017. A group decision making support system in logistics and supply chain management. *Expert systems with Applications,* 88(376-392.

Yilmaz, K. 2013. Comparison of quantitative and qualitative research traditions: Epistemological, theoretical, and methodological differences. *European journal of education,* 48(2)**,** pp 311-325.

Yu, Y., Wang, X., Zhong, R. Y. & Huang, G. Q. 2016. E-commerce logistics in supply chain management: Practice perspective. *Procedia Cirp,* 52(179-185.

Zhang, X., Shi, X. & Pan, W. 2022. Big data logistics service supply chain innovation model based on artificial intelligence and blockchain. *Mobile Information Systems,* 2022(