Exploring the challenges of data analytics in Supply Chain Management (Case study Novago Co Ghana Limited).

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Laurea University of Applied Sciences **Abstract**

Service Business Management

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The objectives of Novago Co Ghana Limited is to enable clients benefit from quality vehicle rental service. The company exist to provide tailored solutions that meet the individual needs of their clients. The company manages fleets of different sizes and provide rental services for a wide range of clients, from professionals/SMEs to some of the largest international corporates based in West Africa. The company expressed interest in this thesis to understand the challenges of data analytics in Supply Chain Management despite the location of the student embarking on this project.

The study targeted employees in data analysis, supply chain, procurement, logistics and management at Novago Co Ghana Limited, with a total population of thirty individuals. These professionals were highly educated with an average of seven years of experience in their fields. The study discovered data privacy and security, managing and integrating data from diverse sources, talent and skill gaps for implementing data analytics, ensuring data accuracy and reliability in supply chain in the organization as challenges.

The opportunities were, enhancing visibility and improvement of supply chain responsiveness to market changes, the role of data analytics in identifying and capitalizing on cost-saving opportunities and the potential of data analytics in optimizing fleet management. Finally, there was a positive relationship between the challenges and company performance.

It is recommended that management invest in advanced security solutions such as, firewalls, intrusion detection systems and robust techniques to safeguard sensitive supply chain data and ensure its integrity. The organization's management must continuously train employees on data security practices. Management can use data analytics to optimize fleet management, reduce fuel consumption, and improve route planning.

Keywords: Data Analysis, Supply Chain, Fleet management

Contents

1 Background of the thesis

In today's world of social networking, data analytics is essential for the success of any business. Businesses worldwide rely on data collection and analysis as part of their day-to-day operations. For instance, Big Data provides companies with insights into their daily activities, enabling them to boost sales through methods such as data mining. The first few days of an average company's existence likely generate more data than what was created since the beginning of capitalism, as proposed by Marxian prophetic oracles (Smolan & Erwitt 2012).

Information plays a crucial role in corporate decision-making at strategic, tactical, and operational levels (Rai et al. 2016). However, the rapid growth in the volume of information and data available to companies presents a significant challenge. This surge in data makes it difficult to identify and extract the most relevant information needed for effective business and supply chain management.

The wealth of available information enables experts in computer science, mathematics, behavioral sciences, and statistics to predict future outcomes more accurately (Rozados & Tjahjono 2014). However, it's not just the volume but also the veracity, velocity, variety, and value of data that pose challenges to supply chains in this era of competition, where predictive data analytics is key to success (Waller & Fawcett 2013). The use of data is primarily determined by its analytical potential. As pointed out by Warth et al. (2011), the impact of poor data analytics on business decisions can be severe and lead to significant financial losses.

Supply chain management (SCM) has garnered significant interest from various organizations for several reasons. Companies have found a competitive edge in focusing on SCM, especially as returns from internal improvement efforts wane (Maloni & Benton 2000). Additionally, industry restructuring due to technological advancements has naturally driven the evolution of SCM. Furthermore, SCM has been identified as a practical response to challenges posed by globalization, deregulation, and the dynamic nature of competitive markets (Christopher 1998). Lastly, increased interdependence between firms, fueled by lean operations, outsourcing, and just-in-time practices, has prompted the robust adoption of SCM by organizations.

Chopra & Meindl (2007) define a supply chain as consisting of all parties involved, directly or indirectly, in fulfilling a customer request. Within each organization, such as a manufacturer, the supply chain includes all functions involved in fulfilling a customer request, including new product development, marketing, operations, distribution, finance, and customer service.

Supply chain management involves the coordination of consumers, manufacturers, and suppliers, with various factors influencing its effectiveness. Among these factors, the flow of information is crucial. However, managing the vast amount of data exchanged among supply chain participants requires technology. This research aims to expand the literature by exploring the challenges of employing data analytics in supply chain management, specifically based on the case study of a fleet management company in Ghana (Novago Co Ghana Limited). The study will also examine the benefits of data analytics and its impact on the company's performance.

1.1 Overview of the partner organization

A leading independent leasing company in West Africa, Novago Co Ghana Limited was established in 2004 and has since expanded to Ivory Coast and Senegal. Novago Co Ghana Limited provides tailored solutions that meet the individual needs of their clients. Moreover, the company has built great relationships with the most prominent car manufacturers, offering customers a wide range of vehicles. With a focus on another operation that has been in business for many years in the country, Novago Co Ghana Limited operates as a service partner for corporate clients ranging from SMEs and private customers to mobility service users, with its reliability being best known.

1.2 Purpose and Aim

The purpose of this research work is to explore the challenges of employing data analytics within Supply Chain Management. Below are the specific objectives to be considered;

1. Determine the opportunities of data analytics in supply chain management.
2. Determine the challenges of data analytics in supply chain management.
3. Examine the impact of the challenges of data analytics on the performance of the company.

1.3 Research Problem

Data Analytics in supply chain management has received increasing attention due to the major challenges that can possibly result in wastage and inefficiencies in supply chains, such as rising fuel costs, inconsistent suppliers and delayed shipments, ever-increasing customer expectations, among others (Barnaghi et al. 2013). Companies expect to capitalize significantly on Data Analytics in supply chain and logistics operations to improve flexibility, visibility and integration of global supply chains and logistics processes to effectively manage demand volatility and handle cost fluctuations (Genpact 2014). However, studies has been silent on the opportunities data analysis brings to an organization through the management of

supply chain. Additionally, Fan et al. (2015) study risk management in the context of the supply chain but was salient on the challenges of data analytics in supply chain management.

Research on the impact of Data analytics on supply chains also has predominantly taken a holistic approach, considering various aspects such as customer behavior, logistics, and manufacturing efficiency, aided by smartphones and IoT sensors. However, company performance, despite the attention given, has received less consideration in terms of what Data analytics in supply chain functions can have on the organization, as noted by Sanders (2016). While literature addressing Data analytics in supply chain management is limited, Richey et al. (2016) and Weng et al. (2016) briefly touch on Data analytics in supply chain management within their studies. Sanders (2014) dedicates a chapter to Data in sourcing, identifying some use cases of Data in procurement.

It appears that existing research does not enable a discussion on the challenges of employing data analytics within Supply Chain Management. The main gap in literature is lack of case studies precisely dedicated to data analytics within Supply Chain Management. In view of this, the study will be conducted to get in touch with Supply Chain Management and data analytics professionals through case study and tries to see if new findings emerge or similar findings.

1.4 Research Question

The questions below will be answered during the study;

1. What are the opportunities of data analytics in supply chain management?
2. What are the challenges of data analytics in supply chain management?
3. How does the challenges of data analytics influence the company's overall performance?

1.5 Key Concepts

This section aimed at providing a clear and concise explanation of the key concepts and terminology relevant to this thesis work and the questions that were raised.

1.5.1 Data Analytics

Data analysis is changing the collected raw data into meaningful facts and ideas to be understood qualitatively or quantitatively. It is studying the tabulated material to determine inherent facts or meanings. It involves breaking down existing complex factors into simpler parts and putting them together in new arrangements for interpretation. Wagner & Ice (2017) state that data analysis includes comparing the outcomes of the various treatments upon the several groups and making a decision as to the achievement of the organization's objectives regarding supply chain management. The analysis, regardless of whether the data is

quantitative or qualitative, may describe and summarize the data, identify relationships between variables, compare variables, and identify the difference between variables and forecast results.

As Ackoff (1961), cited in Dawit's (2020) article, points out, a well-structured plan of analysis should be prepared in advance, even before the actual collection of raw data. This preliminary analysis, like a skeleton plan, guides the investigation, evolving into a comprehensive final analysis that can be expanded and revised as needed. This process demands an alert, flexible, and open mind, with caution being a constant companion at every step.

Statistics methods have made significant contributions to data analysis. Basic statistical calculations are integral to almost any study involving groups of any size, while advanced statistical computations underpin many forms of research. Thus, it is pertinent to outline some statistical analysis methods employed in educational research. Data analysis and interpretation involve applying deductive and inductive reasoning to the research process.

1.5.2 Supply Chain Management

A supply chain encompasses a distribution channel that starts with the supplier of materials or components, progresses through the manufacturing process, and moves on to the distributor and retailer before finally reaching the consumer. Integrity means the degree of consistency in actions, values, methods, measures, principles, expectations, and outcomes. Therefore, supply chain integrity is not a binary attribute but a continuum, making it valuable to assess the impact on integrity before and after modifications to the chain. For instance, adding unvetted brokers as new links reduces integrity, whereas sourcing items directly from the original, trusted manufacturer enhances it. Original component manufacturers often create authorized distribution networks where each link in the supply chain is accountable and possesses certificates of conformance to ensure proper product protection protocols.

1.5.3 Fleet Management

Warren & Huseyin (2019) defines fleet management as the set of activities that oversee, coordinate, and enable various transportation and transport-related functions. This includes managing light vehicle fleets used for transporting people and light cargo, as well as potentially motorbikes and other equipment like generators and warehouse handling tools. Fleet management supports and underpins transport activities by managing the assets involved.

According to Mentzer, Stank & Esper (2013), fleet management is also a function aimed at eliminating or minimizing the risks associated with vehicle investments, productivity and

enhancing efficiency and reducing overall transportation and staffing costs. These tasks can be managed either by an in-house fleet management department or an outsourced provider. Fleet management covers a variety of commercial motor vehicles such as cars, ships, vans, trucks, and rail cars. It involves a range of functions, including vehicle financing, vehicle maintenance, vehicle telematics (tracking and diagnostics), driver management, speed management, fuel management, and health and safety management.

1.6 Reliability and Ethical questions of the study

The reliability of an instrument for a research refers to its ability to produce consistent outcomes across multiple trials. Although some degree of variability is often unavoidable, a high-quality instrument yields reliable results over repeated measurements. This tendency towards consistency in repeated measures is known as reliability (McCutcheon & Meredith 2016). One effective method for assessing reliability is through internal consistency, which strongly indicates the instrument's reliability within the test context.

Hyde (2017) defines validity as the degree to which an instrument measures what is to be measure. Content validity, a specific type of validity, refers to how well the instrument comprehensively evaluates or measures the concept of interest. In this research, the validity and accuracy of the data collected were enhanced through a meticulous process. The questionnaire was deliberately designed and tested with a few respondents from the target population. This preliminary testing aimed to refine the questionnaire and ensure it effectively captures the necessary data for the study, demonstrating the thoroughness of the research procedure.

2 Theoretical Background with Literature Review

Literature reviews are crucial to a thesis because they set the context and background for the research problem. They offer a critical evaluation of existing literature. This thesis's literature review will cover the concept of supply chain management, an overview of data analysis, the role and opportunities of data analytics, challenges in implementing data analysis within supply chain management, and organizational challenges and performance. These topics provide a solid foundation for addressing the central research questions of this thesis.

2.1 Introduction to supply chain management (SCM)

Supply chain management (SCM) has recently become an increasingly popular research topic. According to Genpact (2014), several factors contribute to this trend. Firstly, SCM gained prominence with the rise of global sourcing. As companies increasingly source materials globally, they are compelled to seek more efficient and coordinated material flows into and out of their operations, achievable through closer relationships with suppliers. Secondly, companies began to compete more heavily on time and quality in response to customer demands. This shift towards a global focus and heightened competition based on performance has led to more significant environmental uncertainty and the necessity for tighter coordination with suppliers and distributors. Despite the growing popularity of SCM, there remains to be considerable uncertainty regarding its precise definition and importance.

2.1.1 Definition and importance of SCM

Lambert et al. (1998), as cited by Felea & Albăstroiu (2013), described the supply chain as a network of members and the connections between them. Business processes create value for customers and must be managed and integrated across the supply chain by management components. Mentzer et al. (2013) define supply chain management as "a set of three or more entities (individuals or organizations) directly involved in the upstream and downstream flow of products, finances, services and information from source to customer."

Assey (2012) defines supply chain management as managing and analyzing networks within the supply chain to achieve value for money and enhance service delivery to customers. Ballou, Gilbert & Mukherjee (2010) also described supply chain management as a network of facilities responsible for acquiring products, transforming them into intermediate and finished goods, and distributing the finished goods to customers.

Christopher (1998) presents a paradigm shift, arguing that organizations are no longer seen as independent entities but rather as part of multi-company, multi-echelon networks that facilitate the delivery of goods and services to consumers. This shift in perspective

underscores the increasing importance of collaboration in supply chain management. Furthermore, the concept of material management within supply chain management involves the physical movement of freight from one point to another. Assey (2012) also notes that supply chain management focuses on managing facilities and networks within the supply chain to reduce costs and enhance customer satisfaction and service efficiency, further emphasizing the practical implications of the concept.

2.1.2 Historical Evolution of SCM

The evolution of supply chain management (SCM) can be traced through several distinct phases, with each phase being significantly influenced by professionals in logistics, supply chain management, and education. Before the 1950s, logistics, a field integral to SCM, was primarily a military function involving procuring, maintaining, and transporting military supplies and personnel (Ballou 1978). SCM was not seen as a strategic business function. In the 1960s and 1970s, the study and practice of logistics in business, a field that many of you are part of, began to take shape. Physical distribution management in manufacturing firms started to be recognized as a distinct organizational function (Heskett et al. 1964).

The concept of SCM was coined in the early 1980s by logistics consultants (Oliver & Webber 1992). They emphasized viewing the supply chain as a single entity and the transformative power of strategic decision-making at the top level. This new approach to SCM began to gain traction and became one of the most popular management concepts (La Londe 1997). The intense global competition in the 1990s spurred further development of SCM practices (Handfield 1998). SCM concepts began to be applied in various industries, including electronics (Berry 1994) and services such as the National Health Service (Fernie 1995), showcasing the exciting potential of strategic decision-making in SCM.

SCM principles started to be explored in the service industry in the 2000s (Kathawala & Abdou 2003). The concept of an educational supply chain was proposed as a strategic tool in tertiary education (O'Brien & Kenneth 1996). Extensive research on educational SCM was conducted, leading to developing the Integrated Tertiary Educational Supply Chain Management (ITESCM) model (Habib & Jungthirapanich 2010a).

Key milestones in the evolution of the discipline include:

Military logistics focuses on procurement, maintenance, and transportation in military contexts. Physical Distribution and Logistics were also recognized as an organizational function in the 1960s and 1970s. Supply Chain Management Conceptualization was introduced in the 1980s, emphasizing strategic management of the supply chain. In the late 20th century, SCM Popularization became a widely discussed management concept. Additionally, SCM

principles were adapted to various service industries and educational institutions in the 2000s, and this was known as the Application of SCM Services and Education.

Generally, SCM has evolved from a military-focused logistics concept to a strategic management practice integral to the manufacturing and service industries, including education. The evolution of SCM as a timeline is shown in Figure 1 below.

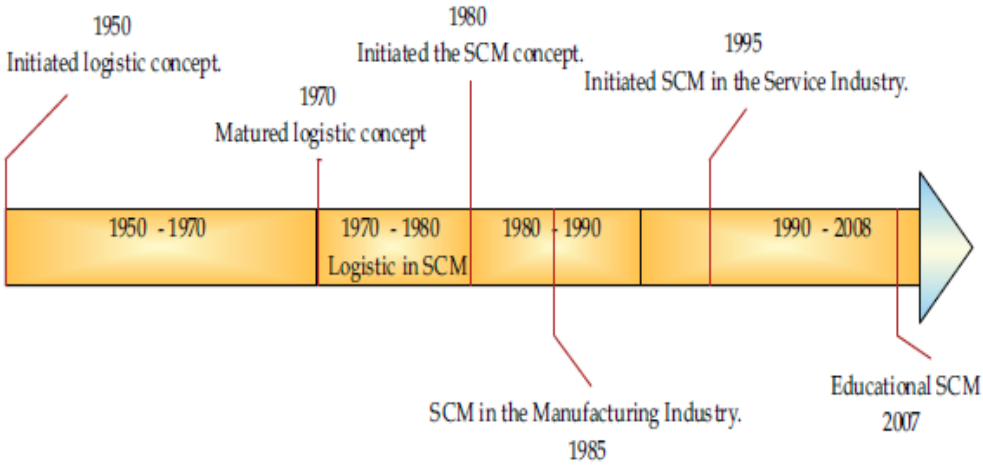

Figure 1: Timeline of SCM Evolution (Habib & Jungthirapanich 2008)

2.1.3 Fleet Management Concept

Fleet management, as defined by White (2015), is a comprehensive set of activities that not only operate, direct, and support various transport and movement functions, but also brings a host of benefits. These include managing light automobile fleets, motorcycles, warehouse tools, and generators, with the aim of reducing risks associated with vehicle investments, improving efficiency and productivity, and lowering overall movement and workforce costs. By understanding and implementing these strategies, professionals in transportation and logistics can feel empowered to make significant improvements in their operations.

Fleet management encompasses a wide range of vehicles, from vans and cars to ships, trucks, and rail cars. It involves tasks like vehicle financing, maintenance, tracking, driver supervision, speed control, health and safety, and fuel management (White 2015). However, the real power of fleet management lies in its sustainable practices. By focusing on minimizing societal impacts through efficient use of vehicles and fuels, reducing road traffic, fuel costs, and enhancing worker safety (Besiou et al. 2012), fleet managers can feel a sense of responsibility and motivation to contribute to a greener future. Whether handled internally or outsourced, fleet management ensures compliance with regulations and integrates with comprehensive transport management systems for real-time data.

Besiou et al. (2012) describe sustainable fleet management as reducing societal impacts through a combination of domestic cars and fuels, fuel-efficient operation and driving, and reducing road traffic. This approach lowers fuel and truck costs, enhances worker safety, and reduces congestion-related issues.

Fleet management allows companies relying on transportation to mitigate risks, increase efficiency, and reduce movement and staffing costs while ensuring compliance with regulations (Langley, et al. 2019). It can be integrated with a comprehensive transport management system, providing real-time data to be combined with other monitoring systems.

2.2 Overview of Data Analysis

Data encompasses numbers, characters, images, or other recording methods that can be assessed to make decisions or determinations about specific actions. Many believe that data is meaningless until it is interpreted and turned into information. By analyzing data and enhancing knowledge, we can identify patterns and extract information.

Data analysis involves various techniques and approaches across business, science, and social sciences. It can be performed qualitatively or quantitatively and is a crucial step in both types of research. Data analysis is vital in scientific disciplines like metabolomics, genomics, proteomics, and bioinformatics (Misra & Fahrmann 2017).

Data analysis can occur at any phase of a project or program. It can also be done before the start, during the design phase, throughout the project, at its conclusion, or even after the project has ended. Data analysis can be performed at various levels within individual projects, across multiple projects, within programs, sectors, or organizations. In social development, data analysis is often promoted within societies as part of a participating process.

2.2.1 Definition and scope of Data Analysis

The internet's upsurge and significant advancements in information technology, such as storage, networking, and telecommunications capabilities, allow companies to access large volumes of data almost in real-time, treating "information as a strategic asset" (Mason-Jones & Towill 1997, 140).

Our daily activities generate data and are no longer restricted to mobile networks, communication, and spreadsheets. With the digitalization and integration of technology in everyday life, enormous amounts of data are collected. From crowd-funded business models and gadgets to large-scale banking and mobility, as well as individual data and behavioral patterns, everything can be recorded and analyzed to improve performance and prevent delays and threats (Koutroumpis & Leiponen 2013).

According to Kothari (2004), data analysis involves comparing the outcomes of various treatments across different groups and determining whether the research goals have been achieved. Whether qualitative or quantitative, the analysis aims to summarize and describe the data, identify relationships between variables, compare them, and forecast outcomes. Peng & Parker (2021) define data analysis narrowly as the application of statistical methods to clean datasets, while others see it as overlapping with data science. This interdisciplinary nature of data analysis incorporates statistics, computer science, and mathematics elements.

Data Analytics has a broad scope, impacting various industries and domains, and its applications extend to different facets of business, research, and decision-making. Critical areas within the scope of Data Analytics include Business Analytics, Healthcare Analytics, Financial Analytics, Marketing Analytics, Social Media Analytics, and Supply Chain Analytics.

Business Analytics is used extensively in businesses to optimize operations, enhance customer experiences, and make strategic decisions based on data-driven insights. Healthcare Analytics is also crucial for improving patient care, advancing medical research, and increasing healthcare efficiency through analyzing patient records, medical imaging, and clinical trials. Financial Analytics is employed in the finance sector to detect fraud, assess risks, and make investment decisions based on historical data and market trends. Marketing Analytics also assists marketers in understanding consumer behavior, targeting specific audiences, and optimizing marketing campaigns for better results.

Social Media Analytics analyzes social media data for sentiment analysis, brand reputation management, and understanding customer feedback. Supply Chain Analytics is applied to optimize supply chain processes, inventory management, and logistics, thereby improving efficiency and reducing costs (Demšar et al., 2013). As technology advances and more data becomes available, the scope of Data Analytics continues to expand, revolutionizing industries, improving decision-making, and driving data-driven innovations.

2.2.2 Types of Data Analytics

Chen et al. (2015) categorize data analytics into three main types: descriptive, predictive, and prescriptive.

Descriptive analytics is utilized whenever necessary to identify issues and opportunities within current processes and functions, employing techniques such as OLAP and drill down. It leverages historical data to detect patterns and model past behaviors. It addresses questions about past events, existing trends, and exceptions. Insights gained from this data provide alerts and visualize results in an easy-to-understand format (Wang et al. 2016).

As defined by Assunção et al. (2015), predictive analytics aims to forecast the future by analyzing current and historical data. This type of analytics benefits from machine learning and data mining algorithms, utilizing techniques such as time series analysis, advanced safety stock forecasting, regression, and statistical analysis. Wang et al. (2016) described predictive analytics in supply chain management (SCM) as using both quantitative and qualitative methods to enhance supply chain design and competitiveness by assessing past and future integration levels of business processes across functions or companies, along with related costs and service levels.

Prescriptive analytics takes these predictions and recommends actions for future situations to capitalize on opportunities or mitigate risks. Optimization, simulations, and what-if scenario analysis are relevant here (Chen et al. 2015). This form of analytics is the least commonly adopted among businesses. Additionally, the concept of relying on a system for decision-making continues to be a subject of debate among practitioners.

2.3 The role and opportunities of Data Analysis in SCM

Data analytics has become a transformative force in numerous industries, including the supply chain sector. Recently, there has been a notable shift towards data-driven decision-making in business operations. Incorporating data analytics into supply chain management allows organizations to optimize processes, enhance efficiency, and achieve a competitive market advantage. By utilizing accurate and real-time data, businesses can make strategic decisions that minimize risks and increase opportunities. Kachikis, et al. (2019) suggest some crucial roles data analytics play in supply chain management.

First, leverage Data Analytics for Inventory Management in the supply chain. One of the challenges in SCM is maintaining optimal inventory levels. Excessive inventory ties up capital, while inadequate inventory can result in stockouts and unhappy customers. Data analytics helps companies predict demand patterns, recognize seasonal variations, and optimize inventory levels. By examining market trends and historical sales data, businesses can make informed decisions regarding when and how much inventory to restock.

Another role is the Predictive Analytics for Demand Forecasting. Accurate demand forecasting is crucial for efficient production planning, resource allocation, and fleet movement. Data analytics allows supply chain managers to analyze customer behavior, identify patterns, and predict future demand. Companies can align their distribution processes and production with anticipated demand through predictive analytics, reducing lead times and lowering inventory carrying costs (Hazen, et al. 2014).

Data Analytics also enhance Logistics and Distribution in the supply chain. In today’s globalized economy, efficient logistics and distribution networks are vital for timely

deliveries. Data analytics offers valuable insights into optimizing transportation routes, selecting the most cost-effective carriers, and minimizing shipping delays. By streamlining logistics processes, businesses can cut operational costs and enhance overall customer satisfaction.

Furthermore, improved efficiency and cost reduction are other opportunities for applying data analytics. Incorporating data analytics into supply chain decision-making enhances operational efficiency. Companies can optimize workflows and eliminate unnecessary costs by analyzing processes and pinpointing bottlenecks. Real-time data insights enable agile decision-making, allowing companies to respond quickly to changing market conditions.

Finally, it enhances visibility and transparency in supply chain management. Data analytics provides supply chain managers with unparalleled visibility into their operations. From sourcing raw materials to tracking shipments, every stage of the supply chain can be monitored and analyzed. This transparency aids in identifying inefficiencies, maintaining quality standards, tracking vehicles, and building stronger relationships with suppliers and customers (Hazen, Hall & Hanna, 2012).

Data analytics is essential for modern supply chain management. It offers significant benefits in inventory management, demand forecasting, logistics, efficiency, and transparency. Its integration into supply chain processes allows businesses to make informed decisions, optimize operations, and maintain a competitive edge in the market.

2.4 Challenges in implementing data analysis in supply chain management

Modern Supply chains navigate an increasingly sophisticated and competitive landscape. Practitioners are pressured to adapt to both national and global changes (Daniel 2015). The decision-making necessary to handle these swift changes can be complex and challenging, particularly when resources are insufficient to effectively utilize a vast array of information. Although data analytics provides considerable advantages, its successful integration into the supply chain is accompanied by challenges that must be addressed.

According to Behera (2017), integrating data with an organization's existing systems is a challenge in implementing data analysis in supply chain management. Accurate and high-quality data are important for meaningful analytics. Only complete or consistent data can lead to decision-making errors and flawed insights. Integrating data from various sources, such as ERPs, IoT devices, and CRMs, requires robust data integration strategies.

Another challenge identified is the talent and Skills Gap. Utilizing data analytics necessitates a proficient workforce capable of interpreting and applying insights derived from data.

Closing the skills gap and ensuring supply chain professionals know data analytics tools and techniques is essential for successful implementation (Daniel 2015).

Data Security and Privacy Considerations are another crucial challenge organizations face. As reliance on data grows, ensuring its security and compliance with privacy regulations becomes vital. Companies must establish robust data security protocols to protect sensitive information on customers and suppliers in the chain.

In addition to the challenges in the implementation of data analysis in SCM, there are data quality and accessibility. With intensifying competition among modern supply chains, collecting and integrating real-time data can be challenging. The first obstacle is identifying and establishing reliable data sources (Behera 2017). After this stage, a system is needed to clean and segment the data into smaller parts. Many businesses design their systems to issue early warnings if defects, exceptions, or abnormalities are detected during this process. Failure to identify these defects promptly can lead to significant issues. Another challenge with Big Data analytics is creating fault-tolerant machines and algorithms, ensuring the probability of failure remains at an "acceptable" level (Madden 2012). Today, supply chains often utilize cloud computing, combining disparate sources with extensive data clusters. SCM necessitates scalable cloud storage to execute different tasks effectively for each cluster (Katal 2012).

The last of the challenges is the Cost of implementation. There is an enormous cost associated with developing algorithms to integrate unstructured and structured formats of data coming from distinct sources and store them in different departments of the stakeholders. Cleaning such massive quantities may result in the loss of data (Daniel 2015). At times, suppliers and distributors need interoperable systems. Therefore, aggregating their administrative data also poses an additional challenge. Furthermore, modeling such disorderly, interrelated, but untrustworthy data is a complicated job as it is expected to unveil more reliable hidden patterns and knowledge.

2.5 Organizational Challenges

Challenges emerge as significant obstacles within organizations, testing the resilience of even the most steadfast leaders. These organizational challenges hinder the smooth functioning of businesses, obstructing progress and success. They manifest in various forms, from internal issues like communication breakdowns and resistance to change to external factors like market volatility and fierce competition. Such challenges pose substantial threats to the well-being and growth of businesses, necessitating prompt attention and strategic solutions.

The impact of organizational challenges can be profound, shaping the future of businesses. Consider a scenario where communication breakdowns disrupt a team, stifling collaboration

and synergy. The results can be severe: projects are delayed, errors go unnoticed, and team morale declines. In such an environment, innovation and productivity suffer, putting the entire organization at risk (Atreyee 2022). Similarly, when a company fails to adapt to market changes, it risks becoming obsolete and losing its competitive edge to more agile and responsive competitors. For instance, Kodak, once a dominant player in the photography industry, failed to embrace digital technology and adapt to changing market dynamics, leading to its downfall while its competitors thrived.

Resistance to change is another form of organizational challenge. When companies resist or ignore the need for transformation, they become stagnant and struggle to keep up with evolving customer demands and industry trends.

Fernando et al. (2013) state that unclear goals can also be an organizational challenge. It's like trying to hit a target blindfolded. Without clear goals, employees are left in the dark, unsure of their objectives. Whether it’s a lack of alignment across teams or vague objectives, unclear goals can leave employees feeling lost and demotivated. Organizations can bring clarity and focus by setting SMART goals (specific, measurable, achievable, relevant, and time-bound) and ensuring everyone is aligned.

Lack of training is another organizational challenge that can negatively impact daily operations. Training is essential for employees to learn valuable information and skills. A lack of training means missed opportunities for communication and development (Atreyee 2022). Employee training can be challenging, as business owners might be reluctant to spend funds on training despite the preference for trained employees. When facing this issue, companies might consider implementing new training strategies to enhance the effectiveness and productivity of their team.

However, organizational challenges are not impossible. With the right mind set, strategies, and tools, businesses can navigate these obstacles and emerge stronger. By fostering a culture of open communication, encouraging collaboration across teams, and embracing change as an opportunity for growth, organizations can overcome challenges and unlock their full potential.

2.6 Organizational Performance

The concept of performance is subjective, leading to various definitions in the literature. Many studies link performance closely with environmental factors. Didier (2018) defines performance as "achieving the goals that were given to an individual in convergence with enterprise orientations." He emphasizes that performance is not merely the outcome but the result of comparing the outcome with the objective. The author views performance as this

comparison, acknowledging that both outcomes and objectives can vary greatly across different fields.

Lebas (2015) describe performance as future-oriented, reflecting the specific characteristics of each organization and based on a causal model linking components and products. The author define a "successful" business as one that will achieve the goals set by management, rather than one that has already achieved them. The scholar distinguishes between "a performance" (a measured result that exceeds expectations or previous results), "performance" (which can be positive or negative and relates to past results), and "being performant."

According to Neely (2012), performance is a socially constructed reality existing in people's minds, not an objective reality waiting to be measured. For the author, performance encompasses products, components, consequences, impact, and can be linked to economy, effectiveness, efficiency, cost-effectiveness, or equity.

In addition, Matei (2018) defines performance as achieving organizational objectives, applicable across various management fields such as human resources management, general politics, and management control. A performer is one who meets their objectives, making performance dependent on these objectives. Performance is multidimensional when goals are manifold and is a subset of action, being subjective due to its nature of aligning reality with desires.

Finally, considering the definitions above, it's clear that the concept of organizational performance varies among authors and across countries. However, two common elements are consistently highlighted: objectives and outcomes.

3 Research Methodology

This study aims to investigate data analytics challenges in Supply Chain Management, using Novago Co Ghana Limited as the case study. In view of this, the research method and procedures adopted for the study are presented in this part of the thesis report. It shows the research design, sources of data, sampling techniques and sample size, data analysis tool and the reliability and validity of data gathered as well as the ethical consideration of the study. These elements were very important since they give the reader insight as to how data were administered, gathered, and analyzed.

3.1 Research Design

Research methods focus on addressing the researcher's inquiries about how data was collected (Saunders et al. 2009). The research philosophy generally stems from the researcher's perspective on the development of data, facts, and knowledge. Essentially, it involves conducting research to generate knowledge, rather than being a deeply complex process that requires extensive contemplation (Saunders et al. 2007).

This study employed a descriptive design and a survey approach, incorporating both quantitative and qualitative methods. Surveys are used to collect data from individuals regarding their lifestyles, homes, or larger social structures. Sample surveys are crucial tools for gathering and analyzing data from groups of individuals and are widely recognized as essential in conducting and relating social science research (Rossi et al. 2012). The choice of this research method is crucial not only due to the investigative nature of the study but also because it has been found suitable for analyzing phenomena, situations, problems, attitudes, and issues by considering a cross-section of the population at a single point in time (Robson 2015). This helps to explore the challenges of implementing data analytics within Supply Chain Management at Novago Co Ghana Limited.

The study also gathered relevant data from both primary and secondary sources. Primary data are mostly gathered from original sources directly related to the research questions. In this case, primary data was gathered from the interviews and questionnaires administered to respondents. On the other hand, secondary data was obtained from existing literature, including journals, articles, and books written by various scholars. These secondary sources provided additional context and background for the research.

3.1.1 Interview for primary data collection

Due to the open-ended nature of the research questions, the primary method of data collection for this thesis is the interview. These questions, which start with words like "why," "what," and "how," invite respondents to provide unrestricted, detailed responses, thereby

yielding in-depth insights. Open-ended questions are designed to elicit comprehensive and detailed answers, which align with the objectives of this thesis.

The purpose of conducting interviews is to delve into and comprehend the interviewee's experiences, opinions, and motivations through in-depth discussion. The relationship between the interviewer and the interviewee is crucial for a successful interview. Interviewers, as the facilitators of this process, should prepare thoroughly, establish a trusting environment, and guide the process and discussion from beginning to end.

Saunders et al. (2009) highlight three different interview styles: structured, semi-structured, and unstructured. A structured interview involves a set of scripted questions, typically consisting of more closed-ended questions. A semi-structured interview, in contrast, includes fewer prepared questions and allows for more participant freedom, with follow-up questions to steer the discussion. An unstructured interview has no prepared questions, offering the most flexibility and enabling a more natural conversation.

Given the open-ended nature of this thesis, semi-structured interviews were not just appropriate, but highly effective. These interviews provide a flexible approach to questioning, which significantly aids in eliciting detailed and informative responses from participants. The qualitative semi-structured interviews were conducted via Zoom video calls and recorded for data analysis. During the interview, the interviewer introduces himself and explains the purpose of the interview. Open-ended questions were asked to encourage the interviewees to provide in-depth answers. While the questions focused on specific topics, the interviewer explored related issues during the conversation. Both parties asked additional questions and probed for further information.

3.1.2 Questionnaire for the Data collection

To ensure the validity of the thesis, incorporating qualitative surveys into the research methodology is highly beneficial. While quantitative research offers a large volume of data, qualitative surveys excel in providing profound insights and understanding the underlying motivations, attitudes, and behaviors of the target groups. In this study, the target groups include professionals in data analysis, general administration, marketing, finance, and supply chain.

Qualitative surveys play a pivotal role in research, enabling the collection of detailed and subjective information. This approach uncovers themes, patterns, and the depth of respondents' experiences, providing a rich and nuanced understanding. The collected data is then subjected to statistical methods, such as pie charts, percentage visuals, and SPSS analysis, to identify patterns and outcomes. The survey responses are compiled and examined to address the research question.

Qualitative surveys are particularly valuable when exploring complex social, cultural, or psychological aspects, as quantitative metrics alone may not adequately capture the degrees of human behavior and perceptions.

3.2 Sampling Techniques and Sample size

This thesis used a combination of purposive and convenient sampling techniques. Purposive sampling, also called judgmental sampling, involves selecting participants based on the researcher's understanding of the population and the study's specific objectives. It was chosen because it can provide in-depth insights into the phenomenon under study.

On the other hand, convenience sampling is a non-probability method that was also adopted for this study. This technique involves selecting respondents based on their close proximity and easy accessibility to the researcher, as explained by Polgar & Thomas (2015). We chose this method for its speed and cost-effectiveness, with the expectation that respondents were willing to participate. The study targeted employees and professionals in data analysis, supply chain, procurement, logistics, and management at Novago Co Ghana Limited, with a total population of thirty (30) professionals. To determine the total number of respondents, we used an online sample size calculator, which was suitable for our study due to the smaller size of the population.

3.3 Data Analysis

Strydom et al. (2013) define data analysis as the process of finding responses by interpreting data and outcomes. Interpretation involves explaining and finding meaning. It is impossible or challenging to explain raw data; one must first describe and analyze the data, then interpret the results of this analysis. Analysis involves categorizing, manipulating, ordering and summarizing data to answer research questions.

The goal of analysis is to condense data into a clear, understandable, and interpretable form, allowing for the study, testing, and conclusion drawing of research relationships. Interpretation involves taking the results of the analysis, making inferences related to the research relationships studied, and drawing conclusions about these relationships. The completed questionnaires were reviewed for completeness, consistency, and readability. Once verified, the data were organized in a format that facilitated easy analysis.

For the analysis of the findings, the study primarily employed IBM's Statistical Software Package for Social Sciences (SPSS) version 28. Microsoft Excel and Google forms were also used for visually representing the study's outcomes.

In order to determine the impact of the challenges of data analysis on the performance of the organization, the IBM's Statistical Software Package for Social Sciences (SPSS) version 28 was employed to determine the correlation between the challenges and the organization's performance. This as a result showed the connection or the relationship between the two variables. By employing these methodologies and tools, the study aims to provide a comprehensive analysis of the challenges faced in employing data analytics within Supply Chain Management at Novago Co Ghana Limited. The combination of descriptive design, survey approach, and a mix of sampling techniques ensures a thorough and efficient data collection process.

3.4 Reliability and Validity

The reliability and validity of research measuring instruments significantly impact the ability to learn from the study phenomena, the likelihood of achieving statistical significance in data analysis, and the potential to draw meaningful conclusions from the collected data.

Charmaz (2016) defines validity as the instrument's capability to measure what it is intended to measure. The author further states that validity involves answering two critical questions: Does the study have adequate control to ensure that the researcher's conclusions are genuinely supported by the data? Can the researcher generalize findings from the specific research situation to a broader population? As a researcher, I am responsible for addressing these questions and considering external, internal, and content validity.

On the other hand, reliability was described by Lee et al. (2013) as the degree to which a measuring instrument produces consistent outcomes when the characteristics being measured remain unchanged. Charmaz (2016) adds that researchers should use consistent templates and static methods as much as possible to enhance reliability. To ensure the measuring instrument's reliability, the researcher should standardize it across different individuals or situations. The questionnaire was first administered among friends to test for the meaning of each question and to check the spelling and grammar for reliability before it was finally administered among respondents of the study.

3.5 Ethical Consideration

Most ethical issues in research can be categorized into four main areas: informed consent, right to privacy, protection from harm, and honesty with professional colleagues (Denzin & Lincoln, 2015). Proper attention was given to securing consent from each respondent regarding their participation in the study, ensuring it was entirely voluntary. The researcher made efforts to respect participants' rights and privacy. The findings were reported accurately, without any distortion of the research outcomes. Additionally, full acknowledgment was given to all reference materials used in the study.

4 Analysis of the Results and Discussion

This part of the thesis presents the outcome of the analysis of the research questions and the discussion. It is presented in four different parts with demographic data of respondents starting the chapter. The three research questions of the study were then answered. This portion of every research is very significant since it serves the purpose of answering the research question base on respondents' opinion on the specific objectives.

A total number of thirty (30) links of the questionnaire were retrieved from google forms and forwarded to respondents on WhatsApp. Out of this, twenty-eight (28) responses representing ninety-three point three percent (93.3%) were obtained and analyzed with the help of SPSS, google forms and Microsoft Excel. The analysis and the results are presented below;

4.1 Survey Results

4.1.1 Demographic Data

It is important to have included this data since it gives the reader the idea of the behavior and attitudes of the respondents. The gender, age, educational level, work experience and the positions of the respondents are presented in this study. Below is the outcome of the data analyzed;

- Gender

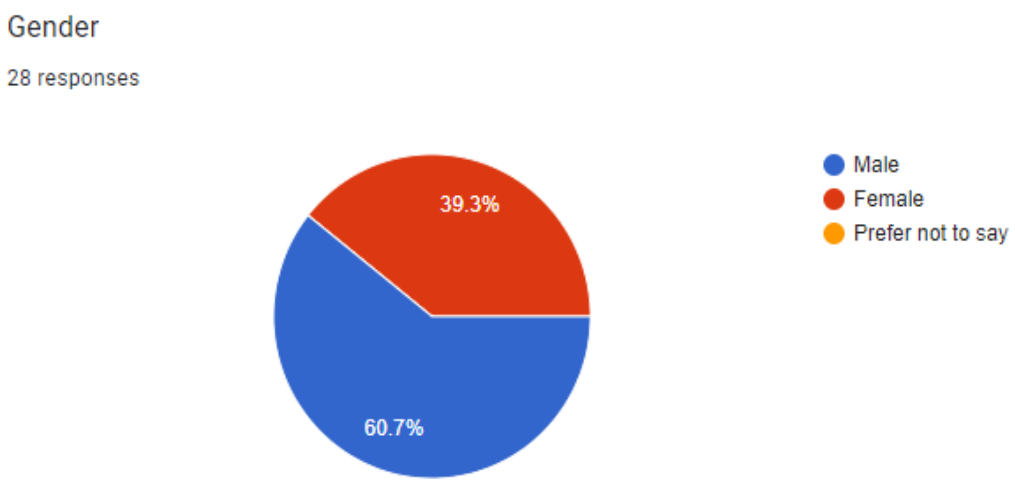

Figure 2: Gender Distribution

The figure 2 above shows the gender distribution of the respondents of the study. It can be seen that 60.7% of the respondents were males while 39.3% were females. There is a clear indication that, majority of the respondents for this study were male.

- Age Distribution

In an attempt to better understand the demographic data of respondents for this study, the age distribution were analyzed. The ages of the respondents were categorised into five different intervals. It was revealed that, majority of the respondents were within the age bracket of 36-40years. This group recorded 39.3%. It was followed by the age bracket of 41-45 years respectfully with a percentage of 28.6. Respondents within the age bracket of 46-50 years and 51 and over recorded the least of 3.6% each respectively. In view of this, one can conclude that, professionals within the age bracket of 36-40 years dominated in the participation of the study. Below is the chart representation of the outcome;

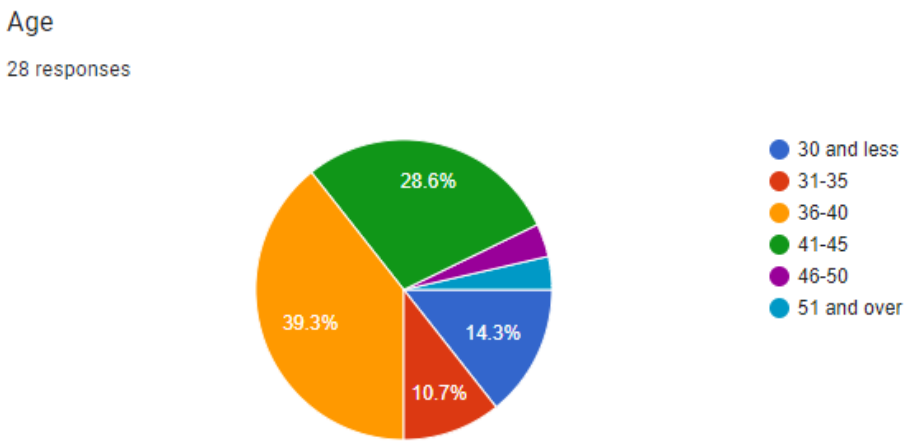

Figure 3: Age Distribution

- Educational level

The educational level of respondents was vital for this study in order to have an insight on how participants understand the topic. This will also give the reader a fair idea of the respondents' knowledge about the challenges of data analytics in Supply Chain Management. The outcome suggest that respondents had first degree and post graduate degree. Majority 57.1% had postgraduate while 42.9% had first degree. It can therefore be inferred that, respondents in the organization have high educational qualifications which is very encouraging in the sector. This is illustrated on the figure 4 below;

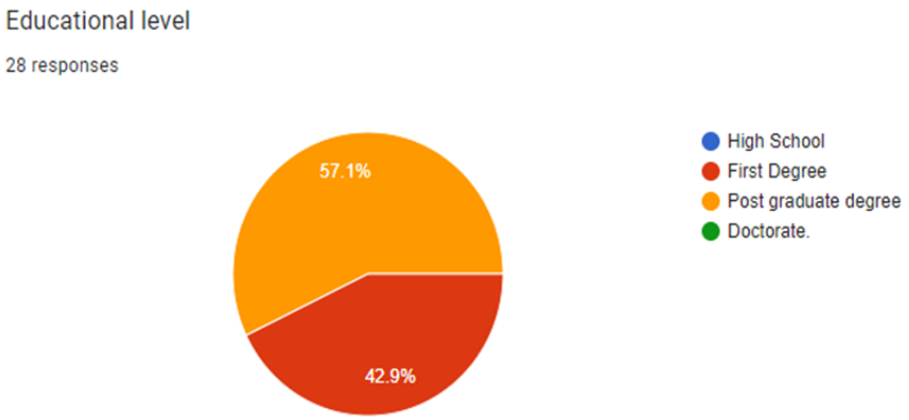

Figure 4: Educational Level

- Work Experience

The experience of respondents was ascertain in order to explore the challenges of data analytics in Supply Chain Management in the organization. This was seen necessary since experience of a professional in any field can give valuable information within the sector they operate. It was discovered that 42.9% representing majority had spent more than 10 years in their field of work. Meanwhile, 35.7% had 6-10 years' work experience in the organization. 5 out of the 28 respondents indicated 2-5 years of experience. It can be concluded that majority had spent more than 10 years of working in this field and as result, the response given is a very credible one. The results are displayed on the figure 5 below;

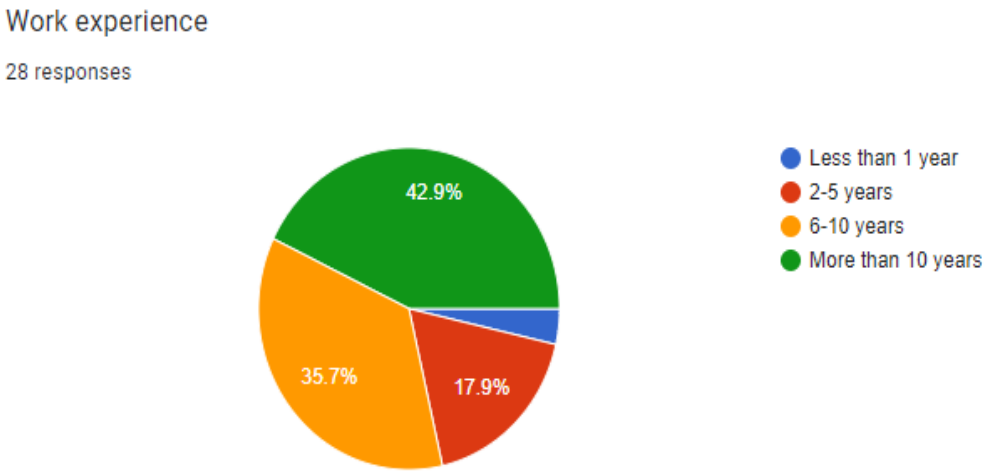

Figure 5: Work Experience

- Current Position

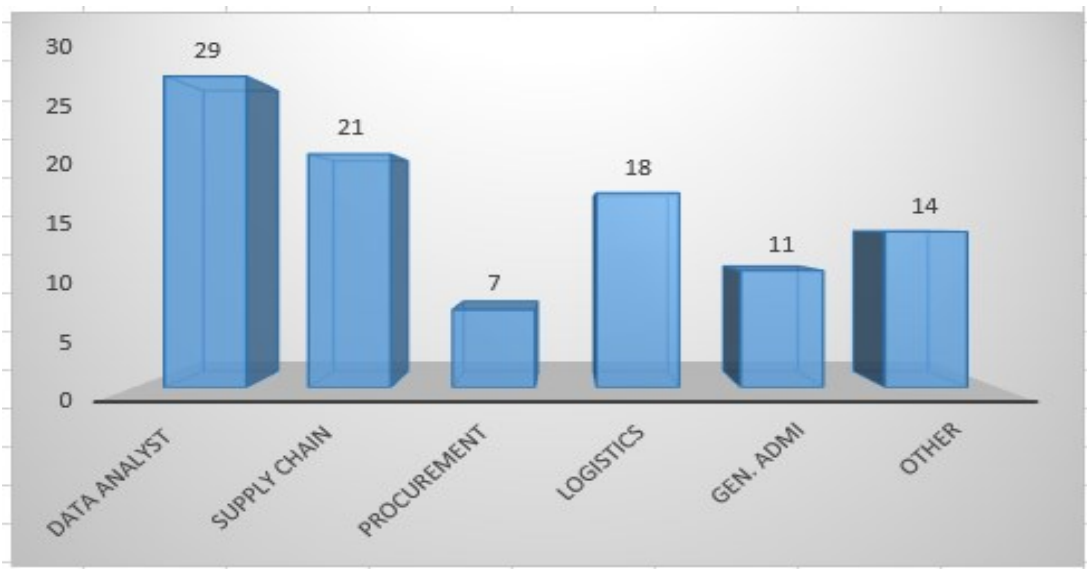

Figure 6: Current Position

The figure 6 above illustrate the outcome of the current positions of the respondents. It can been seen from the figure that, 29% represent majority were data analyst. This was followed by supply chain professionals with 21%. The least group in this category were from the Procurement department. Considering the outcome, one can conclude that, data were gathered from the right professionals on the field as far as the topic is concern.

4.1.2 Challenges of data analytics in Supply Chain Management

The first objective of the study was to determine the Challenges of data analytics in Supply Chain Management in Novago Co Ghana Limited. This section of the study seeks to answer the first research question. In view of this respondents were asked to use the liket scale of 1-5 to either agree or disagree on the suggested challenges. In this same section of the study the liket scale of 1-5 were used to rate high or low of some of the challenges. The outcome of this objective is presented below;

- Data privacy and security concerns

Respondents were asked, to what extent they think data privacy and security concerns pose challenges to effective data analytics in the supply chain? Using a scale of 1-5 {1=totally disagree; 2=partially disagree; 3=Neutral; 4= Partially Agree and 5= Totally Agree. The outcome is displayed on the figure 7 below;

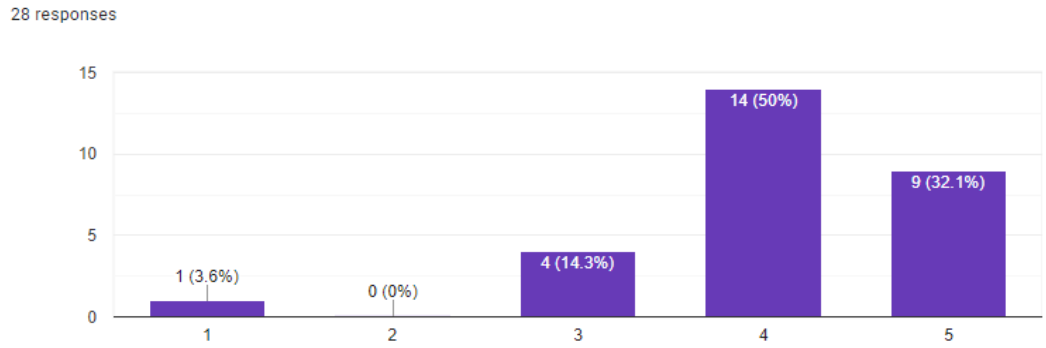

Figure 7: Data privacy and security concerns

It was revealed that, data privacy and security concerns pose challenges to effective data analytics in the supply chain since majority of the respondents representing 50% and 32.1% indicated Agree and totally agree to the statement. Meanwhile 14.3% of the respondents answered neutral which means they had no idea. Only 3.6% of the respondents totally disagreed to the statement. In view of this outcome, it can be concluded that data privacy and security concerns pose challenges to effective data analytics in the supply chain. This is illustrated in figure 7 above.

- Managing and integrating data from diverse sources

In order to determine the challenges of data analytics in Supply Chain Management, respondents were asked, to what extent they agreed that, managing and integrating data from diverse sources in the supply chain functions is a challenge to the organization? A liket scale of 1-5 of which {1=totally disagree; 2=partially disagree; 3=Neutral; 4= Partially Agree and 5= Totally Agree was the mechanism for answering. The results is represented on the figure 8 below;

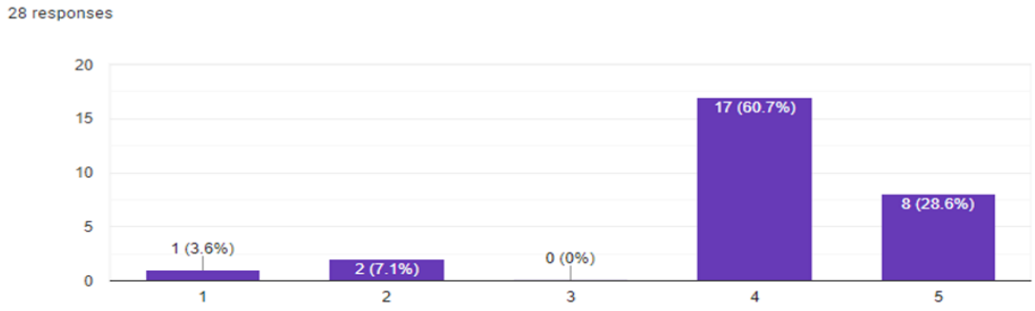

Figure 8: Managing and integrating data from diverse sources

The analysis of the results shows that, 60.7% and 28.6% of the respondents agree that managing and integrating data from diverse sources in supply chain functions is a challenge to the organization while 7.1% and 3.6% disagreed. Based on this outcome, it is obvious that managing and integrating data from diverse sources in supply chain functions is a challenge to the organization.

- Talent and skill gaps

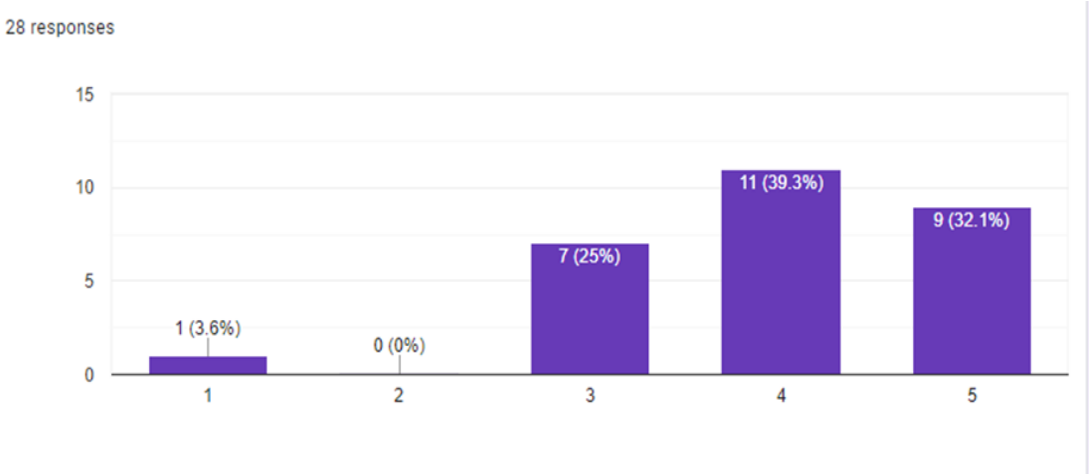

Figure 9: Talent and skill gaps

Considering the descriptive statistics performed, talent and skill gaps for implementing data analytics in supply chain functions in the organization is a challenge because, majority of the respondents representing 39.3% and 32.1% had indicated “agree” and “totally agree” to the statement. On the other hand, 25% were not sure if it was a challenge or not and as a result indicate “neutral”. But, only 3.6% of the respondents indicated “totally disagree” as an answer to the question. Based on this result, it can be concluded that, talent and skill gaps for implementing data analytics in supply chain function in the organization is a challenge.

- Data accuracy and reliability

As part of the journey in achieving the first objective and answering the research question, respondents were asked to use a liket scale of 1- 5 with 1 being very low and 5 very high to rate the difficulty of ensuring data accuracy and reliability in supply chain analytics. The outcome is illustrated on the figure 10 below;

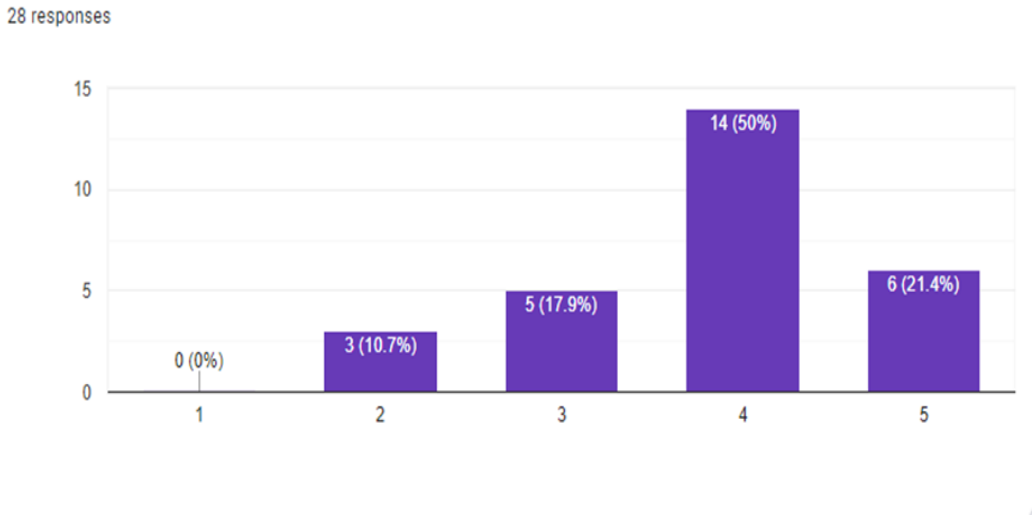

Figure 10: Data accuracy and reliability

Considering the figure 10 above, majority of the respondents 50% rated the difficulty of ensuring data accuracy and reliability in supply chain analytics high and 21.4%, very high. Meanwhile 10.7% disagreed and rated it low. It is also observed that, 17.9% were not sure if the statement was a challenge or not and ended up indicating neutral. Per the finding, it is convincing that, ensuring data accuracy and reliability in supply chain analytics in the organization is a challenge.

4.1.3 Opportunities of data analytic in supply chain management

Data analysis has proven to be very effective tool for management of organizations as far as decision making is concern. And so, the second objective of this study is to identify some opportunities of data analytics in supply chain management. This part analyzed four opportunities discovered in the literature review.

- Enhancing visibility in the supply chain management

In an attempt to answer the second research question, respondents were asked to use a scale of 1-5 (1=totally disagree; 2=partially disagree; 3=Neutral; 4= Partially Agree and 5= Totally Agree) to either agree or disagree the extent to which data analytics can enhance visibility in the supply chain management. The outcome of the analysis is illustrated below;

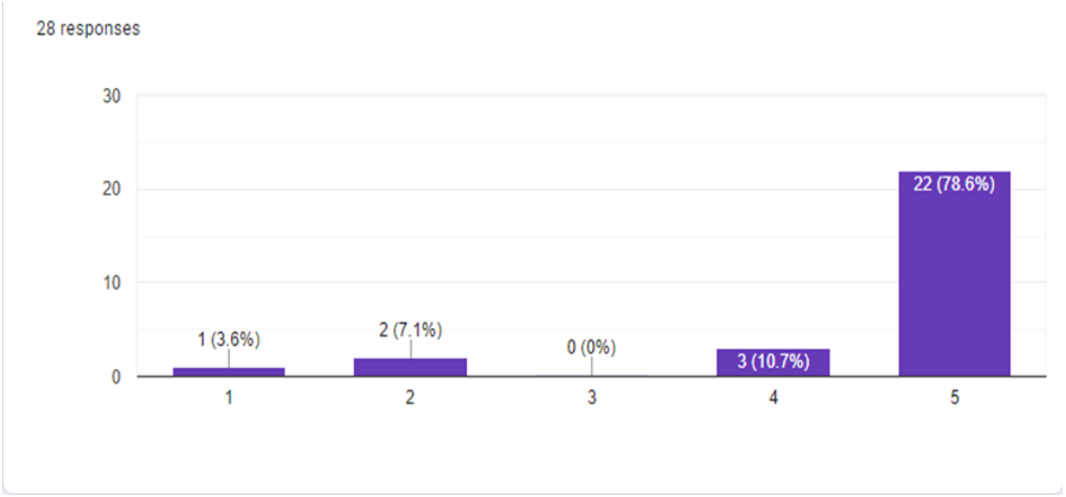

Figure 11: Enhancing visibility in the supply chain management

From figure 11 above, 78.6% being the majority of the respondents totally agree that data analytics can enhance visibility in the supply chain management while 3.6% totally disagree. Meanwhile, 10.7% of them also agree but 7.1% disagree as well. Based on this outcome, it can be concluded that data analytics can enhance visibility in the supply chain management within the organization.

- Data analytics can improve supply chain responsiveness to market changes

Another question under this research objective was the extent to which respondents agree that data analytics can improve supply chain responsiveness to market changes. The liket scale was again utilized in this case with 1-5 {1=totally disagree; 2=partially disagree; 3=Neutral; 4= Partially Agree and 5= Totally Agree. The figure 12 below shows the results of the study;

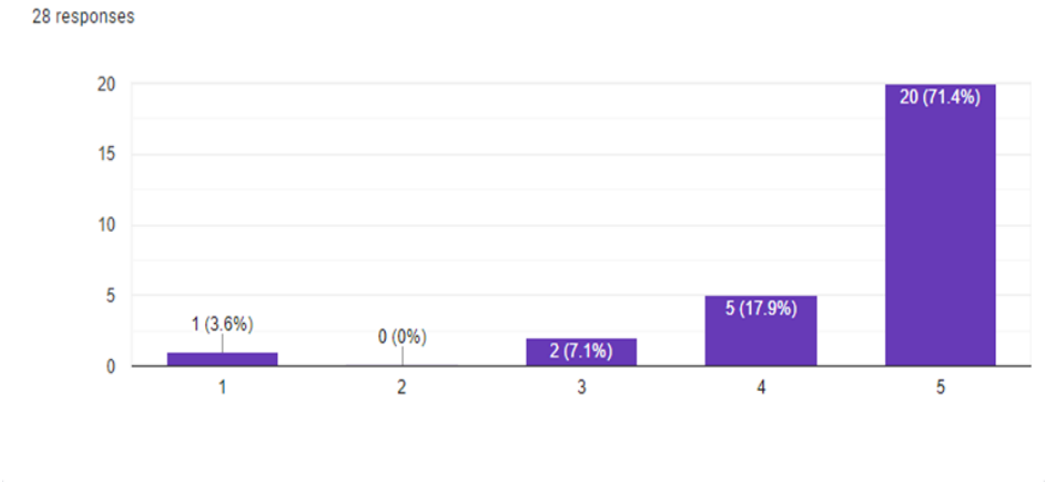

Figure 12: Data analytics can improve supply chain responsiveness to market changes

Considering the figure 12 above, it can be observed that 71.4% respondents totally agree to the fact that data analytics can improve supply chain responsiveness to market changes as an opportunity for the organization. It was also discovered that 17.9% partially agree to the statement while 3.6% totally disagree. In addition, the study reveal that, 7.1% of the respondents neither agree or this agree to the statement and indicated neutral. It is very clear for one to conclude that, data analytics can improve supply chain responsiveness to market changes in the organization.

- The role of data analytics in identifying and capitalizing on cost-saving opportunities in the supply chain management.

Respondents were asked about how important the role of data analytics is, in identifying and capitalizing on cost-saving opportunities in the supply chain management using the liket scale 1-5, (1=not important; 2=Somehow important; 3=Neutral; 4=important and 5=very important). The out is represented on the figure 13 below;

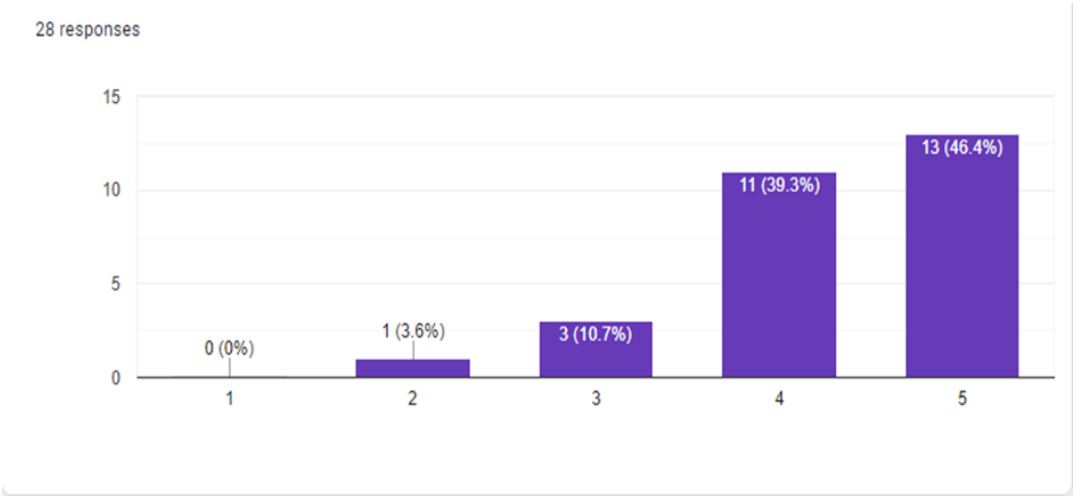

Figure 13: Identifying and capitalizing on cost-saving opportunities

It was discovered that the majority of the respondents, representing 46.4% and 39.3%, saw the role of data analytics in identifying and capitalizing on cost-saving opportunities in supply chain management as very important. Meanwhile, 3.6% think it is somehow important. The neutral group, which did not see it as important or not, recorded 10.7%. This result means that the role of data analytics in identifying and capitalizing on cost-saving opportunities in supply chain management is very important.

- The potential of data analytics in optimizing fleet management

The last question under this objective was to find out from respondents how they would rate the potential of data analytics in optimizing fleet management using a scale of 1-5 (1= very

low; 2=low; 3=Neutral; 4=high and 5=very high). Fleet management is an aspect of supply chain management that needs a good attention in order for the organization to maximize profit. The results is illustrated on the figure 14 below;

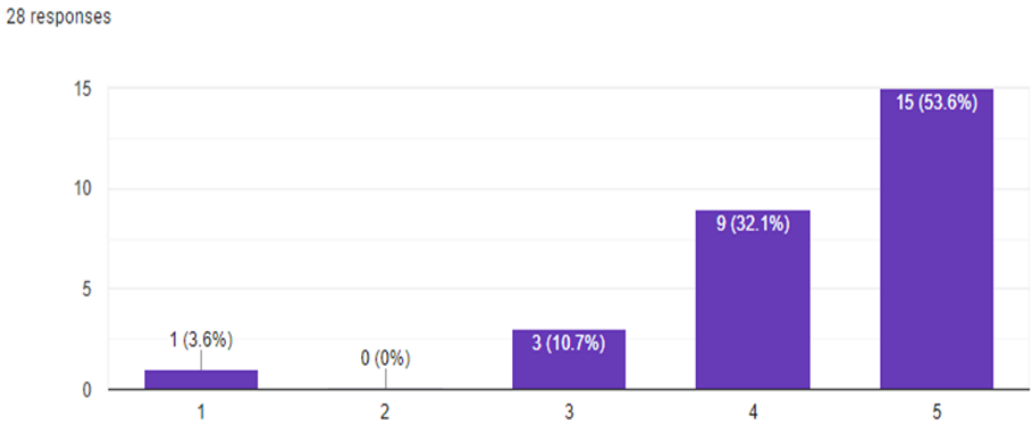

Figure 14: The potential of data analytics in optimizing fleet management

Considering the findings, 53.6% and 32.1% rated the potential of data analytics in optimizing fleet management in the organization as very high and high respectively. Only 3.6% and 10.7% rated the statement as very low and neutral. There is therefore a clear indication that, the potential of data analytics in optimizing fleet management is very significant as far as the daily operation of the organization is concern.

4.1.4 Impact of the challenges of data analytics in Supply Chain Management

The last objective of the study was to determine the impact of the challenges of data analytics in Supply Chain Management on organizational performance. The IBM's Statistical Software Package for Social Sciences (SPSS) version 28 was employed to determine the correlation between the challenges and the organization’s performance. This as a result showed the connection or the relationship between the two variables. The results is illustrated on the figure 15 below;

Correlations

		data privacy and security concerns	managing and integrating data	talent and skill gaps	ensuring data accuracy and reliability	Company Performance
data privacy and security concerns	Pearson Correlation	1	.928*	.938*	.925*	.528
	Sig. (2-tailed)		.023	.018	.024	.360
	N	5	5	5	5	5
managing and integrating data	Pearson Correlation	.928*	1	.746	.912*	.372
	Sig. (2-tailed)	.023		.148	.031	.538
	N	5	5	5	5	5
talent and skill gaps	Pearson Correlation	.938*	.746	1	.845	.591
	Sig. (2-tailed)	.018	.148		.071	.294
	N	5	5	5	5	5
ensuring data accuracy and reliability	Pearson Correlation	.925*	.912*	.845	1	.263
	Sig. (2-tailed)	.024	.031	.071		.669
	N	5	5	5	5	5
Company Performance	Pearson Correlation	.528	.372	.591	.263	1
	Sig. (2-tailed)	.360	.538	.294	.669	
	N	5	5	5	5	5

*. Correlation is significant at the 0.05 level (2-tailed).

Figure 15: Correlation analysis of the impact of the challenges.

Figure 15 above shows the Pearson correlation coefficients and their p-values (significant levels) for the relationships between variables: the company performance (dependent variable) and Data privacy and security concerns, managing and integrating data, talent and skill gaps, ensuring data accuracy and reliability being the challenges identified (independent variables). The Pearson correlation coefficient (r) is utilized to ascertain the direction and strength of the linear relationship between the independent and dependent variables. Values range from -1 to 1. When a value is closer to 1 or -1, it signifies a stronger relationship. A value closer to 0 also signifies a weaker relationship. When the value is positive, there is a positive relationship, and a negative value also means a negative one.

Sig. (2-tailed): Please take note of the following text: "The p-value indicates the significance of the correlation." in Figure 15 above.

It's important to note the significance of the p-value: when $p < 0.05$, it indicates that the correlation is statistically significant at the 5% significance level. This threshold is crucial in determining the strength and reliability of the correlation, as it provides a clear indication of the statistical significance of the findings.

$p >= 0.05$, implying that the correlation is not statistically significant.

Key Findings: The Company Performance was found to have a moderate positive correlation with all the independent variables identified in the study's literature. However, none of these correlations were found to be statistically significant, as they all exceeded the 0.05 or 5% significance level. The specific values discovered from the analysis were: Data privacy and security concerns ($r = 0.528$, $p = 0.360$), Managing and integrating data ($r = 0.372$, $p = 0.538$), Talent and skill gaps ($r = 0.591$, $p = 0.294$), Ensuring data accuracy and reliability ($r = 0.263$, $p = 0.669$).

Overall Findings: The study found strong positive correlations among the identified challenges (data privacy and security concerns, managing and integrating data, talent and skill gaps, and ensuring data accuracy and reliability). These correlations were statistically significant at the 0.05 level. However, the correlations between these challenges and company performance, while moderate and positive, were not statistically significant. This suggests a potential positive relationship, but the evidence is not strong enough to confirm this statistically with the given sample size.

4.2 Interview results

This study encompassed a diverse group of twenty-eight (28) respondents, aged between 30 and 51, with an average age of 28. This group were made of males and females and represented a variety of roles within the company, with a significant presence from the supply chain, data analyst, and marketing departments. The majority of respondents held first and second degrees, indicating a strong educational background among the participants.

Analyzing the challenges in integrating data analytics tools into existing supply chain systems revealed several key areas of concern. These included the implementation of the tools, data compatibility, and inconsistency. Respondents also highlighted the conservative nature of management and the supply chain department, incomplete data, lack of training, and high costs as significant hurdles. These findings provide a clear picture of the obstacles that need to be overcome for successful integration.

In addition to the challenges, a fast-changing market, lack of logistics, cost, and resources, data quality issues, selecting the right tools, accuracy, multiple supply chain entities and diversification of tools, unwillingness to give out personal information, communication barriers, loss of data, poor coordination, Cost and ROI, Vendor selection and management were seen as obstacles to data integration into supply chain management.

The study also uncovered a range of opportunities that data analytics can offer for demand forecasting accuracy in supply chain management. These opportunities include the effective forecasting and reporting of supply chain activities, the ability to negotiate better contracts with suppliers, and the potential to reduce costs and improve margins. Respondents also highlighted the benefits of accurate and precise stock inventory and the reduction in overstocking of particular products. These findings highlight the potential of data analytics to drive significant enhancements in supply chain management.

Data analysis provides a competitive advantage for the organization in the market by focusing on the threads from past business transactions with internal and external dealings. Collaborative forecasting, real-time data integration, inventory management optimization,

better planning, and supply management lead to more informed decision-making and optimized operations, and increased profits were the other opportunities mentioned.

The study also discovered another set of opportunities during the interview: it helps to forecast well, improves risk management/customer segmentation, provides accurate supply predictions, and improves fleet management. It is pivotal for business sustainability, innovation, and advancement. Data analysis enables adjustment to sudden market changes, such as unexpected shifts in supply chain disruption, provides access to related information, identifies reorder levels, and provides clearer market information.

Finally, respondents were asked to indicate the primary data sources used in the organization's supply chain management efforts. The study revealed that enterprise resource planning (ERP), data from experts, observation and online surveys, and vehicle register ordering were the organization's primary data sources.

5 Conclusion

5.1 Survey

The study aimed at exploring the challenges of data analytics in Supply Chain Management with a case study of Novago Co Ghana Limited. After the analysis conducted, it is established that, data privacy and security concerns pose challenges to effective data analytics in the supply chain. It was also concluded that managing and integrating data from diverse sources in supply chain functions is a challenge to the organization as well. The study again concluded that, talent and skill gaps for implementing data analytics, ensuring data accuracy and reliability in supply chain function in the organization are challenges they are confronted with.

It also convincing to conclude that, data analytics can enhance visibility and improve the supply chain responsiveness to market changes within the organization. Again, the role of data analytics in identifying and capitalizing on cost-saving opportunities in the supply chain management is very important. The potential of data analytics in optimizing fleet management is very significant as far as the daily operation of the organization is concern.

Finally, there are strong positive correlations among the challenges (data privacy and security concerns, managing and integrating data, talent and skill gaps, ensuring data accuracy and reliability), and these correlations are statistically significant at the 0.05 level. Meanwhile, the correlations between these challenges and company performance are moderate and positive but not statistically significant, indicating that while there may be a positive relationship, the evidence is not strong enough to confirm this statistically with the given sample size.

5.2 Interview

In a nut shell, the semi-structured interview provided very important insight into the challenges and opportunities of data analytics in Supply Chain Management within the organization. Implementation of the data analytics tools, inefficiency, data compatibility, inconsistency were the other challenges established in this study. It is also established that the primary sources of data used in the organization's supply chain management efforts were enterprise resource planning (ERP), data by experts, observation and online survey and ordering of vehicle register.

5.3 Recommendation

The following recommendations are made to address the challenges and leverage the opportunities of data analytics in Supply Chain Management at Novago Co Ghana Limited based on the findings of the study:

- Investing in advanced security solutions, such as firewalls, intrusion detection systems, and robust techniques, is crucial for safeguarding sensitive supply chain data and ensuring its integrity.
- Regular security audits and vulnerability assessments are crucial for identifying and mitigating potential threats.
- The organization's management must continuously train employees on data security practices and safeguarding sensitive information.
- Advanced analytics tools that can manage large data sets and offer real-time insights to enhance decision-making should be used.
- The management can also collaborate with Educational Institutions to create specialized courses and internships focused on data analytics in supply chain management.
- Management can use data analytics to optimize fleet management, reduce fuel consumption, and improve route planning.

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Figures

Appendices

Appendix 1: Interview Questions

Interview questions

Knowing the interviewee

- What is your age range?
- What is your level of education
- How long have you been working with your organization?
- What is your position in the organization?

General Manager

Marketing Officer

Data Analyst

Supply Chain Officer

Other (please specify)

Challenges of Data Analytics in Supply Chain Management:

- Can you provide specific examples or experiences where data privacy and security were significant issues?
- Are there specific training programs or hiring practices in place to bridge these gaps?
- Can you provide examples of any additional challenges not previously mentioned?

Opportunities of Data Analytics in Supply Chain Management:

- How has data analytics improved visibility in your supply chain operations?
- Can you share any success stories where data analytics led to significant cost savings?
- What impact has data analytics had on your fleet management practices?
- What other opportunities do you think data analytics offers for demand forecasting accuracy in supply chain management?

Impact of Challenges and Opportunities of Data Analysis in Supply Chain Management:

- What impact do challenges in data analytics have on the company's decision-making processes in supply chain management? Positive impact, Neutral, Negative impact
- How do you perceive the impact of successful implementation of data analytics on overall supply chain management performance?

- Can you discuss specific improvements in performance due to successful data analytics implementation?
- What are the primary sources of data used in your organization's supply chain management efforts?
- How do you collect and utilize this data to improve supply chain processes?

Appendix 2: Survey with answers

Laurea University of Applied Science - Finland

This questionnaire addresses the theme, "**Exploring the challenges of employing data analytics within Supply Chain Management.**" Participants can confidently expect the confidentiality and anonymity of their responses. It is emphasized that the information gathered will be utilized exclusively for academic purposes.

Gender *

- Male
- Female
- Prefer not to say

Age *

- 30 and less
- 31-35
- 36-40
- 41-45
- 46-50
- 51 and over

Educational level *

- High School
- First Degree
- Post graduate degree
- Doctorate.

Work experience *

- Less than 1 year
- 2-5 years
- 6-10 years
- More than 10 years

What is your position in the organization? *

- General manager
- Marketing Officer
- Data Analyst
- Supply Chain Officer
- Other...

Using a scale of 1-5{1=totally disagree; 2=partially disagree; 3=Neutral; 4= Partially Agree and 5= Totally Agree. *

To what extent do you think data privacy and security concerns pose challenges to effective data analytics in the supply chain?

1	2	3	4	5
○	○	○	○	○

Using a scale of 1-5{1=totally disagree; 2=partially disagree; 3=Neutral; 4= Partially Agree and 5= Totally Agree. *

To what extent do you agree that managing and integrating data from diverse sources in the supply chain is a challenge to the organization?

1 2 3 4 5

Using a scale of 1-5{1=totally disagree; 2=partially disagree; 3=Neutral; 4= Partially Agree and 5= Totally Agree. *

To what extent do you anticipate that talent and skill gaps for implementing data analytics in supply chain functions is a challenge to the organization?

1 2 3 4 5

*

How would you rate the difficulty of ensuring data accuracy and reliability in supply chain analytics? Using a scale of 1-5.

1= very low; 2=low; 3=Neutral; 4=high and 5=very high.

1 2 3 4 5

Using a scale of 1-5 {1=totally disagree; 2=partially disagree; 3=Neutral; 4= Partially Agree and 5= Totally Agree. *

To what extent do you agree that data analytics can enhance visibility in the supply chain management?

1 2 3 4 5

Using a scale of 1-5 {1=totally disagree; 2=partially disagree; 3=Neutral; 4= Partially Agree and 5= Totally Agree. *

To what extent do you agree that data analytics can improve supply chain responsiveness to market changes?

1 2 3 4 5

Using the scale 1-5, {1=not important; 2=Somehow important; 3=Neutral; 4=important and 5=very important. *

How important is the role of data analytics in identifying and capitalizing on cost-saving opportunities in the supply chain management?

1 2 3 4 5

Using a scale of 1-5{1= very low; 2=low; 3=Neutral; 4=high and 5=very high. *

How would you rate the potential of data analytics in optimizing fleet management?

1 2 3 4 5

https://docs.google.com/forms/d/1yBDKWOflPKU1e37CQWmwkVqagIs9x1oi6msUYiQtpdM