

Factors Affecting Supply Chain Agility in Public Institutions and Healthcare Performance: A Case of Nimba County, Liberia

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ABSTRACT

In today's dynamic and uncertain business environment, the ability of public institutions and healthcare systems to respond swiftly to changes while maintaining high-performance standards is of paramount importance. This study delves into the intricate relationship between supply chain agility and healthcare performance within the context of (Public Hospitals) Nimba County, Liberia. The aim of this study is to identify and analyze the key factors that influence supply chain agility and subsequently impact healthcare service delivery and overall performance in public hospitals in Nimba County, Liberia. Drawing on a comprehensive review of existing literature, this research synthesizes the multifaceted determinants that shape supply chain agility in the unique setting of public institutions (Hospitals) and healthcare preference in Nimba County, Liberia. The regression model with the independent variables (Inventory control, Procurement, Information Technology and Warehouse management) showed a strong positive correlation with the dependent variable. These predictors explained about 60.41% of the variance in the dependent variables, with addition of these predictors have significantly improved the model's performance, as indicated by the low p-value (0.000) for the F Change statistic. The research recommends the management of the public hospitals in Nimba County and Liberia at large, to enhance its implementation to realize its impact at higher levels. Among these practices to put more emphasis on skills development, supportive supervision and performance review. In conclusion, this study offers a comprehensive analysis of the factors influencing supply chain agility in public institutions and their subsequent impact on healthcare performance in Nimba County, Liberia.

Keywords: Agile Supply Chain, Healthcare Performance, Procurement, Supply Chain Factor, Information Technology

CHAPTER ONE

GENERAL INTRODUCTION

1.0 Introduction

This chapter discusses the background of the study, statement of the problem, objective of the study, general objective, specific objective, research hypotheses, scope of the study, domain scope, geographical scope, time scope, significance of the study, significance to other researcher, social significance and academic significance.

1.1 Background of the study

Due to globalization, there has been increased competition, scarcity of resource, need for efficiency and effectiveness, increased demand for environmental protection and changes in customer's preferences and tastes (Muller et al., 2009). This has posed a lot of challenges to organizations and they are trying to come up with ways of averting these milestones. Sustainability has a vital part in ensuring that the integrity of any given brand is maintained while being able to manage the agility of supply chain of an entity to ensure that there is continuity as observed by Muller et al. (2009). Thus, design of materials to be procured and procurement of materials should be in a way that it's sustainable and can help achieve supply chain agility of an organization. Thus, design of materials to be procured and procurement of materials should be in a way that it's sustainable and can help achieve supply chain agility of an organization. Sustainability concept has become relevant in public procurement as entities respond to external and internal pressures (Nair & Chisoro, 2015). Babiak and Trendafilova (2011) opine that pollution of water and air, global warming and ozone layer and deficiencies of resource are as a result of environmental degradation which has increased attention on sustainability all over the world. Porter and Van der Linde (1995) posit that sustainable procurement plays an important part in ensuring that an entity avoids cost of litigations, increases demand for the product and lead to service delivery.

To gain a competitive advantage in a changing business environment, companies should align with suppliers and customers, as well as their institutions, and collaborate for an acceptable level of agility (Chen, 2019). As a result, an agile supply chain is formed. An agile supply chain can respond to workplace changes in a timely and effective manner (Aslam et al., 2020). Agility is defined as the ability to detect and respond to market dynamics quickly (Gligor et al., 2020). As a result, Aslam et al. (2020) define agility as an organization's ability to respond quickly to changes in demand, both in terms of volume and variety, and it is all about customer responsiveness, market turbulence, and the need for specific capabilities. Dubey et al. (2021)

redefined agility as the ability of an organization to evolve products and services quickly and economically in response to customers' dynamic demands, and they have focused on increasing velocity and flexibility in the supply chain to reduce waste and avoid customer dissatisfaction. They also proposed agility performance measures such as product quality, product innovation, and process innovation, all of which are geared toward flexibility and reduced lead times.

Regionally, research carried out by Som, et al. (2019) in Ghana established that integrating information and operations systems in supply chain improved SCP. On the other hand, relationship integration decreased the logistics performance especially if there was lack of commitment and trust. Another study carried out in Guateng Province of South Africa had consistent findings (Mofokeng & Chimona, 2019). SCI showed a major influence on Small and Medium Enterprise's (SME) Supply Chain Performance while both supply chain partnerships and collaborations had little influence on the SCP. This study was limited to SMEs in Ghana. In East Africa, Tanzania integrated Logistics Management Information Systems and Inventory Management Systems in Supply Chain which has contributed to smooth reporting, ordering and distribution processes, improved workforce productivity as well as supply chain data visibility for better planning (USAID, 2016). The net effect is a well-functioning supply chain which responds timely to the needs of the patients. As a result, an agile supply chain necessitates a variety of distinguishing

characteristics. These capabilities are comprised of four major components (Aslam et al, 2018). Dubey et al. (2019) responsiveness, defined as the ability to detect and respond to changes quickly, reactively, or proactively, as well as recover from them; Efficiency is the ability to realize organizational objectives and utilize a firm's resources in an efficient and effective manner; flexibility is the ability to implement different processes and apply different facilities to achieve the same goals; and quickness is the ability to complete an activity as quickly as possible. The study thus adopted factoring affecting supply chain agility in public institutions and healthcare performance.

Liberia supply chain agility of public health system management activities are carried out by three departments of Ministry of Health (MOH) and those include Pharmacy division, National drug service and Supply chain Management unit (SCMU). The Pharmacy Division provides overall oversight for activities carried out by supply chain actors, pharmaceutical service delivery, including the delivery of essential medicines and other health products at the health facility level, the supply chain of medicine and other health products final destination comes to dispensers and pharmacies. Supply chain agility in public health systems have been stranded which resulted into low performance of the public health system and healthcare to reach the best medical services to the patients of which include medicine, healthy equipment, vaccines and other associated medical essentials for life, nevertheless the poor road networks and corruption affect and hindered the supply chain agility, poor public health system supply chain agility continued in Liberia and public system of healthcare system were distorted and the affected health stems and increased the mortality death of patients due to un proper and poor purchasing and distribution of medicine and health equipment. Poor road networks where over 75% of roads in Liberia are either unpaved or path most of the unpaved roads become inaccessible to vehicle during the rainy season. As a result, people use motorbikes or walk long distances to reach their destinations including schools, and health facilities and corruption are also major problems that cause delays in distribution patterns where corruption in health bring inequality with the poor people and other marginalized groups being hit the hardest situation which have the big negative impact in the healthcare performance in Liberia.

In Liberia, Agility has been an issue; the Health systems and healthcare are lagging behind due to lack of supply chain trained professionals, Government free health services policy has affected supply chain agility in Liberia, improper management and timing, however, this backslide the efficiency and effectiveness service received by patients at the healthcare levels. Agility is defined as the ability to detect and respond to market dynamics quickly (Gligor et al, 2020).

The Government of Liberia under the constraints of Public health systems and Health care performances experiences has pushed the Researcher carry out research on factors affecting supply chain agility in public institutions and healthcare performance, in order to design recommendation wherever there will be a need of improvement in as far as the public health systems and healthcare performance for betterment of the people of Liberia.

1.2 Statement of the Problem

Supply chain agility plays a critical role in the efficient functioning of public institutions and healthcare systems, predominantly in resource-constrained settings like Liberia. In recent years, Liberia's healthcare sector has faced challenges related to timely access to medical supplies, equipment, and services due to various disruptions in the supply chain. These disruptions can have adverse effects on the overall healthcare

performance and, consequently, the well-being of the population. Tolf et al. (2015) found that agile supply chain in healthcare can be a promising strategy towards helping the healthcare organization to improve their ability to adopt the unchanging environment, however agile supply chain practices in healthcare is very limited due to the absence of knowledge concerning supply chain in healthcare organizations. Despite of the importance of agile supply chain practices in health care like fast delivery of service, flexibility in meeting changing of demand, time management, cost minimization and profit achievements still agile supply chain practices lagging behind in healthcare organization (Arronson *et al.*, 2011). The Most key challenge inhibiting the operations is ineffective coordination and management between Ministry of health and donors in terms of procurement, storage and distribution of essential medicines and supplies. These ineffectiveness leads to the out stock of supply at the facility, expiration and subsequent destruction of essential medicines and the supply chain functions, unpredictability assistance, fragmentation activities and high transaction costs for Government of Liberia. Finance and procurement procedures delay disbursement of funds which significantly affects the effective implementation of critical functions such as distribution of essential medicines causing stockouts at health facility level, ineffective supervision and monitoring of supply chain activities. The Researcher has pointed out the critical issue to address the problem of Poor road connectivity, corruption, stock out of life saving drugs, poor inventory control, ineffective warehouse management system, inefficient ambulance services, government free public health service and ineffective procurement. Despite the importance of agile supply chain practices in health care like fast delivery of service, flexibility in meeting changing of demand, time management, cost minimization and profit achievements still agile supply chain practices lagging behind in healthcare organization (Aronsson et al, 2011).

1.3 General Objectives

The main objective of this study was focused on factors affecting supply chain agility in public institutions and healthcare performance of Nimba County, Liberia.

1.3.1 Specific Objectives

1. To assess inventory control effect on the supply chain agility in public institutions and healthcare performance in Nimba County, Liberia
2. To determine effect of procurement management on supply chain agility in public institutions and the healthcare performance in Nimba County, Liberia
3. To examine Information technology effect on supply chain agility in public institutions and healthcare performance in Nimba County, Liberia
4. What is the effect of warehouse management on supply chain agility in public institutions and healthcare performance in Nimba County, Liberia

1.4 Research hypotheses

1. H01: There is no significant effect of inventory control on healthcare performance in Nimba County.
2. H02: The procurement has no significant effect on healthcare performance in Nimba County.
3. H03: There is no significant influence of information technology on healthcare performance in Nimba County.
4. H04: Warehouse management has no significant effect on healthcare performance in Nimba County.

1.5 Scope of the Study

This study was carried out in Liberia at Nimba County and focused on the Factors affecting supply chain agility in public institutions and healthcare performance, the scope of this study covered public hospitals in Nimba County, Liberia

1.6 Domain Scope

This study was focused on factors affecting supply chain agility in public institutions and healthcare performance of Nimba County, Liberia, Independent variables (Inventory control, Procurement, Information Technology and Warehouse management) and the Dependent Variable: Healthcare performance (Reliability, Responsiveness, Efficiency and Timeliness are major indicators of the study).

The findings, conclusions and recommendations from this research covered the country in general and public hospitals of Nimba and other similar cases.

1.6.1 Geographical Scope

The research was conducted in five public institutions (hospitals), in Nimba County, which are all government institution operating in Nimba County, Liberia. These institutions was chosen because these are leading public institutions (Hospitals) in Nimba County, Liberia

1.6.2 Time Scope

The time scope of this research titled the factors affecting supply chain agility in public institutions and healthcare performance: case of Nimba County covered a period from 2020 to 2022

1.7 Significance of the Study

Increasing efforts, both from state and non-state actors are being made to establish agility supply chain processes that are robust enough and responsive to changes in the public hospital landscape. Therefore, given that a lot still needs to be done in regard to achievement of Universal Health Coverage (UHC), the results of this research is beneficial to the stakeholders involved. Non- Governmental Organizations (NGOs) involved in strengthening healthcare systems in developing economies may find the findings useful in unearthing important areas that require focus in regard to factors affecting supply chain agility in public institutions and healthcare performance, in Nimba County, Liberia.

In addition, findings of this research are relevant to policy developers among them are: Ministry of Health (MOH), Central Medicine Store (CMS), Supply chain Management Unit (SCM) and other related health organizations in providing information on supply chain agility in public institutions and healthcare performance. It would also assist in formulating public health strategies, policies, and guidelines on health commodities supply chain systems by the authorities to ensure healthcare agility.

The findings are also significant to health-related professions such as Logisticians, Hospitals Administrator, Health Products and Technologies Managers through agility in public institutions and health supply chain partners. Moreover, the results of this research which has contributed to the current literature and expertise on the supply network systems. The study would act as a basis from which other similar research could be anchored. Lastly, it is wished that this document would become a resource to all scholars

and interested researchers on the topic.

1.7.1 Significance to the Researcher

This Research was carried out, the Data collection involved theoretical framework skills, it produces quality product as the researcher excavates enormous skills and Researcher gain more knowledge on Factors affecting supply chain agility in public institutions and healthcare performance: A case of Nimba county, however the Researcher acquired advanced higher qualification award as this research is part of the completion of Master's Degree program.

1.7.2 Social Significance

social significant depended on the findings when it was displayed, it was paramount to social welfare as the study was deeply on supply chain agility in public health system of Liberia and healthcare performance, recommendation was done to improve health sector which was for every Liberian interested and again, the Healthcare leaders are benefiting the project findings for tracking records in respect to intended public health systems and healthcare of Liberians amelioration.

1.7.3 Significance to Other Researchers

Other Researchers regardless they do their own research; this research document should be consulted by other future researchers to discover research gaps as treasured intellectual property. Because research never ends, not only the young generation researcher's even senior researchers will consult the research document for their journal publications.

1.7.4 Academic Significance

Researcher acquired high academic qualification at University of Kigali and be among UoK wish to become a pole of radiance and excellence nationally and internationally with its quality education, research and provision of innovative services to the community.

CHAPTER TWO LITERATURE REVIEW

2.0 Introduction

This chapter discusses, theoretic literature review, the value chain theory, network perspective theory, constraints theory, the factors affecting supply chain activities in Liberia, procurement of pharmaceuticals, inventory control, distribution system, empirical literature review, conceptual framework of the study and research gap of the study.

2.1 Theoretic Literature Review

Several models were established, formulated and designated to know how supply chain agility can improve supply chain in public health system and healthcare to delivery to the final customers as stipulated research study focuses on Factors affecting supply chain agility concept as Supply chain agility may be fixed the persistence of a firm (Vastag et al, 2018). Supply chain agility is the capability of the supply chain to respond quickly and effectively to market changes (Lee, 2004). Scholars have defined supply chain agility as the ability of the firm to adjust tactics and operations within its supply chain to respond to environmental changes, opportunities, and threats (Gligor & Holcomb, 2014). There is literature discussing flexibility as a construct with dimensions including adaptability, alignment and agility (Stevenson & Spring, 2009) but

this has not discussed the combined properties of agility.

2.1.1 The Value Chain Theory

The term 'Value Chain' was used by Michael Porter (1985) in his book *Competitive Advantage: Creating and Sustaining Superior Performance*. The value chain analysis describes the activities the organization performs and links them to the organizations competitive position. With is regard, the healthcare performance always need improvement while valuing the professionalism, therefore, Supply chain agility and healthcare performancerequire competitive advantage to their rivals in purchasing of medicines and other associatedmedical equipment in doing so, patients gain lives as the health facilities well equipped with medicines and equipment through supply chain agility chain as well as achieving them.

Value chain analysis describes the activities within and around an organization and relates them to an analysis of the competitive strength of the organization. Therefore, it evaluates which value each particular activity adds to the organization's products or services. This ideawas built upon the insight that an organization is more than a random compilation of machinery, equipment, people and money. Only if these things are arranged into systems andsystematic activates it will become possible to produce something for which customers are willing to pay a price. Porter argues that the ability to perform particular activities and to manage the linkages between these activities is a source of competitive advantage.

Porter distinguishes between primary activities and support activities. Primary activities are directly concerned with the creation or delivery of a product or service. They can be groupedinto five main areas: inbound logistics, operations, outbound logistics, marketing and sales, and service. Each of these primary activities is linked to support activities which help to improve their effectiveness or efficiency. There are four main areas of support activities: procurement, technology development (including R&D), human resource management, and infrastructure (systems for planning, finance, quality, information management etc.). The flowof information, goods and services, as well as systems ad justifying activity where the marketing & Sales information result into the expected functions in line with procurement necessary material for updated procurement as well as logistics is concerned then cooperationand information flow between the value chain activities which if not properly handled affectsupply chain agility (Lee, 2004).

2.1.2 Network perspective Theory

The firm performance not only depend on efficiencies possess direct partner cooperate with consumers however the inter business cooperation Network perspective theory can be appliedto deliver a basis for the conceptual analysis of reciprocity (Agostini & Nosella, 2019), in cooperative relationships. The firm's constant interaction with other players becomes an important factor in the development of new resources (Haakansson & Ford, 2002). Relationships combine the resources of two organizations to achieve more advantages than through individual efforts. Such a combination can be viewed as a quasi-organization (Haakansson et al, 2018). The resource valuation is built on its technique with other resources,that is inter-business ties may important than resources possession. The structured resources govern the structure of the supply chain agility as motivational icon. The network theory paysprofoundly to an indulgent of the dynamics of inter business relations. A network does not pursue an optimum balance, however a continuous state of movement and change. Acquaintances between firms in a network develop through

two separates, but closely connected, kinds of interface: exchange processes and adaptation processes. Network theory is descriptive in nature and has primarily been applied in SCM to plot activities, actors, and resources in supply chain agility. The developing long-term, trust-based relationships between the supply chain agility actors. Network theory performance will prove an important significance customer role in this dynamic business environment and more so in supply chain agility. Beside this inter-relationship it would complicate the compliance and adoption of supply chain agility factor in the sphere of network.

2.1.3 Constraints Theory

This theory is founded by Eliyahuin in 1987. The theory of constraints explains the ways to solve the problems or challenges faced by logistics Company, the problems can be categorized in resources constraint, marketing constraints, policy constraints and dummy constraints. The management has to work with these problems very closely so as to achieve its long-term objectives by very little number of constraints. It is difficult to work without any constraint so, there is constantly at slightest one constraint, the theory utilizes a concentrating procedure to categorize the limitation and reorganize organization to comply with changing environment. Restraints can be interior or exterior to the handling system. An interior constraint is when customer demands their cargo more rapid while the handling system lacks capacity to handle to deliver to the customers (Kathurimaet, 2016).

The theory used to discuss the effects of constraints on material handling performance efficiency of the firm. If a firm lacks skilled and experienced personnel, machines break up or shortage of handling equipment could experience inefficient material handling activities that lead to the poor operating performance of the firm. This would result in long working hours and the number of cargos to be handled increased, therefore the firm has to assess the constraints that would hinder the handling activities performance and keep it into consideration for the sustainable competitive advantage of the firm.

2.2 Healthcare Performance

Mahapatro (2009) defined performance as the ease with which an organization is able to achieve its desired objectives. Performance in organizations may take many forms depending on the purpose of the measurement. Different stakeholders usually require different performance indicators to enable them make accurate decisions (Manyuru, 2005). For this research, healthcare performance is ability of healthcare to meet the three specific outcomes; financial performance, product and market performance and customer satisfaction. The performance of a supply chain is geared by both internal and external factors of the organization. SCM measures can be classified broadly into two categories qualitative measures such as customer satisfaction and product quality; and quantitative measures such as order-to-order lead time, response time, flexibility, resource utilization and delivery performance.

2.3 The factors affecting supply chain activities in Liberia

The public health supply chain in Liberia Deals with medicine and other health products and equipment through Ministry of Health (MOH) together its affiliated agencies which include Pharmacy division, National drug service (Ministry of Health, 2010) and Supply chain Management unit (SCMU). The Pharmacy Division provides overall oversight for activities carried out by supply chain actors, pharmaceutical service delivery, including the delivery of essential medicines and other health products at the health facility level. It is also in charge of developing policies and tools as well as managing training

programs for dispensers and pharmacists to drive the supply chain agility. (Mentzer, 2001) defines supply chain (SC) as the set of three or more entities either directly or indirectly involved in the upstream and downstream flows of products, services, finances and information from the source to a customer. The vision of the supply chain as a holistic construct with close cooperation between the different organizational units has replaced the traditional picture of it as a collection of vertically organized functional units (Stadtler & Kilger, 2005). The factors affecting supply chain agility in public health systems in Liberia against performance of healthcare in Nimba County.

2.3.1 Procurement of Pharmaceuticals

Procurement processes for essential medicines and health products are mostly donor-driven and based on SCMU's quantification and supply planning in Liberia. At the county level, parts for procurement of essential medicines is received from Ministry of health (MOH) and procurement processes initiated when internal requisition processes are triggered by departments. In Liberia, the loopholes had been encountered where there is lack of procurement planning for drugs and medical equipment, particularly at the county level. County health teams and hospitals do not submit a procurement plan to Ministry of health. There is no consolidated budget; operational challenges include inadequate transport facilities as National Drug Service (USAID, 2014) currently has only eight trucks. Consequently, it relies on funds from partners for procurement of vehicles to supplement its existing fleet this stipulates medical procurement by donors and Government of Liberia should be fully harmonized. However, only 60 percent is currently harmonized. This means that Ministry of health is not aware of all the drugs and medical equipment donors are bringing into the country resulting in duplication and misalignment as these donors are not following the National Drug Service procurement plan (PPCC, 2022) **Procurement** is the process of obtaining goods, or works from external sources, often through purchasing or contracting, to fulfill the needs of an organization. It involves stages such as identifying requirement, sourcing potential suppliers, negotiating terms and managing contract to ensure that the organization receives the desired products or services in timely and cost-effective manner. Chartered Institute of Procurement & Supply (CIPS). (2021)

Procurement in health sector complies with Ministry of Health procurement requirements to ensure procurement and health products regulatory requirements for public and private sectors are respected. Information about consumption and stock levels are crucial to plan procurement, order and distribution. Therefore, different approaches such as mobile technology. In general, up-to-date information is necessary, but the system needs to balance requirements and available resources.

2.3.2 Inventory control

National Drug service is an agency responsible for the storage and distribution of medicines, medical devices, equipment, reagents, and vaccines. In the countrywide, only seven warehouses are available which are mostly rented and supported by donor funds. The existing warehouse capacity looks after finished pharmaceutical products, excipients, reagents, medical devices, diagnostics, vaccines and biological items. There exist lacks of the capacity to store and distribute nutritional products due to their specific temperature requirements. Liberia has Infrastructural challenges due inadequate storage space to accommodate the delivery of shipment of essential medicines and supplies procured. Medicine needs to be stored in warehouses under appropriate conditions regarding security, temperature, conditions and storage area.

Inventory needs a correct inventory management to ensure adequate stock levels and strategies such as regular stock taking, inventory reconciliation, and first-expired-first-out. The objective of the study to recommend storage capacity and suitability of warehouses to maximum good storage practice with thermal standard include storage charges, handling, insurance premiums, pilferage, breakages, obsolescence and capital. Having the right amount of inventory to meet customer requirements is critical (Logistics Bureau, 2007)

. Dooley (2005) stated that most organizations resorted to inventory cutback strategies due to their desire to cut cost. Routine inventory activities will improve and support distribution planning, identification of at-risk items and reducing expiration of essential medicines where stocks for health facilities depots are maintained.

2.3.3 Distribution System

Supply chain Management unit (SCMU) of Ministry of health distributor supports distribution planning and implementation; there is no yet efficiency, also lack of available and timely submission of consumption data by the counties and hospitals in Liberia. Distribution of essential medicines and other health products is mostly donor-driven in the country, but channeled through the Office Finance Management (OFM) at the central Ministry of health (MOH). Distribution in Liberia still proves weak coordination between donor partners in distribution of essential medicines and supplies create an undue demand for fleet availability that is beyond the capacity to deliver. Challenges with fleet availability and MOH disbursement of funds for movement of essential medicines and health supplies from the central to the county level, significant delays of over one to two months are associated with each distribution activity in Liberia including fragmentation of distribution of essential medicines procured. Costing of an integrated distribution of essential donors to support an integrated approach and again Parallel distribution channels exist at the central level for vaccines and nutrition products due to the inability of National Drug Service to manage and distribute the commodities. Burton (2008) recognized three categories of distribution channels. The first one is Intensive, where items are readily available in various outlets. The second being selective where there are few intermediaries between producers and customers. The final category is exclusive distribution where there are very few or no intermediary.

2.4 Empirical Literature review

This empirical review is about comparison of previous study that are relevant to this topic on factors affecting supply chain agility in public institutions and healthcare performance as the motivation of the Researcher, the study conducted by Mathur et al. (2015) aimed to provide a conceptual framework showing the relationship between the components of supply chain management and healthcare performance for Indian healthcare industry.

(Rahimnia & Moghadasian, 2010) on the study of Supply chain agility in professional services: how to apply decoupling point concept in healthcare delivery system in Iran indicated that due to the agility being very important for the treatment process in healthcare supply chain operations because of the special condition of service offered by healthcare organization it required to be considered. Also, Rahimnia & Moghadasian (2010) found that, the less flexibility to cope with the uncertain environment/demand it requires the healthcare organization to apply agility in treatment process by making sure that all numbers of patients entering into the hospital get desired treatment through absorbing additional work to employee by

paying overtime in order to meet the demand.

Hakan (2011) indicate that, an observation from a case study of the one biggest hospital in Sweden shows that fifty percent of the patients admitted to the hospital arrived through the emergency department, which shows the necessity of the hospital to organize their operations in quick response, flexibility that is to be agile. Also, Hakan (2011) observed that the presence of large number of patients which exceed the planned capacity of the healthcare organization results into longer lead times and queues. The authors compare the principle of „produce to stock” as long queues and long waiting times for the patients. They suggest that in order to avoid the long lead times, the healthcare organization must work with flexible capacity and flexible lead-time as compared to the principle of “produce to customer order”. But this move towards requires the presence of high availability of extra personnel and other resources that are needed to perform the process and all activities in healthcare on time, independently and in the actual volume.

According to Macleod (1994) supply chain managers increasingly want to automate all of the supply chain, from forecasting to distribution, and to link every element of the chain. Use of Information Technology (IT) in supply chain management can be defined as the use of electronic equipment and devices especially computers and internet for processing, storing and transferring information across organizational boundaries (Subramani, 2004). Previous studies have shown that information technology is widely used locally and globally in managing effective supply chain functions in many organizations including healthcare industries (Lamming et al, 2001).

Professional workers in the health care sector, working with patients and the community must ensure a high standard of performance. Therefore, health organizations must recognize the value and role that healthcare professionals play globally. For health organizations to deliver a quality of healthcare service, it is important to acknowledge the performance of the workers. More research encouraged that health organizations must test the factors affecting (Awases et al, 2013). A quantitative study followed a non-experimental descriptive of the performance of professional workers, including doctors, nurses, and administrators to improve the quality of health care survey of a questionnaire used to support a study (Awases, Bezuidenhout, & Roos, 2013). The questionnaire comprised of open-ended and closed questions; and organized under thematic analysis, and a statistical analysis

Program SPSS to analyze the data of 770 professional nurses in Namibia, 180 randomly selected, and 147 successfully responded to the questionnaires. Based on participants’ responses, it is noted that most African countries are facing challenges of healthcare workers to improve productivity and performance (Awases et al, 2013). Thus, human resources selection for workers causes a major problem. To ensure an effective working environment, and to improve the performance of healthcare professionals, it is important to hire motivated individuals with the right knowledge and skills.

A study conducted in South Africa has proven that an organization’s strategic vision, mission, and desired organizational values should link to decision-making structures, systems, and processes (Mash et al., 2013). Culture plays a key role in a term of level of identity, and culture could have different meanings in different contexts. Organizations in all sectors need to recognize an organizational culture that enhances performance. The success of a firm lies in its organizational culture. Organizational culture has gained its

popularity in management, organizational behavior, and marketing literature (Hogan & Coote 2014). Schein (1992) referred to organizational culture as the norms, underlying assumptions, artifacts, expected behaviors, values, and beliefs that employees must follow, and organizational culture is powerful. Empirical evidence showed that organizational culture impacts employee behaviors, knowledge management, organizational strategy and structure, and organizational effectiveness that contribute to desired organizational outcomes (Hogan & Coote, 2014). Besides the attention given to organizational culture, extant literature does not provide detail on the characteristics of an organizational culture that supports innovation. Advancing the literature imposes an organizational culture that supports innovation (Hogan & Coote, 2014). Managers argued that organizational culture plays a role in a firm's management effectiveness and employee performance (Hogan & Coote, 2014). For a solid understanding of the key's organizational cultural characteristics, Schein (1992) organizational culture model provides a better understanding of the factors between the specific layers of organizational culture that motivate behaviors. Also, the organizational culture model makes it easy to test and manage the specific fundamentals of an organization's culture effectiveness that contribute to value creating outcomes.

According to Shah et al. (2002), much of the current theoretical/empirical research in Supply Chain Management focuses on only the upstream or downstream side of the supply chain, or certain aspects perspectives of supply chain. However, there are certain previous researchers which have devoted a great deal of attention to the relationship of supply chain management practices and certain aspects of overall organizational performance from different perspective/dimensions or overall supply chain. Some of these researches finding are discussed as follow: (Ronald & Salazar 2012) conducted a study The Effect of supply chain process on competitive advantage and organizational performance. This research conceptualizes and develops three dimensions of SCM practice (supplier relationship management, manufacturing flow management, and product development and commercialization) and tests the relationships between these supply chain practices and organizational performance. Data for the study will be collected from prominent organizations and the relationships proposed in the framework were tested using rigorous statistical techniques. The results indicate that higher levels of Supply chain agility practice can lead to enhanced and improved organizational.

Hakan (2011) indicate that, an observation from a case study of the one biggest hospital in Sweden shows that fifty percent of the patients admitted to the hospital arrived through the emergency department, which shows the necessity of the hospital to organize their operations in quick response, here the flexibility needs to be agile. Also, Hakan et al. (2011) observed that the presence of big number of patients that exceeds the planned capacity of the healthcare organization results into staying longer and spending times. They suggest that in order to avoid the long lead times, the healthcare organization must work with flexible capacity and flexible lead-time as compared to the principle of "produce to customer order". But this move towards requires the presence of high availability of extra personnel and other resources that are needed to perform the process and all activities in healthcare on time, independently and in the actual volume. Al-Saada (2013) on the study of supply chain management and its effect on healthcare service quality; Quantitative evidence from Jordian private hospital, the study tries to explain the existing difference between supply chain management and quality of health service due to some geographical variables which include (gender, age, education level, and years of experience in the field of supply. The study uses Quantitative design approach. This study uses both qualitative and Quantitate design and the aim is to analyze the agile supply chain practices towards performance of healthcare.

Performance of healthcare organization indicators this study uses one performance indicator of healthcare organization which are patient's satisfaction. This is supported by Pelone (2012) in their study they use average length of stay, inpatient raw mortality rate, bed turnover and patient's satisfaction as the performance indicators of the healthcare organization. Example in length of stay as performance indicator, Pelone (2012) said that healthcare organization can try their level best to collect information on how long patients stay in the hospital after certain procedures or in a certain department, and they suggest that hospital should do more investigation on possible causes if the patients stay in hospital is lengthy. Also Pelone (2012) found that patients satisfaction is a most appropriate indicator for performance of healthcare organization because patients if are satisfied with the treatment and all other services given in hospital they become loyal to the hospital and numbers of claims will be reduced due to the good performance of hospital. Also using patient's satisfaction as performance indicator in this study supported by Oche and Adam (2013) found that patient's satisfaction is necessary criteria to evaluate if the hospital is performing well or poorly in terms of treatment and other services offered by hospital.

A study on Supply chain performance measurement in the manufacturing industry conducted by ILKKA SILLANPÄÄ and Ilkka (2011). The main aim of this study is to create a supply chain measurement framework for manufacturing industry, define what data should be measured and verify the measurement framework in the case company's supply chain. This study presents the main theory framework of supply chain performance measurement. The key elements for the measurement framework were defined as time, profitability, order book analysis and managerial analysis. The measurement framework is tested by measuring case supply chain performance. The measurement framework is a valid framework for supply chain performance measurement in manufacturing industry. It is stated that supply chain performance measurement is extremely important in developing supply chain. The measurement framework in this study offers guidelines for measuring the supply chain in manufacturing industry but the measurement framework could be used in different areas of industry as well. Zhu and Kraemer (2002) conducted study on management of Supply chain the case of Denmark Manufacturing Company called Danfoss Heating District Business Area by viewing the supply chain as a strategic asset the study tried to highlight theoretical frameworks that improve supply chain performance especially in-service level and logistics cost. Supply Chain Management, Product Quality and Business Performance in case of Malaysian manufacturing companies conducted by Arawati (2011) and the study specifically investigates relationships between Supply chain agility Management, product quality and business performance and these associations are analyzed and the result demonstrates that SCM dimensions namely lean production, new technology and innovation, strategic supplier partnership and postponement concept, appear to be of primary importance and exhibit significant effects on product quality and business performance.

In this previous study, the author investigated importance capability of agility, sharing of information across the supply chain partners (Lamming, 2001). Barratt and Oke (2007) have illustrated the importance of establishing or breaking relationships between supply chain partners, obtaining a shared understanding and access to information that partners request without "loss, delay and distortion" (Hofstede, 2003), monitoring inventory (Petersen et al, 2005), and supply chain responsiveness (Williams et al, 2013). In author's investigation will be on information sharing. Fawcett et al. (2009) and Brandon et al., (2014) Supply chain agility is an organization ability to gather and share information through use of information

and communication technologies (ICTs), whereas (Zhu, K; Kraemer, K.L., 2002) have noted that an important tangible resource that facilitates information sharing, refers to IT infrastructure. Information sharing has to do with the “nature, agility, and quality of the information being conveyed” (Brandon et al, 2014). (Brandon-Jones, 2014) have utilized the study relationship between information sharing and supply chain resources to supply chain agility and performance in terms of supply chain resilience and strength. However, further on investigating the role of these resources for supply chain agility can be the most effectiveness in supply chain agility in public health system and healthcare.

2.5 Conceptual framework of the study

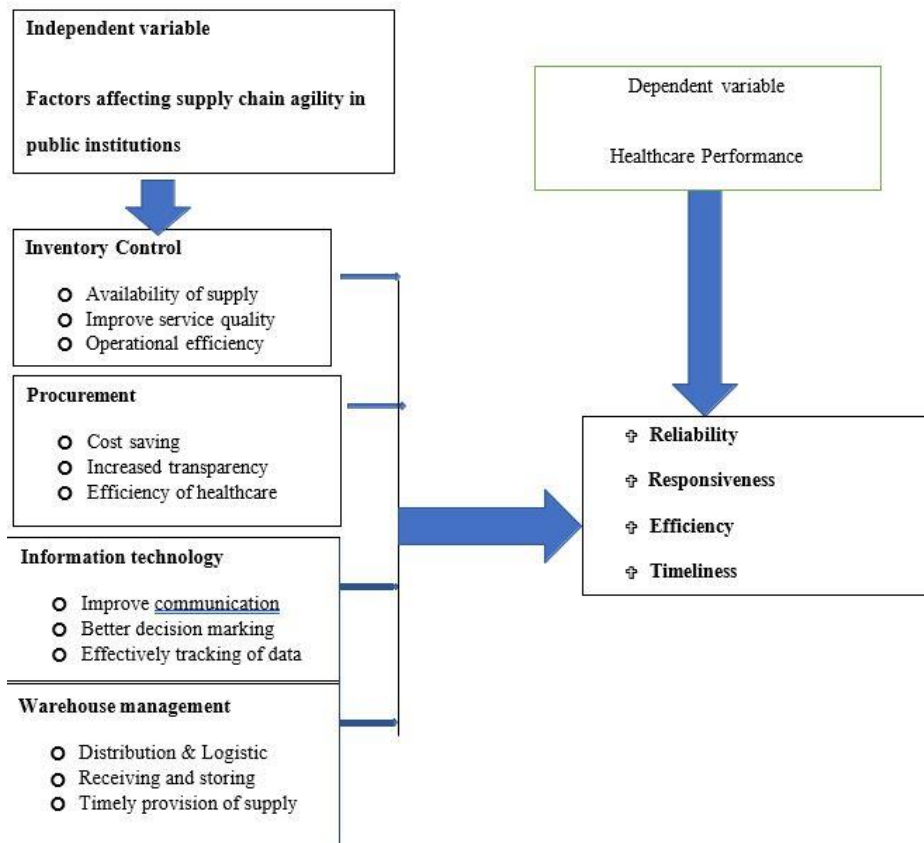


Figure 1. Conceptual framework of the study

Source: Researcher, 2023

2.6 Research Gap of the study

This empirical review is about comparison of previous study that are relevant to this topic on factors affecting supply chain agility in public institutions and healthcare performance as the motivation of the Researcher, the study conducted by Mathur et al. (2015) aimed to provide a conceptual framework showing the relationship between the components of supply chain management and healthcare performance for Indian healthcare industry. However, the author did not mention and even supply chain agility and it showed as a gap is such way a researcher developed need to fill the gap

According to (Ronald, M; Salazar, BS, 2012) conducted a study The Effect of supply chain process on competitive advantage and organizational performance, as per researcher critics, the authors missed up the supply chain agility and healthcare performance and it proved the gap for the researcher to fill at this stage

A study on Supply chain performance measurement in the manufacturing industry conducted by (ILKKA et al, 2011). The author here was in general health supply and manufacturing but did not mention the supply chain agility and healthcare performance thus research gap. According to the researcher consultations on previous theoretical reviews and empirical reviews found are focusing on supply chain management in general and some they mention healthcare and supply chain however, they don't much emphasize on attaining a supply chain agility as the engineering tool in solving problem of Poor road network, corruption, stock out of life saving drugs, poor inventory country control, ineffective warehouse management system, inefficient ambulance services, and government free public health service and ineffective procurement. The highlighted issues to achieve them in Liberia, research should be conducted on factors affecting supply chain agility, the Researcher suggest that further theoretical and empirical review are needed to undergo to search out other more possibilities and harmonizing supply chain agility in order to paving public health system and healthcare performance in Liberia.

CHAPTER THREE: RESEARCH METHODOLOGY

3.0 Introduction

This chapter discusses, research design, study population, sample size, sampling technique, population distribution, professional details, source of field data, determination of sample size from given population, data collection procedures and instruments, primary data, secondary data, research instruments, questionnaire, interview, documentation, observation, data processing, editing, coding, tabulation data analysis, validity and reliability, limitation of the study and ethical consideration.

3.1 Research Design

This study was focus on factors affecting supply chain agility in public institutions and healthcare performance, a case study of Nimba County, Liberia. Research design, according to (Babbie, 2002) is the arrangement of condition for data collection and analysis in a way that aims to combine relevant to research purpose with economy in the procedure. The descriptive research design was used. Descriptive research design obtains information that describes existing phenomena. Individual perception, attitude, behavior or values to determine description characteristics related to the target population, finding proportion of population characteristics in different variables. Descriptive research shows an accurate profile of persons, events, or situations (Robson, 2002). These approaches are vital and indulgent of the factors affecting supply chain agility in public health sector.

3.2 Study population

This study was about factors affecting supply chain agility in public institution and healthcare performance, a case study of Nimba County. This was undertaken from health facilities professional workers. The Population is 705 professional workers from the five governments (Hospitals) source of Nimba County health team 2020-2022.

3.3 Sample size

Sample size is defined as the number of experimental or observational units required for any research. This experimental or observational unit could be in the form of study subjects/respondents, or a geographical area; like city, state, region, and country. It is a subset of a population (Charan *et al*, 2021). Sample size is a research term used for defining the number of individuals included in a research study to represent a population. The sample size references the total number of respondents included in a study, the number is often broken down into sub-groups by demographics such as age, gender, and location so

that the total sample achieves represents the entire population. If the sample size is too small, it will not yield valid results or adequately represent the realities of the population being studied. On the other hand, while larger sample sizes yield smaller margins of error and are more representative, a sample size that is too large may significantly increase the cost and time taken to conduct the research (Kibuacha, F., 2021). In Taherdoost, H. (2017), the sample size is a significant feature of any empirical study in which the goal is to make inferences about a population from a sample.

However, the study considered a sample size of two hundred fifty-four (254) respondents, comprising Doctors, Physician Assistant, Midwives, Nurse (RN), Nurse (NA), Lab Personnel, Hygienists, Administration and Social workers at Nimba County, Liberia

The Krejcie & Morgan (1960) Table was used to come out with the sample size, the table which can be found in the appendices.

3.4 Sampling technique

Stratified random sampling technique was defined by (Sekaran, 2009) as a Process that involves stratification or segregation, followed by random selection of the subject from each stratum was adopted for this study.

Table 1. Population Distribution

Professional Details	Target population	Proportionate sampling	Sample Size
Doctors	22	$\frac{22 \times 100}{705} = 3.1\% \times 254$	7
Physician Assistant	14	$\frac{14 \times 100}{705} = 2.0\% \times 254$	5
Midwives	30	$\frac{30 \times 100}{705} = 4.2\% \times 254$	10
Nurse (RN)	145	$\frac{145 \times 100}{705} = 20.5\% \times 254$	52
Nurse (NA)	129	$\frac{129 \times 100}{705} = 18.2\% \times 254$	46
Lab Personnel	36	$\frac{36 \times 100}{705} = 5.1\% \times 254$	13
Hygienists	73	$\frac{73 \times 100}{705} = 10.3\% \times 254$	27
Administration	245	$\frac{245 \times 100}{705} = 36\% \times 254$	92
EHT	1	$\frac{1 \times 100}{705} = 0.14\% \times 254$	1

Social workers	10	10×100 $= 0.4\% \times 254$ 705	1
Total	705		254

Source: field data 2023

Therefore, the sample is rounded to nearest whole number 254

3.5 Data collection procedures and instruments

Primary data refers to the information which is collected in the first time while secondary information refers to data collected by someone else other than user (Kothari C. , Research Methodology: Methods and Techniques, 2004). The specific instrument will be applied and used for both primary data and secondary data of this research study.

3.5.1 Primary data

Primary data was collected from field, with materials which include pens, pencils, and notebooks while recording every step. Researcher acts face to face with the questionnaire to respondents where researcher will collect primary data on supply chain agility in public health insulation and healthcare performance in Nimba County.

3.5.2 Secondary Data

The secondary data source of information was regarded as second-hand information, in order to obtain reliable information, the documentary review instrument was used to collect data obtain in order to enrich information on the research purpose

3.6 Research Instruments

Designed structured questionnaire was used in primary data collection as the instruments and again Documentaries was used from gathering secondary data.

3.6.1 Questionnaire

A set of structured questionnaires was distributed to the respondents including Doctors Physician Assistant, Midwife, Nurse (RN), Nurse (NA), Lab personnel, Hygienists, Administration, Environmental health Technician (EHT), Social worker purposely to collect views on the subject matter to be observed where the respondent was able to select the most preferred answer for a particular question. The justification for choosing the questionnaire in this study is that the researcher was able to establish a relationship with respondents and, therefore, was able to explain and clarify the purpose of the study and possibly, anything thereof, which might seem to be ambiguous to the respondents.

3.6.2 Interview

Interview was conducted out patients in order to get information on how service is provided in health systems. The interview was carried out to the outpatients who were available during data collection for the purpose of getting more data to support data collected from questionnaires. As described by (Magigi, 2015), purpose of selecting interview is that an activity was carried out as quickly as possible, and the possibility of interviewing many respondents is assured. But secondary data were collected through reviewing various documents which were applicable to the study policies.

3.6.3 Documentation

Documentation refers to any written words that contain information on the issue under investigation that the scientist intends to investigate and may include published and unpublished sources for the enrichment of the research, for instance documents telling about supply chain agility in public health system and healthcare performances, here, whether published or unpublished, a researcher will be much interested to consult them for extension of ideas in intended study.

3.6.4 Observation

Observation intends to act as observational research correlational where a researcher detects ongoing behavior that involves the direct observation of phenomena (Agyekum, 2018). Relatively to factors affecting supply chain agility in public health system in Liberia and healthcare performance will be applicable for being more vigilant and come up with resourceful information in intended study.

3.7 Data Processing

Data processing was assignment of organizing and gathering together the replies into relevant categories, while undertaking the steps of editing, coding, and tabulating the results of the surveyed data.

3.7.1 Editing

Editing is the process of revisiting and reading the questionnaire to ensure that coherence of intended study ideal is followed and all set questions are replied. In editing, questionnaire form was inspected, and if suitable, editing is to administer some marginal quality checklist for primary raw data.

3.7.2 Coding

Data grouping method, a researcher will use coding to ensure code implementation. Coding change original data information into countable symbols, usually in the form of numbers. The coder must exercise some discretion. Codes were classified and tallies for determining frequency in a study survey to categorize responses gathered and same themes or categories were grouped.

3.7.3 Tabulation

Tabulation is technical process of statistical data analysis; tabulation was encompassing counting cases to control how many falls into each of the several categories referred to codes will have been given to each answer after faults were tidied out. The statistical tables were shown how frequent respondents replied to them. The statistical tables matched the number of cases each response to the questions postured in the study if had it attained.

3.8 Data analysis

The methodology statistical for this research study that was employed was that of descriptive and inferential statistics then after fieldwork raw data analysis. Operation of data analysis was manipulated while using Statistical Package for Social Sciences computer software. And then descriptive statistics were produced frequency tables, percentage and mean and was utilized to present the numerous characteristics for the data sets. For this generous of study inferential statistics was one of the best in retrieving the relationship correlation between components of supply chain agility and its independent variables.

Multiple correlation and regression model were employed to analyze the data ;(STATA15.0) computer software was employed to run the analyses. (Kothari, 2004) States that this model is best used when more than two independent variables are analyzed. The multiple regression equation was applied to regression dependent variable against independent variables. The multiple regression equation will be as follows;

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + e$$

Where;

- Y = Supply chain agility in public institutions and healthcare performance
- α = Constant
- β_{1-4} , = Regression coefficients
- X₁ = Inventory control
- X₂ = Procurement
- X₃ = Information technology
- X₄ = Warehouse management
- E = Error factor

Table 2. Evaluation of correlation

Correlation coefficient	(positive or Label /positive or negative)
r=1	Perfect linear correlation
0.9 <r<1	Positive strong correlation
0.7<r<0.9	Positive high correlation
0.5<r<0.7	Positive moderate correlation
0<r<0.5	Weak correlation
r =0	No, relationship
-1<r=< 0	Negative relationship

Source of (sample 2023)

3.8.3 Data and model diagnostic test

Data and model diagnostic tests are statistical procedures used to assess the quality and suitability of data and models in statistical analysis. These tests help identify potential problems or errors in the data or model specification, ensuring accurate and reliable results. In this section, we conducted residuals diagnostic tests to assess the normal distribution, Multicollinearity test and heteroscedasticity problems. The study also utilized the RAMSEY RESET test.

3.8.3.1 Normality test

A normality test is a statistical procedure used to determine if a given dataset adheres to a normal distribution, often referred to as a Gaussian distribution (Johnson, 1954). The primary aim of conducting a normality test is to evaluate whether the data align with the assumptions required by certain statistical techniques that rely on the normal distribution. Some of these techniques encompass hypothesis testing, analysis of variance (ANOVA), and regression analysis (Box et al., 1978). The study adopted Shapiro-Wilk Test, this test is widely used for small to medium-sized datasets. The Shapiro-Wilk test, introduced

by Shapiro and Wilk in 1965, is a statistical procedure used to test the normality of a dataset. The test statistic, denoted as W , is calculated using the formula:

$$W = \frac{(\sum a_i y_{(i)})^2}{\sum (y - \bar{y})^2} \dots \dots \dots (3.1)$$

In this equation, y_i represents the $i - th$ order statistic and a_i denotes the expected value of the normalized order statistics. The test statistic W can be interpreted as the squared correlation coefficient between a_i and y_i . The null hypothesis in the Shapiro-Wilk test states that the data follow a normal distribution. If the calculated p-value associated with the test statistic is below the predetermined significance level (typically 0.05), the null hypothesis is rejected. Rejection of the null hypothesis indicates that the data does not adhere to a normal distribution.

3.8.3.2 Multicollinearity test

Multicollinearity is a statistical problem that arises when there is a high correlation between two or more independent variables in a regression model. In simpler terms, it means that there is a strong linear relationship among the predictor variables themselves (Johnson & Wichern, 2007). To detect multicollinearity, this study utilized the Variance Inflation Factor (VIF), a statistical measure that quantifies the inflation of the variance of the estimated regression coefficient when independent variables are correlated. The formula to calculate VIF for a specific independent variable in a regression model is:

$$VIF = 1 / (1 - R^2) \dots \dots \dots (3.2)$$

Where: R^2 is the coefficient of determination from the regression model where the specific independent variable is the dependent variable, and all other independent variables are used as predictors. The VIF value provides an indication of how much the variance of the estimated regression coefficient is increased due to multicollinearity. If the VIF for a variable is equal to 1, it suggests no correlation or multicollinearity issues. Generally, a VIF value above 1 indicates some degree of multicollinearity, with higher values indicating stronger multicollinearity. A commonly used threshold to identify problematic multicollinearity is a VIF value of 5 or 10((Gujarati, 2008).Rejection criteria for VIF values:

Table 3.3 Rejection criteria for VIF values

Vif value	Conclusion
VIF < 1	No multicollinearity issue
VIF between 1 and 5	Moderate to high multicollinearity, indicating potential problems that should be investigated further.
VIF between 5 and 10	Moderate to high multicollinearity, indicating potential problems that should be investigated further.

Source: (Montgomery et al., 2012)

3.8.3.3 Heteroscedasticity Test

Heteroskedasticity refers to the situation in which the variability of errors (or residuals) in a regression model is not constant across all levels of the independent variables. In other words, it implies that there is unequal spread or dispersion of the residuals (Wooldridge, 2019). This study applied the Breusch-Pagan LM test, originally developed by Trevor Breusch and Adrian Pagan in 1979, to examine whether the variance of the errors in a regression is dependent on the independent variables. One of the assumptions

of the Classical Linear Regression Model (CLRM) states that disturbances should exhibit a constant variance, known as homoscedasticity, denoted by:

$$E(\mu_i^2) = \sigma^2 \dots\dots\dots (3.3)$$

where $i = 1, 2, n$. The Breusch-Pagan LM test statistic ($BP = NR^2$) follows a chi-square distribution with m degrees of freedom [$\chi^2(m)$], where m represents the number of explanatory variables. The null hypothesis (H_0) of the test is constant variance. If BP exceeds the critical value χ^2_{tab} , the decision rule is to reject the null hypothesis. Alternatively, if the p-value is less than 0.05, indicating the presence of heteroscedasticity. On the other hand, if the p-value is greater than or equal to 0.05, the null hypothesis is not rejected, suggesting no evidence of heteroscedasticity.

3.8.3.4 Specification Error Test

The Ramey regression of specification error test, also known as the RESET test, was utilized to assess whether a model is accurately specified. If the model is found to be incorrectly specified, it can lead to specification bias. Various errors may contribute to this, such as including irrelevant variables, using incorrect functional forms, excluding relevant variables, and experiencing measurement errors (Greene, 2003). When any of these errors occur, they violate the assumptions of the Classical Linear Model. By utilizing F-statistics that can be calculated as follows:

$$F = (\text{Explained Variability} / \text{Number of Explanatory Variables}) / (\text{Unexplained Variability} / (\text{Total Observations} - \text{Number of Explanatory Variables} - 1))$$

The null hypothesis, H_0 : model specification is correct, is put forward. If the computed p-value of F-statistics is lower than a predetermined level of significance ($P\text{-value} < 0.05$), we conclude that the model being used is not correctly specified, whereas if the p-value is greater than or equal to the significance level, we fail to reject the null hypothesis.

3.8.2 Validity and reliability

Researcher developed a validity and reliability to check on and verify concepts of research to measure consistent stability, the researcher exercised a pilot, a pilot study was done in two days from Saclepea competitive health center to check accuracy and clarity of questions before remain activity of the study that will be conducted in Nimba county, Liberia and this pilot study conducted will not be countable in main field study According to Sekeran (2009), reliability measure the internal consistency of items in the study tools normally include questionnaire and interview to give similar results every time used under the similar conditions. The Cronbach alpha will be used to test on the response from the pre-testing to ensure items in the questions and response gathered in pilot study collected are pertinent and accurate. The minimum acceptable Cronbach alpha coefficient is 0.7 and above. Cronbach's alpha reliability coefficient ranges between 0 and 1. However there is no lower limit to the coefficient. The closer Cronbach's alpha coefficient is to 1.0 the greater the internal consistency of the items in the questionnaires. Therefore, Pilot study was conducted on Saclepea competitive health center, the 24 items to test questionnaire and Cronbach alpha and Cronbach alpha presented 0.83 and shows that all respondents were consistency on research objective.

3.8.3 Limitation of the study

The study limitation in the process of data collection was hindered by three issues which included limited financial resources. Here research, because research is self-funded, insufficient budget was setback to go

intrinsically in data collection , and lack of enough time, due to the University allocated time was quiet short however in such timeframe , data collection activity was carried out but not satisfactorily to willingness of research which leave the gap for next researcher and lastly , while Researcher being panic by the outbreak of COVID-19 that shook the world in general , diligently data collection activity will be conducted while respecting measures against COVID-19 hence reducing the chances of covering big scope in designated timeframe of research

3.8.4 Ethical Consideration

These research ethical concerns of findings were treated confidential, owning copyright, privacy, was followed to create and maintaining research ethics. The essence of the research was presented to the respondents before action start to enable them becoming part of the research work to gain their willingness before respondents filling the questionnaire. The consent and matters of confidentiality were guaranteed throughout the study work. Researcher presented acceptance letter to the respondents allowing data collection activities and one to the University of Kigali and other for Nimba County. Data Collection process was of safety, integrity, truthfulness while respondents being respected while researcher aiming to reach the research findings expectations so that the research was following procedures and standard of University of Kigali Ethics and accordance guidance manners.

CHAPTER FOUR DATA PRESENTATION, ANALYSIS AND INTERPRETATION

4.1 Introduction

This chapter was made to present findings, interpretations and discussions in order to explain the effect of factors of supply quality chain on health performance; specifically, it shows how changes in variables such as inventory control, procurement, information technology and warehousing have an effect on the performance of health care. In the chapter various statistics were used including descriptive statistics, correlation and regression analysis in order to show how these independent variables we have an effect on health care performance.

4.2 Response Rate

The study used a sample size of 254 people selected from 705 people. The table below indicates the response rate of this study.

Table 3. Response rate

	N	percent
Responses	254	100
No responses	0	0
Total	254	100

Based on the given table 4.1, it appears that there was a total of 254 responses, which account for 100% of the total. This implies that all participants or individuals included in the study provided some form of response. On the other hand, there were no instances of non-response, as indicated by the "No responses" category, which shows a count of 0 and a percentage of 0%. This means that every individual or participant who was included in the study provided a response, and there were no missing or incomplete data points.

4.3. Respondents' demographic characters

This frequency table 4.2 provides a summary of the distribution of participants across gender, education

level, and working experiences. It allows for easy comparison and understanding of the demographic characteristics of the sample.

Table 4. Respondents' demographic characteristics

	Categories	N	%
Gender	Male	81	31.62
	Female	173	68.38
	Total	254	100
Education level	Secondary Certificate	109	43.08
	Bachelor's degree	129	50.99
	Master's degree:	16	5.93
	PhD degree	0	100
	Total	254	
Working Experiences	1-4 years	80	31.50
	5-8 years	123	48.43
	9-12 years	40	15.75
	Above 12 years	11	4.33
	Total	254	100

According to the information presented in table 4.2, the majority of participants, accounting for 50.9%, have obtained a bachelor's degree. The next largest group, at 43%, has completed secondary education, while 5.9% of respondents have achieved a master's degree. Regarding gender distribution, it was found that the majority of respondents, accounting for 68.38%, are females, while males make up 31.62% of the sample. When examining the participants' work experience, it was revealed that the highest percentage, 48.43%, falls within the range of 5 to 8 years. Those with work experience ranging from 1 to 4 years account for 31.50% of respondents. Additionally, 15.75% reported having between 9 and 12 years of experience, while 4.33% indicated having more than 12 years of experience.

Table 4.3 reveals the distribution of job roles within the organization or industry. The most common role is "Registered Nurse," which accounts for 12.6% of the total workforce, with 32 individuals. Other significant job roles include "Administrator" (9.8%, 25 individuals), "Administrative Support" (11.0%, 28 individuals), "Clinical Support" (9.4%, 24 individuals), and "Pharmacist" (8.3%, 21 individuals). There are also several job roles with moderate representation, such as "Physician Assistant" (7.5%, 19 individuals), "Environmental Health Technician" (7.1%, 18 individuals), "Midwife" (7.1%, 18 individuals), and "Pharmacy Workers" (7.1%, 18 individuals). Some job roles have a lower presence, including "Physician" (4.7%, 12 individuals), "Dentist Lab Technician" (5.1%, 13 individuals), "Public Health

Specialist" (6.3%, 16 individuals), and "Social Worker" (3.9%, 10 individuals). These findings indicate the reliability and validity of the research data, as the study involved experienced respondents who are known for providing trustworthy information. Furthermore, these findings align with the research conducted by Saunders et al. (2018).

Table 5. Respondents' occupation distribution

Occupation	Freq.	Percent	Cum.
Administrative Support	28	11.02	11.02
Administrator	25	9.84	20.87
Dentist Lab Technician	13	5.12	25.98
Environmental Health Technician	18	7.09	33.07
Midwife	18	7.09	40.16
Pharmacist	21	8.27	48.43
Pharmacy workers	18	7.09	55.51
Physician Assistant	19	7.48	62.99
Public Health Specialist	16	6.30	69.29
Registered Nurse	32	12.60	81.89
Social Worker	10	3.94	85.83
clinical support	24	9.45	95.28
Physician	12	4.72	100.00
Total	254	100.00	

4.4. Descriptive statistics analysis

This section of descriptive analysis was included in this study in order to see how the respondents answered the questions that were prepared on the effect of inventory control, procurement, information technology and warehouse management on health care performance. In particular, table 4.4 to table 4.7 aims to show the mean and variability of respondents' answers to different questions used in this study.

4.4.1 Inventory control and Health care's performance

In this section, the researcher aimed to see how the respondents answered questions about the effect of inventory control supply chain on healthcare performance. These were answered using the Likert scales technique. Where 1 stands for Strongly disagree, 2 stands for 1 disagree, 3 stands for neutral, 4 stands for Agree and 5 stands for strongly agreed.

Table 6. To assess inventory control on the supply chain

Statements	Mean	Std
Is there applied Inventory control strategy at your health facility?	3.47	0.85
Doses the inventory targets safety stocks level at your facility	3.48	0.83
Are there clear inventory targets by components for your health facility	3.5	0.84
Is there accountability for Inventory targets at your facility	3.46	0.9
Are the inventory targets related to a demand estimated for your health facility	3.51	0.89
Do all goods have catalog for supply in your health facility	3.45	0.1
Aggregate mean and Standard Deviation	3.48	0.72

The results presented in table 4.4 indicate that, for the statement "Is there an applied inventory control strategy at your health facility?", the respondents' average score was 3.47. This suggests that, on average, the

respondents had a neutral stance towards this statement. Similarly, for the statement "Does the inventory target safety stocks levels at your facility?", the average score was 3.48, indicating a relatively neutral response from the respondents.

Additionally, for the statement "Are there clear inventory targets by components for your health facility?", the average score was 3.5. This suggests that, on average, the respondents neither strongly agreed nor strongly disagreed with this statement. Moreover, for the statement "Is there accountability for inventory targets at your facility?", the average score was 3.46, indicating a relatively neutral stance from the respondents.

Furthermore, regarding the statement "Are the inventory targets related to a demand estimated for your health facility?", the average score was 3.51, implying that, on average, the respondents neither strongly agreed nor strongly disagreed with this statement. Lastly, for the statement "Do all goods have a catalog for supply in your health facility?", the average score was 3.45, indicating a neutral response from the respondents.

Overall, considering the aggregate mean score for all the statements, which is 3.48, it can be concluded that the respondents had a relatively neutral response. The standard deviation of 0.72 suggests some variability in the responses received, reflecting diversity in the perceptions and experiences of the respondents regarding the inventory control strategies and practices in their health facility.

4.4.2 Procurement and Health care’s performance

In this section, the researcher sought to assess the effect of procurement on health facility performance by utilizing the Likert scale technique. The respondents provided their feedback using a scale where 1 represents "Strongly Disagree," 2 represents "Disagree," 3 represents "Neutral," 4 represents "Agree," and 5 represents "Strongly Agree."

Table 7. To determine effects of procurement on supply chain

Statements	Mean	Std
Are there some of the most procuring factors to consider when negotiating with a potential supplier in your health facility	3.14	0.69
Does Procurement double check the goods procured whether ordered goods are substandard from supplier at your facility	3.14	0.73
Has there been a situation in procurement where a supplier was not meeting quality standards in your health facility.	3.19	0.82
Is there mechanism dealing with suppliers in case suddenly raise in prices of products at your facility?	3.09	0.77
Have been a time when you successfully managed a complex procurement process in your health facility.	3.28	0.81

Does your institution have best procurement method in place for negotiating with a supplier in your health facility	3.13	0.79
Aggregate mean and Standard Deviation	3.21	0.69

The findings presented in table 4.5 indicate that, for the statement "Are there some of the mostprocuring factors to consider when negotiating with a potential supplier in your healthfacility?", the respondents' average score was 3.14. This suggests that, on average, the respondents had a neutral stance towards this statement. Similarly, for the statement "Does Procurement double check the goods procured whether ordered goods are substandard from thesupplier at your facility?", the average score was 3.14, indicating a relatively neutral responsefrom the respondents.

The results also show that, for the statement "Has there been a situation in procurement wherea supplier was not meeting quality standards in your health facility?", the average score was 3.19. This suggests that, on average, the respondents neither strongly agreed nor strongly disagreed with this statement. Additionally, for the statement "Is there a mechanism dealing with suppliers in case there is a sudden rise in prices of products at your facility?", the averagescore was 3.09, indicating a neutral stance from the respondents.

Furthermore, the average score for the statement "Have there been times when you successfullymanaged a complex procurement process in your health facility?" was 3.28, suggesting a relatively neutral response from the respondents. Similarly, for the statement "Does your institution have the best procurement method in place for negotiating with a supplier in your health facility?", the average score was 3.13, indicating a neutral stance from the respondents.

Overall, considering the aggregate mean score for all the statements, which is 3.21, it can be concluded that the respondents had a relatively neutral response. The standard deviation of 0.69 suggests some variability in the responses received, reflecting diversity in the perceptions and experiences of the respondents regarding the procurement processes and supplier managementin their health facility.

4.4.3 Information technology and Health care’s performance

In this section, the focus of the study was to examine the responses of the participants regardingthe impact of information technology supply chain on healthcare facility performance. The Likert scale technique was used to gather these responses, with 1 representing Strongly Disagree, 2 corresponding to Disagree, 3 indicating neutrality, 4 representing Agree, and 5 indicating Strongly Agree.

Table 8. To examine Information technology on supply chain

Statements	Mean	std
Does greater knowledge and visibility across the supply chain benefit to utilizing information technology in logistics	3.24	0.70
Does the effective and efficient utilization of information technology for logistics management brings importance of analytical thinking	3.2	0.65

Are information technology suitable for decision making in supply chain depending upon data associated with decision support systems in supply chain management	3.19	0.66
Does network through information technology transmit signals that pinpoint the exact location of an object in supply chain management	3.11	0.63
Is there the measuring stock for logistics information technology in the supply chain agility towards healthcare performance	3.09	0.61
Does the integration of information technology systems affect the overall agility of healthcare in responding to dynamic in your facility?	3.12	0.67
<u>Aggregate mean and Standard Deviation</u>	<u>3.24</u>	<u>0.66</u>

Based on the findings presented in table 4.6, it is observed that the average score for the statement "Does greater knowledge and visibility across the supply chain benefit from utilizing information technology in logistics?" is 3.24. This suggests that, on average, the respondents had a neutral stance towards this statement. Similarly, for the statement "Does the effective and efficient utilization of information technology for logistics management bring importance to analytical thinking?", the average score was 3.20, indicating a relatively neutral response from the respondents.

The results also indicate that the respondents scored an average of 3.19 for the statement "Are information technology suitable for decision making in the supply chain depending upon data associated with decision support systems in supply chain management?". This suggests that, on average, the respondents neither strongly agreed nor strongly disagreed with this statement. Additionally, for the statement "Does the network through information technology transmit signals that pinpoint the exact location of an object in supply chain management?", the average score was 3.11, indicating a neutral stance from the respondents.

Furthermore, the average score for the statement "Is there a measuring stock for logistics information technology in the supply chain agility towards healthcare performance?" was 3.09, implying a relatively neutral response from the respondents. Similarly, for the statement "Does the integration of information technology systems affect the overall agility of healthcare in responding to dynamic situations in your facility?", the average score was 3.12, suggesting a neutral stance from the respondents.

Overall, according to the aggregate mean and standard deviation (Mean: 3.24, Std: 0.66), it suggests that information technology has a moderate level of effectiveness in healthcare. However, the standard deviation indicates varying responses, implying potential differences in the perceived effectiveness of information technology among different healthcare facilities.

4.4.4 Warehouse management and Health care's performance

In this portion, the researcher's objective was to assess how the participants responded to inquiries concerning the effect of warehouse management on the performance of healthcare. The Likert scale

technique was employed for this purpose. The Likert scale encompasses a range from 1 to 5, with 1 denoting "Strongly Disagree," 2 corresponding to "Disagree," 3 indicating "Neutral," 4 representing "Agree," and 5 denoting "Strongly Agree."

Table 9. To determine warehouse management on supply chain

Statements	Mean	std
Doses your facility has a well-defined warehousing management and planning strategy in place?	3.09	0.74
Is order sorting and packing part of the challenges facing your facility?	3.17	0.7
Depending on the warehouse management, do all orders be sent to the warehouses automatically	3.05	0.72
Does your warehouse have some basic warehouse management equipment and technology in place?	3.10	0.75
Do accessibility and preference routes in supply chain be optimized by chosen product locations be placed in respective warehouses?	3.23	0.78
Do shipped products be assigned to a warehouse representative and easily split into cycle counts for logistics	3.31	0.69
<u>Aggregate mean and Standard Deviation</u>	<u>3.16</u>	<u>0.59</u>

Based on the findings presented in table 4.7, it can be observed that the respondents scored an average of 3.09 for the statement "Does your facility have a well-defined warehousing management and planning strategy in place?" This suggests that the respondents, on average, neither agreed nor disagreed with this statement. Similarly, for the statement "Is order sorting and packing part of the challenges facing your facility?" the average score was 3.17, indicating a neutral stance from the respondents. Looking at the statement "Depending on the warehouse management, do all orders be sent to the warehouses automatically?", the respondents had an average score of 3.05. This implies that, on average, the respondents neither strongly agreed nor strongly disagreed with this statement.

Regarding the statement "Does your warehouse have some basic warehouse management equipment and technology in place?", the respondents scored an average of 3.10. This suggests a neutral response from the respondents towards this statement. For the statement "Do accessibility and preference routes in the supply chain be optimized by chosen product locations placed in respective warehouses?", the respondents' average score was 3.23. This indicates that, on average, the respondents had a neutral stance towards this statement. Additionally, the average score for the statement "Do shipped products be assigned to a warehouse representative, and easily split into cycle counts for logistics?" was 3.31, suggesting a relatively neutral response from the respondents.

Overall, based on the aggregate mean and standard deviation (Mean: 3.16, Std: 0.59), it indicates a moderate level of warehouse management effectiveness in the healthcare facilities. However, the standard deviation suggests some variability in the responses, indicating that there might be differences in the

effectiveness of warehouse management across different facilities.

4.3 Inferential statistics

4.3.1 Correlational analysis

Table 4.8 below, illustrates a strong positive association between inventory control and health care performance ($r=0.725$, $p=0.00$). The correlation between procurement and health facility performance is also positive, although it is relatively weak ($r=0.358$, $p=0.000$). Similarly, the relationship between information technology and health facility performance is positive but weak ($r=0.353$, $p=0.000$), while the correlation between warehousing and health facility performance is positive and weak ($r=0.336$, $p=0.000$). These findings suggest potential connections or associations between health performance and the variables of inventory control, procurement, information technology, and warehousing. Further investigation and exploration are needed to determine the specific strength and direction of these relationships.

Table 10. Correlational test

Variables	(1)	(2)	(3)	(4)	(5)
(1) Health Performance	1.000				
(2) Inventory Control	0.725* (0.000)	1.000			
(3) Procurement	0.358* (0.000)	0.239* (0.000)	1.000		
(4) Information Technology	0.353* (0.000)	0.279* (0.000)	0.316* (0.000)	1.000	
(5) Warehousing	0.336* (0.000)	0.168* (0.007)	0.167* (0.007)	0.110 (0.080)	1.000

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

4.3.2 Data and regression model diagnostic test

Regression model diagnostic tests are commonly used to evaluate the soundness and dependability of regression models (Montgomery, Peck, & Vining, 2012). These tests aid in the detection of possible problems or deviations from assumptions, enabling necessary modifications or further examination. By identifying issues, diagnostic tests contribute to the improvement and refinement of regression models for more accurate analyses (Rencher & Schaalje, 2008). To ensure compliance with the essential regression assumptions, several diagnostic tests were conducted. These tests included assessing linearity, examining the normality of variables, detecting multi-collinearity, and heteroskedasticity test and model specification/omitted variable test.

4.3.2.1 Data normality test

The data in the study was assessed for normality using a Shapiro-Wilk W test. A p-value greater than 0.05 indicates normal distribution. The null hypothesis assumes that the data follows a normal distribution. From the results in table 4.9 revealed that only the procurement technology and warehouse management variables exhibited normal distribution, as their p-values were greater than 0.05. However, for health performance, inventory control, and procurement, the calculated p-values were less than the chosen alpha

level of 5%. Hence, the null hypothesis is rejected, indicating that the data for health performance, inventory control, and information technology does not display normal distribution. Table 4.11 presents a summary of the normalcy test results conducted.

Table 11: Test for normality of the Distribution (Shapiro-Wilk W test for normal data)

Variables	Obs	W	V	z	Prob>z
Health performance	254	0.969	5.770	4.081	0.000
Inventory control	254	0.981	3.548	2.948	0.002
Procurement	254	0.997	0.489	-1.667	0.952
Information technology	254	0.982	3.368	2.828	0.002
Warehouse management	254	0.990	1.853	1.436	0.076
H₀: data follows a normal distribution			Conclusion made at 5%		

4.3.2.2 Multicollinearity test

The variance inflation factor (VIF) is commonly used to identify multicollinearity in regression analysis. A high VIF value indicates a strong correlation between predictor variables, which can introduce problems like unstable coefficient estimates and reduced predictive power. By examining the VIF values for each variable, we find that all of them are relatively low in this case. Specifically, "information technology," "procurement," "inventory control," and "warehouse management" have VIF values below 1.2, suggesting minimal or no multicollinearity with other predictors as indicated in table 4.10. Furthermore, the VIF values closest to 1 indicate that these variables do not heavily rely on other predictors and can be considered as independent contributors to the model. The mean VIF value of 1.127 reinforces the absence of multicollinearity, as it is close to 1. Moreover, when we consider the 1/VIF values, representing the inverse of the VIF, we observe that they are all above 0.85. This implies that the variables contribute to the model's explanatory power without being overly redundant. Based on these findings, we can conclude that there does not appear to be a significant issue with multicollinearity among the predictor variables in your analysis. The findings were presented in Table 4.10

Table 1. multicollinearity test using Variance inflation factor

Variable	VIF	1/VIF
Information technology	1.169	.855
Procurement	1.159	.863
Inventory control	1.132	.883
Warehouse management	1.049	.954
Mean VIF	1.127	.

4.3.2.3 Heteroskedastic test

The Breusch-Pagan/Cook-Weisberg test was utilized to detect heteroskedasticity, which refers to the presence of unequal variances in the errors of a regression model. The null hypothesis (H₀) posits that there is constant variance present. The results from table 4.11 show that the Chi-square value is 16.52, indicating the likelihood of observing such a test statistic under the null hypothesis (H₀) of constant variance. The p-value of the Chi-square test is denoted as "Prob > chi²" and is reported as 0.0000. In statistical hypothesis testing, a p-value below the selected significance level (often 0.05) implies evidence

against the null hypothesis. In this case, since the p-value is extremely small (i.e., less than 0.05), we reject the null hypothesis of constant variance. Therefore, these results indicate evidence suggesting the violation of the assumption of constant variance in the tested regression model for heteroskedasticity. The findings were presented in Table 4.11 below.

Table 4.11. Test For heteroskedasticity for fitted values of health performance variable

Test For heteroskedasticity	Chi-square	P-value of Chi-square
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity	chi2(1) = 16.52	Prob > chi2 = 0.0000
Ho: Constant variance		

4.3.2.4 Model Error specification Test.

The Ramsey RESET test was used to check if a regression model has omitted variables. In this case, the null hypothesis (Ho) states that the model does not have any omitted variables. The test results in table 4.12, show an F-statistic value of 1.87, with 8 degrees of freedom for the numerator and 241 degrees of freedom for the denominator. The probability (Prob > F) associated with this test statistic is 0.0657. Based on these results, we can interpret that the p-value (0.0657) is greater than the conventional significance level of 0.05. Therefore, we do not have sufficient evidence to reject the null hypothesis. This suggests that the model does not have any omitted variables. In conclusion, according to the Ramsey RESET test, there is no indication that the model under consideration has any omitted variables. The findings were presented in Table 4.12 below.

Table 2. Model specification test for variable omitted

Test For model specification	F-statistic	P-Value of F-Statistic
Ramsey RESET test using powers of the independent variables	F (8, 241) = 1.87	Prob > F = 0.0657
Ho: model has no omitted variables		

4.3.3 Regression analysis on effect of factors affecting healthcare performance

Regression analysis was utilized to gain insights into how healthcare performance affected by a set of independent variables, including inventory control, procurement, information technology, and warehouse management. This method enables us to make predictions or estimates regarding the value of the dependent variable based on the values of the independent variables. As shown in table 4.13, the Adjusted R-squared value is found to be 0.6041, indicating that approximately 60.41% of the variation in health facility performance can be explained by the independent variables incorporated into the regression model.

Table 3. Model Summary

	R-squared	Adj R-squared	Root ME
	0.6194	0.6041	0.28183

Predictors: (constant)inventory control, Procurement, information technology and Warehouse management

4.3.2 Regression analysis

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Table 11 .Model Summary

	R-squared	Adj R-squared	Root ME
	0.6194	0.6041	0.28183

Predictors: (constant)inventory control, Procurement, information technology and Warehouse management

4.3.2.1 Anova summary

The ANOVA table 4.10 reveals that the independent variables (inventory control, procurement, information technology, and warehouse management) play a significant role in elucidating the fluctuations observed in healthcare performance. Bolstering this finding is the F-value of 34.66, accompanied by a highly low p-value of 0.000 (***) , signifying the statistical significance of the regression model at 1% level as a whole in forecasting healthcare performance

Table 12. Anova summary

Model	Sum of Squares	Df	Mean of square	F	Sig(prob>F)
Regression	32.136395	12	2.6780329	34.66	0.0000***
Residual	18.623447	241	0.07727572		
Total	50.759843	253	0.20063179		

- a. Dependent variable: Healthcare performance
- b. Predictors: (constant)inventory control, Procurement, information technology and Warehousing

4.3.2.2 Regression model results

The table 4.11 presents the coefficients, standard errors, t-values, and p-values for a linear regression analysis examining the relationship between different factors (inventory control, procurement, information technology, and warehousing) and health performance. The constant coefficient is also provided. It is observed that all variables in the table have p-values below 0.01 (***) , indicating their statistical significance at a 1% level. This leads to the rejection of the null hypothesis that the coefficients are zero, suggesting that the independent variables (e.g., significant inventory control, procurement, information technology, and warehousing) are significant predictors of

the dependent variable (healthcare performance)

Table 13. Estimated coefficient of factor affecting healthcare performance

Dep.var: Health performance	Coef.	St. Err.	t-value	p-value
Inventory control	.387	.026	14.92	0.000***
Procurement	.091	.028	3.28	0.001***
Information technology	.075	.029	2.61	0.010***
Warehouse management	.15	.031	4.81	0.000***
Constant	.542	.13	4.17	0.000***

*** p<.01, ** p<.05, * p<.1

4.3.2.3 Interpretation and discussion of the findings

The first objective of this study was to examine the impact of inventory control on health facility performance. The null hypothesis was formulated as follows: H1: There is no significant effect of inventory control on health facility performance. In table 4.11, the results indicate that the coefficient for inventory control is positive (0.387) and statistically significant at the 1% level, leading to the rejection of the null hypothesis. This suggests that for every unit increase in inventory control, healthcare performance is expected to increase by 0.387 units. The importance of an efficient inventory control system in healthcare performance lies in its ability to ensure the availability of necessary supplies, reduce costs, improve service quality, safeguard patient safety, enhance operational efficiency, and promote transparency and accountability. These findings align with similar studies conducted by (Kagwisagye and Mulyungi 2018,); Sporta (2018); Anichebe and Agu (2013); Obinna et al. (2019) in their findings effect of inventory control on performance found to be positive.

The second objective of the study was to examine how procurement affects the performance of healthcare. The null hypothesis was formulated as follows: H2: The procurement has no significant effect on healthcare performance in Nimba County. According to the statistics in table 4.11, the results indicate a positive and statistically significant effect of procurement on healthcare performance at a 1% significance level ($\beta = 0.091$, $p < 0.001$). This means that the null hypothesis of the study can be rejected. Additionally, the findings reveal that a one-unit increase in procurement leads to a 0.091 unit increase in healthcare performance. This is could be because procurement plays a crucial role in improving healthcare performance by ensuring the availability of necessary supplies, resulting in cost savings, improved service quality, enhanced patient safety, and increased transparency and accountability. A well-organized and efficient procurement system directly contributes to the overall effectiveness and efficiency of healthcare services provided to individuals and communities. These findings align with previous studies carried out by Oloo et al., (2017) and Gabriel Awuah et al., (2022) postulated that effective procurement performance helps procuring entities and firms to increase performance.

The third objective of this study was to examine the impact of information technology on the performance of healthcare facilities. To do so, the following null hypothesis was formulated: H3: There is no significant effect of information technology on supply chain agility in public institutions and healthcare performance in Nimba County. According to the results presented in table 4.11, information technology has a positive

and statistically significant effect on healthcare performance at the 1% level, leading to the rejection of the null hypothesis. Furthermore, the coefficient for information technology is 0.075, suggesting that a one-unit increase in information technology is associated with a 0.075 unit increase in healthcare performance. This finding can be attributed to the fact that the integration of information technology in healthcare has the potential to enhance performance by improving efficiency, patient safety, communication, decision-making, and patient engagement. These findings are supported by the studies of Alotaibi & Federico, (2017); Atarodi et al., (2019) and Black et al., (2011) postulated that information technology offers numerous possibilities for enhancing and revolutionizing healthcare. These encompass minimizing errors caused by humans, enhancing clinical outcomes, simplifying the coordination of care, optimizing practice efficiency, and effectively tracking data over time

The fourth objective of the study was to examine the influence of warehouse management on healthcare performance. The null hypothesis was formulated as follows: H4: Warehouse management has no significant effect on healthcare performance in Nimba County. The findings presented in table 4.11 indicate that the variable representing warehouse management has a positive and statistically significant effect on healthcare performance ($\beta = 0.15$, $p < 0.000$). This suggests that a one-unit increase in warehouse management corresponds to a 0.15 unit increase in healthcare performance. Warehouse management serves as a central hub for receiving, sorting, and distributing medical supplies to different healthcare facilities. By optimizing distribution and logistics, healthcare organizations can enhance operational efficiency and ensure the timely provision of crucial supplies to various departments or locations. The finding supported by studies of Smith (2018) and Johnson et al. (2019) designating that warehouse management allows for effective inventory management, ensuring that essential medical supplies and equipment are readily available when needed and helps to avoid stock outs or delays in patient care, ultimately leading to better healthcare performance.

5.0. Introduction

CHAPTER FIVE SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter discusses the summary of findings along the study objectives and the corresponding hypothesis. It then draws conclusions based on the findings and discussions are put for the recommendations of the study based on the factors affecting supply chain agility in public institutions and healthcare performance: a case of Nimba County, Liberia. The null hypotheses for each objective were formulated, and the results from Table 4.8 are presented

5.1. Summary of Major Findings

The purpose of this study was to investigate the factors affecting supply chain agility in public institutions and healthcare performance of Nimba County, Liberia. The research was directed by the following objectives:

1. To assess inventory control on the supply chain agility in public institutions and healthcare performance in Nimba County, Liberia
2. To determine effects of procurement management on supply chain agility in public institutions and the healthcare performance in Nimba County, Liberia
3. To examine Information technology on supply chain agility in public institutions and healthcare performance in Nimba County, Liberia

4. What is the effect of warehouse management on supply chain agility in public institutions and healthcare performance in Nimba County, Liberia

For data analysis, the descriptive survey was used to collect and analyze data from a few samples from professional health workers in Nimba County, Liberia. The total population of this study was made up of Physician, Physician Assistant, Administrator, Administrative Support, Clinical Support, Environmental Health Technician, Dentist, Lab Technician, Midwife, Registered Nurse, Pharmacy Workers, Public Health Specialist and Social Worker. This was research carry out using questionnaires. To analyze the data relating to study objectives, frequencies and percentage were used. For more accurate statistics, (STATA 15.0) was used in the operations of data analysis. The sampling came out with the following results considering the study objective:

Referring to the finding of this study **objective one**, the study found a positive and statistically significant effect on healthcare performance, indicating that an increase in inventory control leads to an increase in healthcare performance. This is important as efficient inventory control ensures the availability of supplies, reduces costs, improves service quality, and enhances operational efficiency. With the coefficient for inventory control been positive at (0.387) and statistically significant but weak correlation meaning the County Health Team should put much attentions to inventory control strategy, so as to reduce the issues of stock out of drugs, expiration of health product and bring high level of convenience to the population or patients at all time.

The objective two of this study found a positive and statistically significant effect of procurement on healthcare performance. A one-unit increase in procurement resulted in a corresponding increase in healthcare performance. Effective procurement ensures the availability of supplies, cost savings, improved service quality, patient safety, and transparency. With the coefficient for procurement been positive at (0.09) statistically significant but weak correlation meaning much thoughtfulness should be placed on procurement process.

The objective three of this study was to explain the effect of information technology on healthcare performance in Nimba County. Regarding information technology, a positive and statistically significant effect on healthcare performance was found. Integrating information technology in healthcare improves efficiency, patient safety, communication, decision-making, and patient engagement. The coefficient at (0.75) is statistically significant but it has a weak correlation, meaning greater attention must be employed to in the area of information technology so as to bring better quality of healthcare services.

Furthermore, the fourth objective of this study indicated that warehouse management has a positive and statistically significant effect on healthcare performance. Optimizing distribution and logistics through warehouse management enhances operational efficiency and ensures timely provision of supplies to healthcare facilities. Overall, these findings align with previous studies and emphasize the importance of efficient inventory control, procurement, information technology, and warehouse management in improving healthcare preference in public institutions (Hospitals), Liberia.

5.2. Conclusion

Based on results from the study, it can be concluded that enhancing Inventory control, Procurement, Information Technology and Warehouse management significantly improve healthcare performance in Nimba County and Liberia as a Nation in general. In conclusion, this study found that inventory control, procurement, information technology, and warehouse management have significant positive effects on healthcare performance in Nimba County, Liberia. The null hypotheses for each objective were rejected, indicating that these factors do have an impact on healthcare performance. A one-unit increase in inventory control was associated with a 0.387 unit increase in healthcare performance, highlighting the importance of efficient inventory control in ensuring supply availability, cost reduction, service quality improvement, patient safety, operational efficiency, and transparency.

Similarly, a one-unit increase in procurement led to a 0.091 unit increase in healthcare performance, emphasizing the role of procurement in supply availability, cost savings, service quality improvement, patient safety, and accountability.

Information technology also had a positive effect on healthcare performance, with a one-unit increase associated with a 0.075-unit increase, enhancing efficiency, patient safety, communication, decision-making, and patient engagement.

Lastly, a one-unit increase in warehouse management corresponded to a 0.15 unit increase in healthcare performance, demonstrating the importance of optimizing distribution and logistics to improve operational efficiency and ensure timely supply provision. Overall, these findings highlight the significance of these factors in enhancing healthcare performance in public institutions (hospitals) in Nimba County, Liberia.

5.3. Recommendation

The researcher recommends the management of the public hospitals in Nimba County and Liberia at large, to enhance its implementation to realize its impact at higher levels. Among the practices to put more emphasis on are skills development, supportive supervision and performance review.

Since it was established that integration of inventory control, procurement, information technology and Warehouse management information systems has been established to have a significant effect on healthcare performance, the study recommends the management of the public hospitals in Nimba County and Liberia at large, to enhance its implementation so as to further realize its impact at higher levels. Among the practices to put more emphasis on are putting in place practices aimed at ensuring availability of data, timeliness and data completeness can significantly improve healthcare performance. Supply chain agility in public institutions and healthcare is a critical factor in ensuring effective and efficient healthcare delivery. Several factors play a significant role in influencing the agility of the supply chain in these sectors and consequently affect healthcare performance. The researcher recommends the following based on the study objective:

Referring from the study objective one, the researcher recommends the following:

Implement an Inventory Management System: Invest in a robust inventory management software system that allows for real-time tracking of inventory levels, reordering, and automated alerts for low-stock items.

This system should be user-friendly and tailored to the specific needs of healthcare facilities in Nimba County, Liberia.

Regular Training and Capacity Building: Train healthcare staff on best practices in inventory management. This includes proper record-keeping, data entry, and understanding inventory turnover rates. Continuous capacity building is crucial to keep staff updated on the latest techniques and technologies in Nimba County.

Regular Audits and Stock Checks: Conduct regular physical audits and stock checks to identify discrepancies between recorded and actual inventory levels. This helps in identifying and rectifying issues promptly.

For the second objective, the researcher recommends the following:

Supplier Database: Develop and maintain a comprehensive database of qualified and reliable suppliers, including local vendors, to promote competition and reduce procurement costs.

Implement a vendor performance evaluation system to assess supplier performance and make informed procurement decisions.

Budget Transparency: Improve transparency in the budget allocation process for healthcare procurement to prevent misappropriation of funds.

Ensure that budgets are realistic and sufficient to meet the healthcare needs of the population.

Standardization: Standardize the procurement of medical equipment, pharmaceuticals, and supplies to simplify the procurement process and ensure quality and cost-effectiveness.

Establish a central medical equipment and pharmaceuticals procurement agency to leverage bulk purchasing power.

For the three objectives this study recommends the following:

Invest in robust IT infrastructure, including high-speed internet connectivity, reliable power sources, and hardware upgrades. Ensure that healthcare facilities have access to uninterrupted power and internet to support IT systems.

Develop mobile applications for healthcare providers and patients. These apps can support appointment scheduling, medication reminders, and access to health information.

Create supportive policies and regulations for IT adoption in healthcare. Provide financial incentives for healthcare institutions that invest in IT infrastructure and systems.

For the fourth objective, this study recommends the following:

Storage Conditions: Ensure proper storage conditions, especially for temperature-sensitive items. Install climate control systems, if necessary, to maintain the required temperature and humidity levels for pharmaceuticals and other sensitive supplies.

Regular Audits and Inspections: Conduct routine audits and inspections to verify the accuracy of inventory records and check for damaged or expired items. This helps in preventing stock outs and wastage.

First-In, First-Out (FIFO): Implement the FIFO method to ensure that older supplies are used first, reducing the risk of items expiring before use.

5.4. Areas for Further Study

Contextually, the study focused on public hospitals based in Nimba County Liberia, which delimits the contextual scope and presents a contextual research gap for other studies. Therefore, there is a need for future studies to widen the scope to other counties other than Nimba as to have in-depth empirical evidence regarding integration of supply chain management systems and healthcare preference in public hospitals in Liberia.

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Appendices

Appendices 1. Questionnaire Dear Respondent,

I am JAMES MEHN, a student at the University of Kigali, Rwanda with Reg. No: MBA /AF/22/01/6836. I have brought this questionnaire to enable me as the researcher to collect data; this research will enable successful completion of my studies at University of Kigali as a requirement for every student before graduating in partial fulfillment of the requirements for the award of the Master of Procurement and Supply Chain Management of the University of Kigali. The questions asked in this section will be used for dissertation purpose only. The information that will be gathered on the topic: Factors Affecting Supply Chain Agility In Public Institutions Towards Healthcare Performance: Case Study of Nimba County will not be used in any other way and will be confidential. Kindly therefore respond to each of the questions below:

SECTION I: GENERAL INFORMATION ON RESPONDENTS TO QUANTITATIVE DATA

The following questionnaire will be used to collect quantitative data.

1. Please tick the appropriate response for each question below.

Physician Physician Assistant Administrator

Administrative Support

Clinical Support
 Environmental Health Technician
 Dentist
 Lab Technician
 Midwife Registered Nurse Pharmacist Pharmacy workers
 Public Health Specialist Social Worker

2. GENDER

Male Female

3. WORKING EXPERIENCE 1-4 Years

5-8 Years 9-12 Years
 12 Years and Above

4. Level of education:

- Secondary level
- Bachelor’s degree
- Master’s degree:
- PhD degree:
- Other (please specify) PART I:

FACTORS AFFECTING SUPPLY CHAIN AGILITY IN PUBLIC INSTITUTIONS AND HEALTHCARE PERFORMANCE:

1. To assess inventory control on the supply chain agility in public institutions and healthcare performance Use the following Keys to answer:

Use the following Key to answer: Strongly agree, Disagree, Neutral, Agree and Strongly Agree (Write the most appropriate number representing key words mentioned)

	Strongly agree	Disagree	Neutral	Agree	Strongly Agree
	1	2	3	4	5
Is there applied Inventory control strategy at your health facility?					
Doses the inventory targets safety stocks level at your facility.					
Are there clear inventory targets by components for your health facility					
Is there accountability for Inventory targets at your facility					

Are the inventory targets related to a demand estimated for your health facility					
Do all goods have catalog for supply in your health facility					

To determine effects of procurement management on supply chain agility in public institutions and the healthcare performance

	Strongly agree	Disagree	Neutral	Agree	Strongly Agree
	1	2	3	4	5
Are there some of the most procuring factors to consider when negotiating with a potential supplier in your health facility					
Does Procurement double check the goods procured whether ordered goods are substandard from supplier at your facility					
Has there been a situation in procurement where a supplier was not meeting quality standards in your health facility.					
Is there mechanism dealing with suppliers in case suddenly raise in prices of products at your facility?					
Have been a time when you successfully managed a complex procurement process in your health facility.					
Does your institution have best procurement method in place for negotiating with a supplier in your health facility					

Use the following Key to answer: Strongly agree, Disagree, Neutral, Agree and Strongly Agree(Write the

most appropriate number representing key words mentioned)

To examine Information technology on supply chain agility in public institutions and healthcare performance

Use the following Key to answer: Strongly agree, Disagree, Neutral, Agree and Strongly Agree(Write the most appropriate number representing key words mentioned)

	Strongly agree	Disagree	Neutral	Agree	Strongly Agree
Does greater knowledge and visibility across the supply chain benefit to utilizing information technology in logistics					
Does the effective and efficient utilization of information technology for logistics management brings importance of analytical thinking					
Are information technology suitable for decision making in supply chain depending upon data associated with decision support systems in supply chainmanagement					
Does network through information technology transmit signals that pinpoint the exact location of an object in supply chain management					
Are information technology suitable for decision making in supply chain depending upon data associated with decision support systems in supply chainmanagement					
Is there the measuring stock for logistics information technology in the supply					

chain agility towards healthcare performance					
Does the integration of information technology systems affect the overall agility of healthcare in responding to dynamic in your facility?					

To determine warehouse management on supply chain agility in public institutions and towards and healthcare performance

Use the following Key to answer: Strongly agree, Disagree, Neutral, Agree and Strongly Agree (Write the most appropriate number representing key words mentioned)

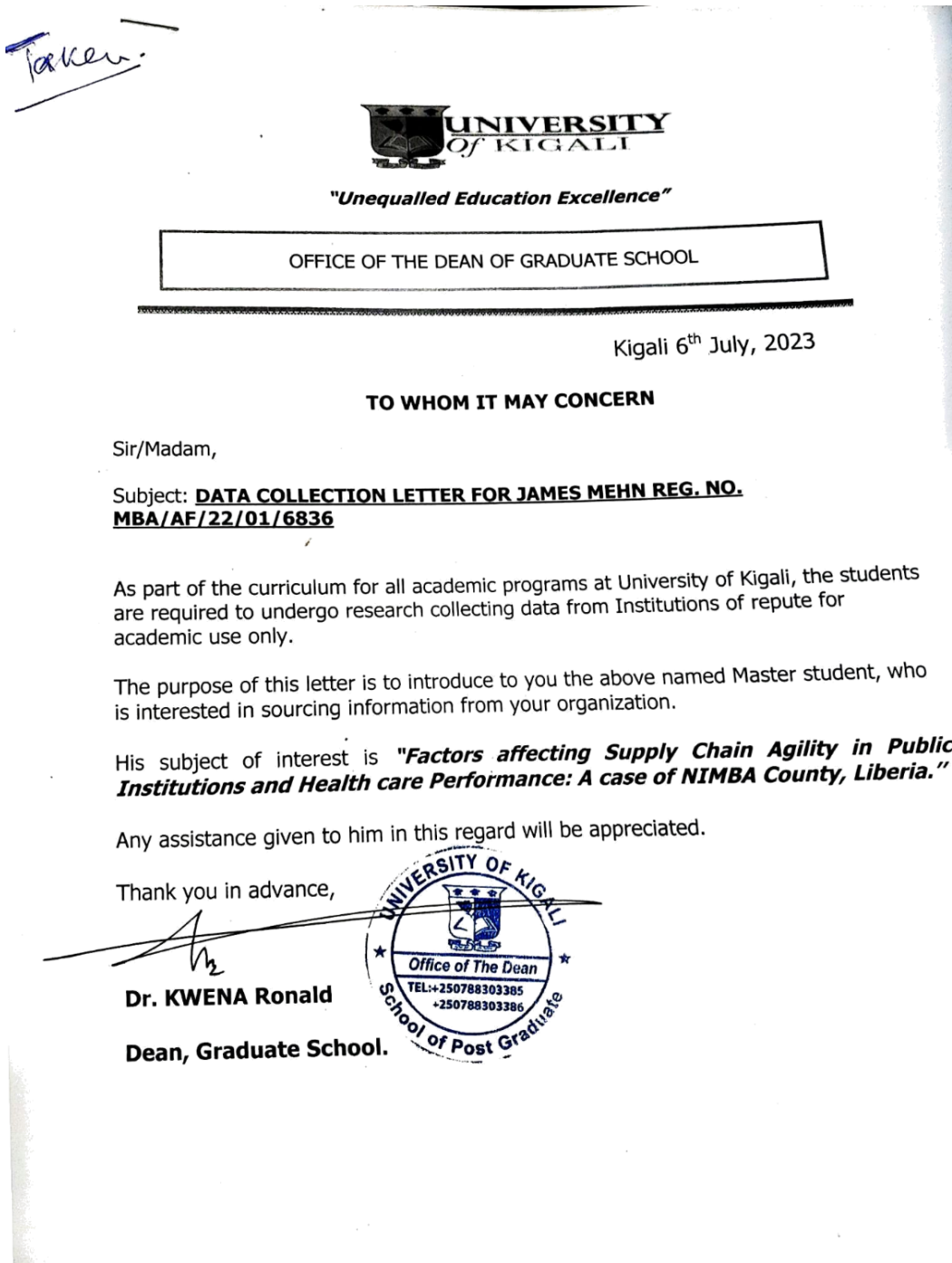
	Strongly agree	Disagree	Neutral	Agree	Strongly Agree
Doses your facility has a well-defined warehousing management and planning strategy in place?					
Is order sorting and packing part of the challenges facing your facility?					
Depending on the warehouse management, do all orders be sent to the warehouses automatically					
Does your warehouse have some basic warehouse management equipment and technology in place?					
Do accessibility and preference routes in supply chain be optimized by chosen product locations be placed in respective warehouses?					
Do shipped products be assigned to a warehouse representative and easily split into cycle counts for logistics					

Healthcare preference, dependent variable Reliability

Use the following Key to answer: Strongly agree, Disagree, Neutral, Agree and Strongly Agree(Write the most appropriate number representing key words mentioned)

	Strongly agree	Disagree	Neutral	Agree	Strongly Agree
	1	2	3	4	5
Does training and competency contribute to the reliability of healthcare in delivering patient care in your facility?					
Does resource allocation and funding impact the reliability of medical supply chain preference at your facility?					
Does implementation of quality assurance and performance measurement influence reliability of healthcare in your facility?					
Responsiveness					
Do organizational structure, resource allocation, and communication strategies influence the responsiveness in your facility?					
Do cultural and societal norms affect patients' perceptions of responsiveness in your facility?					
Does technological advancements and digital health solutions contribute to improving responsiveness in your facility?					
Efficiency					
Does supply chain resilience intersect with agility in ensuring efficient healthcare performance, especially during crises, at this facility?					
Does supply chain agility impact the overall performance efficiency of healthcare at this facility?					
Do collaborations and partnerships among various stakeholders within the public healthcare supply chain enhance overall agility and performance efficiency?					
Timeliness					
Does supply chain agility contribute to the					

timeliness of medical supply delivery in your facility?					
Do disruptions (e.g., pandemics, natural disasters) impacts the timeliness of medical supply delivery in supply chain natively impacts your facility?					
Can demand forecasting accuracy impact the timeliness of medical supply chain activities in your facility?					



Taken.



"Unequalled Education Excellence"

OFFICE OF THE DEAN OF GRADUATE SCHOOL

Kigali 6th July, 2023

TO WHOM IT MAY CONCERN

Sir/Madam,

Subject: **DATA COLLECTION LETTER FOR JAMES MEHN REG. NO. MBA/AF/22/01/6836**

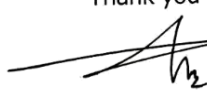
As part of the curriculum for all academic programs at University of Kigali, the students are required to undergo research collecting data from Institutions of repute for academic use only.

The purpose of this letter is to introduce to you the above named Master student, who is interested in sourcing information from your organization.

His subject of interest is ***"Factors affecting Supply Chain Agility in Public Institutions and Health care Performance: A case of NIMBA County, Liberia."***

Any assistance given to him in this regard will be appreciated.

Thank you in advance,



Dr. KWENA Ronald
Dean, Graduate School.



N	S	N	S	N	S			
10	10	220	140	1200	291			
15	14	230	144	1300	297			
20	19	240	148	1400	302			
25	24	250	152	1500	306			
30	28	260	155	1600	310			
35	32	270	159	1700	313			
40	36	280	162	1800	317			
45	40	290	165	1900	320			
50	44	300	169	2000	322			
55	48	320	175	2200	327			
60	52	340	181	2400	331			
65	56	360	186	2600	335			
70	59	380	191	2800	338			
75	63	400	196	3000	341			
80	66	420	201	3500	346			
85	70	440	206	4000	351			
90	73	460	210	4500	354			
95	76	480	214	5000	357			
100	80	500	217	6000	361			
110	86	550	226	7000	364			
120	92	600	234	8000	367			
130	97	650	242	9000	368			
140	103	700	248	10000	370			
150	108	750	254	15000	375			
160	113	800	260	20000	377			
170	118	850	265	30000	379			
180	123	900	269	40000	380			
190	127	950	274	50000	381			
200	132	1000	278	75000	382			
			210	136	1100	285	100000	384

Krejcie & Morgan (1960)