


DETERMINANTS OF SUPPLY CHAIN AGILITY AT ZAMBIA MEDICINES AND MEDICAL SUPPLIES AGENCY IN LUSAKA DISTRICT

BY

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A Dissertation submitted to the University of Zambia in partial fulfilment of the requirements for the award of the Degree of Master of Science Operations, Projects and Supply Chain Management

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DECLARATION

I, **Chansa Mwango** do hereby declare that this work is my original work achieved through personal reading and research. This work has never been submitted to the University of Zambia or any other Universities. All sources of data used and literature on related works previously done by others, used in the production of this Dissertation have been duly acknowledged. If any omission has been made, it is not by choice but by error.

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APPROVAL

This Dissertation by **Chansa Mwango** is approved as a partial fulfilment of the requirements for the award of the Degree of Master of Science Operations, Projects and Supply Chain Management.

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ABSTRACT

Zambia Medicines and Medical Supplies Agency (ZAMMSA) has a responsibility to supply medicines and medical supplies to health facilities (Government of The Republic of Zambia, 2019). Although preliminary factors affecting Supply chain agility (SCA) have been reported, it is not well established how SCA is affected. The current business environment is characterized by constant change, turbulent and volatile markets, shorter product life cycle, and increased demand uncertainty. Therefore, attainment of quality and affordable healthcare is dependent on the ability of the healthcare organizations to promote resilience and mitigate operational and quality risks through support of dynamic capabilities that reduce negative impact of supply chain instability and disruptions. The aim of this study was to assess the determinants of Supply Chain Agility at Zambia Medicines and Medical Supplies Agency (ZAMMSA) in Lusaka District. The researcher used a mixed method, descriptive approach. Taro Yamane formula was used to determine the sample size of 80 respondents at 0.05 level of significance from the total population of 150 members of staff. From the distributed 80 questionnaires, only 67 responded giving 83% as response rate. Purposive sampling was used on senior management as key informants who were interviewed and random sampling for other staff. Stata, a statistical software was used to analyse descriptive and inferential statistics while thematic descriptive framework was used to analyse qualitative data. The findings showed the independent and dependant variable were positively correlated as they had a p value of less than 0.05. Overall, the new mandate for ZAMMSA is to procure medicine and medical commodities though still facing administrative bottlenecks which is affecting SCA. The study revealed that supply chain agility is effective in managing an organization's supply chain in Zambia. The study deduced that, the sooner the procurement mandate is finalized and stabilizes the model using the four objectives will effectively and efficiently take-off. Therefore, the Ministry of Health/cabinet should ensure that ZAMMSA takes up its full mandate, by creating a robust delivery system to the health facilities and hubs, introduce a buffer supply chain management system to avoid expiry drugs. The agency should comprehensively and intentionally adopt the combination of market sensitivity, swift response, process integration and flexibility as a model for supply chain agility; and future studies should triangulate the SCA model of ZAMMSA from the perspective and experiences of the demand side and when or if possible from the supply end as well should be under taken.

Keywords: Agility, Effects, Stock outs and Supply Chain Management

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DEDICATION

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ACRONYMS AND ABBREVIATION

ELMIS : Electronic Logistic Management and Information System

IDC : Industrial Development Corporation

KEMSA : Kenya Medical and Supply Authority

MENA : Middle East and North Africa

OODA : Observe, Orient, Decide, Act

SCA : Supply Chain Agility

SOE : State-Owned Enterprise

ZAMMSA : Zambia Medicines and Medical Supplies Agency

CHAPTER 1

INTRODUCTION

1.1 Introduction

The chapter provides a background to the topic area specific to the study title. The background outline is on agility supply chain and the Zambia Medicines and Medical Supplies Agency (ZAMMSA). Other key sections of the chapter is statement of the problem, study objectives, study questions, significance of the study, scope of the study, definition of key operational terms, organisation of the report and chapter summary.

1.2 Background

Supply chain being an integral part of the business highly contributes to the success of organizations or sectors. Morever as these conditions became the norm, supply chain practitioners and researchers alike have turned to the concept of agile supply chain in their quest for a sustainable source of competitive advantage and a measure of service delivery to their customers.

As the business environment experiences constant change there is need for organization's to incorporate agility to its supply chain. Emergence of a new business era characterized by continuous and unpredictable changes with a focus on core competence and mass customization has forced companies to find flexible ways to meet patient and customer demand (Patel and Sambasivan, 2022a).

1.2.1 Supply Chain Agility

According to (Harrald, 2006) agile supply chain has been recognized as a competitive strategy for companies to survive and prosper. Agility is distinctively a business-wide capability that embraces organizational structures, information systems, logistics processes, and in particular mind-sets (Adobor and McMullen, 2018). Agility focuses on maintaining good productivity under pressure of uncertainty (Harrald, 2006). Thus the goal in achieving agility is to establish a seamless supply chain in which all players think and act alike.

Poor supply chain management can ultimately determine the success or failure of any business that it delivers in its chosen market. It is no wonder that most organizations are bent towards designing supply chain to be patient or customer centric. The continuous transfer of power in

the distribution channel from the producer to the consumer, has a conventional philosophy which is termed as agile supply chain (Abdelilah, et al., 2018). Instead of designing supply chain from the factory outwards, the challenge is to design them from the customer backwards (Ceuta Group, 2019).

In the past, the ground rules for market success were obviously consisting of strong brands backed up by large advertising budgets and aggressive selling but this formula now appears to have lost its power and touch to its respective customers (Chu and Lee, 2006). Instead, the argument is heard, companies must recognize that increasingly it is through their capabilities and competencies that they compete. Essentially, this means that organizations are becoming more responsive to customers and consumers by managing their core processes in an agile manner that is competitive. These core processes encompass activities such as agile product development and agile order fulfilment to its customers (Msh, 2012).

Agile and supply chain are inherent to form agile supply chain, which is brought out as a network of a different body integrated to streamline material, information and financial focusing on speed, flexibility and performance (Abdelilah, et al., 2018). Agile supply chain highlights the promptness and the degree to which a firm can adjust its supply chain speed, destinations and volumes to its customer's which matters most in this dynamic business environment (Msh, 2012; Leung et al., 2016). The agile supply chain is method of responding to customers' demand more effectively, in which logistics capabilities focus on individual end-consumer demand (Anesan *et al.,* 2018).

The essential difference in an agile supply chain is the development of the ability to respond to a range of possible customer needs in advance and hence increasing the value that logistic processes create for customers (Abdelilah *et al*., 2018). Most organizations are forecast-driven rather than demand driven, therefore they have little direct feed-forward from the marketplace in terms of data on actual customer requirements. Hence organisations are forced to make forecasts based on past sales or shipments which they convert these forecasts into inventory.

Agile supply chain has been noted as a means of handling change which increases customer responsiveness and aims at understanding market turbulences. SCA is considered to be one of the fundamental characteristics of successful supply chains in today's turbulent and increasingly in a competitive environment (Agarwal *et al*., 2007; Al-Shboul, 2017; Aslam *et al*., 2018; Braunscheidel and Suresh, 2009)) Al et al., 2020). Furthermore, it has emerged as

the dominant competitive vehicle for organizations in such an uncertain and ever-changing business environment, and has been heralded as the business paradigm of the 21st century (Patel and Sambasivan, 2022a). Achieving a competitive advantage in a rapidly changing business environment, must bring organisations into line suppliers and customers to coordinate operations so that together they can achieve a level of agility beyond that of competitors.

A comprehensive definition of agile supply chain cannot be developed unless the multidimensionality of the concept is fully explored thus different scholars in various disciplines give emphasis to varying aspects of agility and this is reflected in divergent views of what supply agility is, by (Braunscheidel and Suresh, 2009; Gligor et al., 2013; Li et al., 2008; Swafford et al., 2006; Russell and Swanson, 2019). To facilitate an in-depth understanding of the concept, the sports science and military science theoretical bases are investigated, in addition to the agility-related literature within the business domain. The effort culminates in the identification of five firm agile supply chain dimensions which are market sensitivity, process integration, flexibility and swift response. The identification and classification of the dimensions of agility enables the development of a comprehensive understanding of agile supply chain (Harrald, 2006). Therefore, compellingly it is noted that all of these definitions and descriptions of agility put together, has no one of them that subsumes the others but puts across some commonalities, distinctions, and gaps depending on the industry.

1.2.2 Stock Outs

Stock-outs of essential medicines at the clinic level are an important and widely acknowledged public health problem in sub-Saharan Africa with a recognized negative impact on morbidity, mortality and disease epidemiology (Leung et al., 2016). However Sub-Saharan African is not the only one facing the medicine and medical supplies challenges but this is a global issue which is affecting all countries (Cynthia et al., 2020). Some of the cited possible causes according to (Leung et al., 2016) include procurement financing and processes, supply capacity, communication and road infrastructure, distribution resources and planning methods, personnel staffing and training, coordination among stakeholders and the impact of stock-outs on patients and staff which is more severe.

Research on stock-outs strives to quantify the extent and severity of shortages of medicines and medical supplies. It has therefore identified which drugs and medical products are most

commonly depleted, through research on tracer medicines that represent procurement and provisional challenges.

A growing literature reveals gaps between the government policy and legislative commitments to improving public healthcare, and on-the-ground challenges that continue to obstruct public access (Msh, 2012). The management of medical stocks is a multi-dimensional issue especially that it involves ordering, receiving, dispensing and reporting which depends on the structure and staffing of facilities (Hodes et al., 2017).

A public outcry of stock outs of medicines at health facilities is persistent (Mwamba, 2022). Though a substantial fraction of stock-outs observed in common situations involves demand seasonality and facility access interruptions (Bright et al., 2020) the public just want a continued access to drugs every time they are diagnosed and prescription given. A Greater number of patients in Zambia receive medicines freely through the public health system. (Msh, 2015) The supply chain Health system involves procurement of medicines with financing from the Government of the Republic of Zambia, external donor support (Yadav, 2015), primary monthly distribution from a national warehouse in Lusaka at the agency to approximately 70 district stores and 20 hospitals, and secondary monthly distribution from district stores to approximately over 1500 health clinics or posts (Mwamba, 2020).

While the government is committed to improving access to medicines and medical supplies, the procurement and distribution of medicines and medical supplies remains inadequate in many health districts thereby causing stockouts. The outcome of stockouts is prolonged sicknesses or aliments and in most cases immature death. Unfavourable and uncomfortable conditions for patients were medical equipment is not available, for instance were patient beds are in-adequate and patients have to sleep on the floor.

1.2.3 Zambia Medicines and Medical Supplies Agency

Zambia Medicines and Medical Supply Agency (ZAMMSA) is a Government of the Republic of Zambia agency and is part of the Industrial Development Corporation (IDC) companies. The agency is responsible for procuring, storing and distributing of medicines and medical supplies, re-packaging and re-labelling medicines and medical supplies, ensuring timely availability of medicines and medical supplies in public health facilities and facilitating selection, forecasting, quantification and supply planning of medicines and medical supplies for health facilities among many other functions (Government of The Republic of Zambia, 2019). The agency is

funded by the government through the Ministries of Finance and Health but is independently managed by its own board appointed by the Ministry of Health. As an establishment under the Company Act of 1976 as Medical Stores Limited existing in accordance with the aforementioned act, Zambia Medicines and Medical Supplies Agency was restructured under the Zambia Medicines and Medical Supplies Agency Act, 2019 (Government of the Republic of Zambia, 2019).

The practices of the Agency mirror that of the private sector characteristics despite it not being a profit-making entity. Therefore, it is evident that in Zambia the supply chain of pharmaceutical products is dualist involving the public and the private sector. Though the agency has cooperating partners which operate as non-governmental organisation, the bi-lateral and multi-lateral organisations all supply and distribute medicines and medical products through the state-owned agency (Msh, 2012). The private sector supply and distribution is fragmented with limited capacity and presence around the country, this interrupts consistent supply of medicines and medical products on the market affecting end-users that depend on retail supply when there are stock outs in the public health facility of a particular drug or drugs. Though retailers are able to stock different drugs and medical supplies many patients are not able to afford the purchases as these prices are usually competitive.

ZAMMSA has an obligation to ensure that there is sustainable supply of essential medicines and other pharmaceutical commodities in all public health facilities to control morbidity and avert mortality incidents (ZAMMSA act, 2019). Indicated in its strategic plan, ZAMMSA is unrelentingly improving its services of delivering essential commodities by upgrading its management systems. This is aimed at reducing stock outs episodes and lead time between ordering and delivery of commodities (ZAMMSA act, 2019).

1.3 Statement of the Problem

Zambia Medicines and Medical Supply Agency (ZAMMSA) is responsible for procuring, storing and distributing, re-packaging, re-labelling and ensuring timely availability of medicines and medical supplies in public health facilities (ZAMMSA act, 2019). With this new mandate, ZAMMSA underwent restructuring to enhance its operations and this involved revisiting the supply chain processes. It was expected that lead time between ordering and delivery would improve, stock outs of medicines and medical supplies would end, however, stock outs have persisted.

Despite all these changes, there has been a number of complaints from public medical facilities and patients over shortages of medicines and medical supplies across the country (Lusaka Times, 2020). This however was disputed by the health minister claiming it was an artificial shortage as those entrusted with the responsibility were not communicating with ZAMMSA (Times of Zambia, 2020).

This problem has negatively affected communities and patients specifically those on Anti retro-viral treatment (ART) which poses a threat on their lives due to inconsistencies in drug uptake and likewise, this has raised concerns on the increasing number of deaths during the shortage of medicines and medical supplies (Mwamba, 2022). Hence a study to establish factors affecting supply chain agility at ZAMMSA could help improve supply of medicines and medical supplies in its future service delivery.

Existing studies in Zambia have primarily focused on particular industries such as agriculture, aviation and manufacturing firms leaving a crucial research gap concerning the factors of agility in supply chain. This study seeks to link this gap by providing a comprehensive analysis of factors affecting Supply chain agility and the service delivery of medicines and medical supplies in public facilities.

1.4 Main Objectives

To determine the factors affecting Supply Chain Agility at ZAMMSA in Lusaka.

1.5 Research Objectives

i) To establish the current state of supply chain agility at ZAMMSA.
ii) To institute the linkage between stockouts with supply chain agility at ZAMMSA.
iii) To recommend strategies that can be employed in Supply Chain Agility at ZAMMSA.

1.6 Research Objectives

i) What is the current state of supply chain agility at ZAMMSA?
i) How does supply chain agility link up with stockouts at ZAMMSA?
ii) What Supply Chain Agility strategies can be employed at ZAMMSA?

1.7 Significance of the Study

It is hoped that the findings of the study will assist management (the logistics department) of Zambia Medicines and Medical Supply Agency (ZAMMSA) to address the Short-comings in its service delivery; challenges experienced in supply chain agility of health care commodities, and providing guidance in the up-scaling of its activities for enhanced service delivery.

Further it is expected that stakeholders such as government might find the study valuable in the implementation of policies aimed at achieving effective supply chain agility in public organizations. The policy makers would also gain knowledge of supply chain agility dynamics and the responses that are appropriate and specific for both governmental and non-governmental organizations, they may therefore obtain guidance from this study in designing appropriate policies that can ensure effective logistics management especially in the health and medical sector.

Finally, the study may also be useful to scholars and academicians. The findings will add knowledge on the application of value Chain theory to explain the Supply Chain Agility on medicines and medical supplies at ZAMMSA. Consequently, this may provide information to potential and current scholars on supply chain agility and those who wish to use the findings as a basis for further research on supply chain agility both in the public and private health sector.

In summary, this study wheels considerable significance at various levels which looks at improving agility which is key in the efficient running of supply chain at ZAMMSA. The research will also contribute to the academic discourse and will inform policy decisions. Ultimately, the study's impact encompasses a goal by ensuring that supply chain agility drops down to meet demand in the service delivery of providing medicines and medical supplies to Patients.

1.8 Scope of Study

The focus of the research will be on the operations and gaps faced by Zambia Medicines and Medical Supplies Agency. The research aims to provide a comprehensive understanding of the factors affecting Supply Chain Agility at ZAMMSA.

The study will be conducted at the ZAMMSA headquarters in Lusaka and will be limited to ZAMMSA. A specific target of staff from lower levels, middle management and senior

management will be engaged this is to allow for an in-depth quest which is intended to inform key stakeholders. The insights will drive management and policy makers to monitor and review the operations of ZAMMSA after optimisation. The emphasis on Supply Chain Agility will be in relation to achieving improved service delivery that meets demand of the health facilities and hubs by ZAMMSA.

1.9 Definition of Key operational terms

Below are the key definitions used in this study:

Agility: Is defined as business-wide capability that embraces organizational structures, information systems, logistics processes and, in particular, mind-sets.

Effects: A change exerted by factors consist of market sensitivity, process integration, flexibility, swift response and optimisation of warehouse and transportation to improve supply chain of medicines and medical supplies.

Stock outs: Is defined as the complete absence of a required medicine at a storage point or delivery point.

Supply Chain Management: Is the planning and management of all activities involved in sourcing and procurement, conversion and all logistics management activities.

1.10 Organisation of Report

The study is outlined as follows:
Chapter One: The chapter introduced and presented the topic area specific to the study title. Further, study objectives, study questions, significance of the study, scope of the study, definition of key operational terms, organisation of the report and chapter summary.

Chapter two: Under this chapter a detailed review on key studies on the topic area that was performed. Theoretical perspective, theoretical and conceptual framework, and empirical review were conducted.

Chapter Three: This chapter demonstrated how the study will be conducted to generated findings to respond to the study questions and attain the study objectives. Mixed method was presented as well as data analysis, and explained how the ethical consideration was acquired.

Chapter four: Presentation of the study findings was done under this chapter. Only key study findings were presented. This chapter showed findings according to the ZAMMSA context.

Chapter Five: A discourse on the study findings and other studies on the topic area was conducted. This was a contrast of study findings and other studies to demonstrate the contribution of this study to the topic area's body of knowledge.

Chapter Six: This chapter was a concise conclusion of the study findings. It also presented the implication of the findings and recommendations for policy considerations and suggestions for future studies.

1.11 Chapter Summary

The chapter described the background of the topic area specific to the study title. Smart objectives of the study were listed to indicate precise expectation of the study outputs. The significance of the study was indicated so that the study findings will be used to design a policy brief that would inform on reviewing the Supply Chain at ZAMMSA. Further the chapter described that the scope of the study will be on medicines and medical supplies on the continuum of Supply Chain Agility in relation to market sensitivity, process integration, flexibility, and swift response components. The next chapter is a collated review of key literature on the topic area aligned to the study objectives.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

The previous chapter described the background of the study specific to the study title. This chapter provides a detailed discourse to the topic area. It focuses on the theoretical review, conceptual frame work and a review of theory related to the variables of the study and empirical review.

2.2 Theoretical Review

The goal of this style is to look at the body of thought that was formed around a certain topic, concept, theory, or phenomenon (Fink, 2014). The theoretical literature review aids one in the identification of current theories, their linkages, the extent to which existing theories have been studied, and the development of new hypotheses to be tested. This form is frequently used to develop current supply chain agility concepts and theories that have been applied to them. The unit of analysis, according to Abend, (2013), might be a single theoretical notion or an entire theory or framework.

2.2.1 Supply Chain

A supply chain encompasses all parties engaged in completing a customer's request, whether directly or indirectly. Oloruntoba and Kovács, (2015) labels supply chain as a system of companies, people, actions, and information engaged in transporting products and services from source to customer.

The mapping out of a supply chain is one of the most critical activities in the strategic planning process. The importance of precisely drawing out the supply chain stems from the fact that it assists a company in defining its own market and determining its future direction. When developing a corporate strategy, a company must frequently determine whether to concentrate on a single line of business or diversify into similar or unrelated industries. Each stage of the supply chain, such as raw material extraction and manufacturing, is essentially its own business. Supply chain therefore, enables a corporation to comprehend those involved at each level, by providing some insight into the attractiveness or competitiveness of the sector that it may choose to enter in the future (Rahiminezhad *et al.*, 2016). Supply chain is very important in

this regard and to this study because it will assist in distinguishing the generic concept of supply chain from supply chain agility.

2.2.2 What is Agility

The concept of agility is borrowed from sport and military which defines agility as the ability to decelerate, accelerate, and change direction while retaining good body control and minimizing transition time (Ali et al., 2017). Agility is further explained as business-wide capability that embraces organizational structures, information systems, logistics processes, and in particular mind-sets (Anesanb *et al.*, 2018). Though agility focuses on maintaining good productivity under pressure of uncertainty (Aldrighetti, *et al.*, 2021), it is also pronounced as an organization's capacity to survive in a rapidly changing and uncertain business environment (Anesanb *et al.*, 2018). Ali et al., 2017 points out that agility is thought to be the key deciding element for success in sports, aside from sport-specific talents. The conventional push-ups, sit-ups, and 1.5- to two-mile run are being replaced with improved speed, agility, and combat conditioning in military fitness exams (Ali *et al*., 2017). This training is also employed in the pre-hiring stages of law enforcement. Leasers need agility to manage their businesses and organizations in today's dynamic world. Agility is a collaborative effort. The finest leaders accomplish agility through influencing others to collaborate successfully (Aronsson *et al.*, 2011). Firms in highly volatile or innovative markets prefer rapid-reaction approaches to medium- and long-term supply chain configurations in order to retain the ability to act quickly and seize new opportunities (Shekarian et al. 2020).

With the concept of agility in the sports world, one can deduce that agility is a well-rounded capability that would facilitate adaptation by firms so as to curb uncertainty and respond appropriately.

2.3 Agility in Supply Chain

According to Yarosen *et al*., (2019) agility is the ability of the supply chain team and its members as a whole to quickly adjust the network and operations to changing and volatile consumer demands. While the ability of an ecommerce supply chain to respond rapidly and efficiently to changes in the market and consumer demands is referred to as supply chain agility (Ali, *et al.*, 2017). Agility further foresees, resists, and recovers from unexpected and disruptive occurrences (Anesanb, *et al.*,2018). To have an agile supply chain, an ecommerce company has to be able to effortlessly optimize and enhance logistical operations, implement cutting-

edge technologies and automation with ease, and access real-time data and gain visibility into operations. Other characteristics, included are adaptability, responsibility, expertise, and rapidity, are required to achieve supply chain agility (Bvuchete, *et al*., 2018).

In the face of unanticipated failures and uncertain demand, having the correct technology and processes in place is what keeps consumers delighted and an ecommerce firm financially safe. Therefore agility has always been vital in business, and seems to be more decisive in ecommerce as it satisfies consumer expectations and lowers operating expenses.

2.3.1 Attributes of Supply Chain Agility

This section described the attributes of supply chain agility. The context of agility on supply chain borrowed from sports and military profession and technology. The section labours to bring the understanding of supply chain agility.

2.3.1.1 Alertness

The capacity to notice changes, opportunities, and dangers rapidly is the first component of agility (Bvuchete, *et al*., 2018). Alertness is a fundamental component of agility in both sports and military science. Agility in athletics refers to a player's ability to shift his or her body orientation fast, and attentiveness is an important aspect of that talent (Chowdhury and Quaddus, 2016). The United States' national protocol (200) evaluates agility performance in team-sport athletes for example, by acknowledging the importance of alertness and claims that the athletes' ability to move with agility during a game is influenced by factors such as visual processing, timing, reaction time, perception, and anticipation. The awareness dimension of agility is analogous to the loop's "observe" and "orient" stages, and it is required for an agile reaction quote.

In supply chain of medicines and medical supplies, the same idea applies. Before a company can react to changes in its environment, it must first recognize them. Companies that are really agile have established a high level of vigilance. Recognizing developing market trends, listening to clients, exchanging information with suppliers, monitoring demand, and sensing approaching disruptions, whether natural or man-made, are all part of the awareness dimension (Wong *et al.*, 2020).

2.3.1.2. Accessibility

The second factor which is accessibility works hand in hand with alertness. The capacity to swiftly retrieve important information is defined as accessibility (Gligor *et al.*, 2021). According to a military study (Chowdhury and Quaddus, 2016), the capacity to respond quickly is dependent on the availability of relevant data. Due to the dynamic nature of warfare, troops must be able to swiftly obtain information on both enemy and friendly forces' positions in order to coordinate and execute their strategy which gives them advantage over their enemy. Agility studies in sports science shows that high-performing athletes may begin a change of direction before their opponent delivers the ball. Such highly competent sportsmen are capable of foreseeing the opponent's behaviour before it occurs. This is due to some players' capacity to retain knowledge about their opponent and the sport as a whole (Gligor *et al.*, 2019).

Once a corporation exudes its alertness in their capacity to notice change, the corporation must be able to swiftly access relevant data in order to choose the best course of action. Access to information across the supply chain is therefore critical for supply chain agility. Further members of the supply chain must at the very least communicate real-time demand, inventory, and production data. Without information this is difficult to accomplish since it includes data from hundreds of sources, firms, geographies, and time periods. Mostly businesses still lack "crazy data accessibility" in real time, which limits their agility. Many companies still rely on their information technology (IT) department to provide reports that take time to prepare and are often restricted to specific formats. Instead, firms that wish to be more nimble should make real-time data available to all employees who might benefit from it within their supply chains, agile organizations have invested substantial resources in enhancing data accessibility (Lemmens *et al.*, 2016).

2.3.1.3 Decisiveness

According to sports science and military science studies, agility is based on decisiveness, or the capacity to make quick judgments based on the information available (Gligor *et al.*, 2019). Researchers in motor learning have isolated athletes' decision-making time in order to assess its impact to agility performance (Gligor *et al.*, 2019). On the other hand the time that passes between the moment a stimulus is delivered to the player and the player's beginning of movement is used to calculate decision-making time this is because alertness moves judgment.

Findings show that athletes with good agility have better decision-making abilities in reaction to their opponents' movements and body positioning (Hosseini *et al*., 2019).

In addition, as the task of agility becomes more complicated, decision-making abilities become more able. The limited link between straight running ability and the ability to do complicated agility tests demonstrates how increasing complexity impacts on athlete's performance. The decision-making component of agility may explain why straight sprinting performance (which requires less decision-making) has little bearing on agility performance. The necessity of decisiveness is widely acknowledged in military science study. The "decide" phase is one of the OODA (observe, orient, decide, act) loop's components and is considered crucial for agility (Gligor *et al.*, 2019). For instance, military pilots undergo extensive training to improve their decision-making abilities, as the quickness with which they make decisions in combat may jeopardize operations and mean the difference between life and death (Sawyerr and Harrison, 2019).

Thus in the business world today, firms must be able to recognize changes promptly (alertness) and obtain essential information (accessibility) inside their supply chains. They must also have the ability to make firm judgments about how to respond to change (decisiveness). The realisation of these attributes helps firms to maximum on its operations. More departments and management levels become engaged in choices as organizations become larger and their supply chain networks increase, which eludes slowing down decision making (Novoszel and Wakolbinger, 2022).

2.2.1.4 Speed/ Swift

Agility is predicated on a company's swiftness, or the capacity to execute choices rapidly, once a decision has been made on how to respond to changes (Charles et al. 2020). According to research on the benefits of agility training on sports performance, agility is heavily dependent on the athlete's movement speed. Military study also emphasizes the functions of speed of movement and rapidity of action in enabling agility. In truth, supply chain agility is built on speed. When an organization senses a change in its environment, it gathers relevant data, and makes a firm decision on how to respond, but lacks the capacity to swiftly put that decision into action, therefore the agility cycle breaks (LANGAT *et al.*, 2013).

2.2.1.5 Flexibility

Agility's final dimension is flexibility. Flexibility in the supply chain may be defined as a company's capacity to change its range of tactics and operations to the extent necessary to carry out its plan (Gligor *et al.,* 2019). A sports analogy may be used to demonstrate the need of flexibility in supply chain agility. The range of modifications an athlete may make is determined by the flexibility of their joints. Injury occurs when the athlete's range of motion is exceeded. Similarly, a supply chain functions within a certain range, and that range limits the company's supply chain agility (that is, its capacity to swiftly modify tactics and operations). A supply chain, for example, cannot generate more things faster than its suppliers' as fixed production capacity permits (Mandal, 2018).

2.3 Inventory management in supply chain

One of the most key elements of Supply Chain Management (SCM) is inventory management which tries to efficiently streamline inventories to avoid both gluts and shortages (Muyinda and Mugisha, 2022). Inventory management therefore looks at elements such as inventory, buffering, logistics, storage and technology which closes in issues related to stockouts.

2.3.1 Stockouts

According to Abimbola et al., (2016) stock-outs arise from an inability to manage medical supplies, report shortages, and act swiftly and effectively to prevent their further recurrence. In addition they further add that stock-outs are intertwined with other challenges in the health sector including shortages of healthcare workers, inadequate training, weak oversight and management, and inadequate monitoring and evaluation of clinic data, and inadequate procurement and distribution of medical supplies.

Stock-outs, also known as shortages or complete absence of a particular inventory, in public health facilities stockouts have become a hallmark in a global context (Ahmadi et al., 2022). Stockouts are recorded due to unavailability of drugs or supply at the stage when a patient needs it which may result in a life-threatening situation for a patient.

Major contributors to stock-outs include an absolute shortage of funds; human resources for health issues, including absolute shortages, skill deficits and urban concentration; and inefficiencies and malpractice in the supply chain exacerbated by a lack of reliable information on medicine needs and usage (Wales et al., 2014).

In 2018 a survey conducted revealed that in Europe hospital pharmacists showed that there had been a significant increase in medicine shortages across Europe with 91.8% hospital pharmacists in 2018 experiencing shortages compared to 86.2% in 2014, with 35% experiencing them on a daily basis and 38% on a weekly basis which was a concern (Leung et al., 2016). Stock outs of medicines and medical supplies are a global matter (Muyinda and Mugisha, 2022).

2.5.2 Inventory Management

Inventory management involves striking a balance between inventory investment and customer service according to Heizer and Render (2014). The duo also further highlight that functions of inventory is primarily to decouple various parts of the production process by covering delays that might occur, protects the company from demand fluctuations, provides a selection of customers , takes advantage of quantity discounts and hedges the company against inflation.

Significant to inventory management is the classifying of inventory items and keeping an accurate record. Nirmala et al., (2022) affirms that inventory management and having a control system is a very essential component for a firm and that inventory is estimated as quite possibly the most imperative resources of an endeavour. On the other hand, Xiaoting (2019) asserts that inventory management is the practice of supervising, controlling, storing and utilization of quantities that an organization uses to manufacture the products it sells. Nirmala et al., (2019) also further suggests that stock is fundamental for each association to pledge smooth running of the establishment interaction, diminish the demanding cost of stock, exploit amount discount, stay away from a promising circumstance misfortune on deals, to use and streamline the plant limit and to decrease the general cost.

Therefore, Heizer and Render (2014) emphasises that inventory management offers classification as a measure of importance and allocation of control by underlining the importance of the degree of any given product. This means that items are counted and recorded, and updated on a periodic basis which often is used with ABC analysis to determine the cycle (frequency of counting), eliminates shutdowns and interruptions, and maintains accurate inventory records through periodic and continuous inventory counting system.

However, there are challenges that are caused by inventory management which are; inventory ties up working capital, inventory takes up space, inventory is prone to damage, pilferage and

obsolescence and inventory hides problems (Heizer and Render ; 2014). This then implies that whenever inventory management is not examined then challenges remain hidden.

Though inventory is important an example of Amazon.com a world leader in warehousing and inventory management is however a “virtual” retailer with no inventory, no warehouses, no overhead; just computers taking orders to be filled by others. Perhaps it is worth studying and understanding what Amazon.com does in order to implement some of its strategies Heizer and Render (2014).

2.5.3 Buffering

Buffering is one of the most commonly used mitigation strategies that a firm implements to assist administrators protect their supply chain from any kind of disruptions or risk by keeping sufficient inventory. Bode et al. (2011) argue that a firm responds to supply chain disruptions based on information processing and resource grounded theories. On the other hand, Talluri et al., (2013) discuss that the risk mitigation strategies appropriateness and effectiveness are contingent on the internal and external environment.

According to Silva et al., (2022) material requirements planning (MRP) systems, safety stock and safety time are two well-known inventory buffering strategies to protect against supply and demand uncertainties. Additionally no supply chain can operate without safety inventory buffers as they are required at different levels of the product structure in order to guarantee timely delivery of products and components. Furthermore, safety stock solutions generated during the optimization process are successively evaluated, in terms of the proposed objectives, via a MRP simulation model and a move in directing buffering strategies is cost-effective in approach.

2.5.4 Logistics

The importance of logistics has greatly increased due to reasons such as the increase in the interest and demand for individualized products, the increase in the international trade volume and the interest in e-commerce Yalcin and Daim (2022).

Logistics is therefore concerned with material and material flows. Yan et al., (2022) states that transport and logistics, is the state of a system that are usually characterised by the statuses of vehicles, customer demands and their locations, time windows, and inventory levels. On the other hand Yalcin and Daim (2022) refers to logistics as a management of materials &

information flow from a business down through a distribution channel to the retail store or direct to consumers. Yan et al., (2022) emphasises that logistics makes possible the optimised flow and positioning of goods, materials, information and all resources of an enterprise by incorporating physical distribution management (PDM) which relates to output phase of moving goods. Further, as logistics advance the term third party logistics is sometimes used to indicate that management of the logistics chain is outsourced to a specialist logistics company.

Yalcin and Daim (2022) additionally asserts that aspects such as varying consumer expectations, custom-made product expectation, and the expectation of speed in the supply period have caused great changes in the logistics sector. “It has been seen that logistics services are able to be done in a more realistic way with regular, functional and management dimensions”. Logistics, is a chain of interconnected rings, consists of many components, from transportation to storage, from stacking days to shipment while logistics management is as a task with very delicate balances since the slightest roughness in these chains will adversely affect the whole system. Logistics is the whole process of a product from the first step in production to the last moment when it is delivered to the final consumer (Yan et al., 2022).

2.5.5 Storage

Multi-echelon inventory systems- materials flowing through a system are stored at different points before reaching the customer.

Ahmadi et al., (2022) asserts warehouses can simplify routes and communications by managing medicines and supplies by managing inventory at a healthcare facility and central warehouse. Further the supplies are replenished from the upstream agent to the healthcare facilities and central warehouse. Inventory management also applies storage systems such as pallets, storage cabinets, static shelving, multi-tier racking, double deep racking, mobile storage and mezzanine flooring which easily allows for maintenance and inspection (Ahmadi et al., 2022). Inventory control system plays a very critical role in reducing the risks of product shortage and expiration. The decision of purchasing is usually done centrally thus the central warehouse is responsible for ordering, stocking and replenishing stocks to hospital or health facilities (Ibid).

2.5.6 Technology

Innovation efforts in recent years have largely focused on seeking how countries and companies can improve their socio-economic and technological performance. There are

innovations that have taken place which provides significant benefits, particularly with the dynamism of the effort at the point of using and sending the information, to use the required information at the desired time and in the desired way (Yalcin and Daim, 2022).

Several new technologies have advanced among them is IOT, Sensor networks, bitcoin and blockchain which affects the way business is run (Burmaoglu et al., 2019, Daim and Yalcin, 2019, Yalcin and Daim, 2021b, Zeba et al., 2021). Technology capacities of companies in SCM has made great progress as a result of recent advances in Information and Communication Technologies (ICTs), (Yalcin and Daim, 2022).

Information technologies is important as it delivers a service that companies recognise in technology infrastructure. If used rightly this can help an organisation survive. Infrastructure also offers tight control, quick response, efficient consumer responses, marketing communication and drives E- and fast delivery Wales et al., (2021).ICT enables partners to closely synchronise operations and enable real-time fulfilment (Violah, 2022). Therefore, the technique based on agreed standards, facilitates business transactions in standardised electronic form in an automated manner directly from a computer application in organisation to an application in another.

Electronic Data Interchange (EDI) works in such a way that it creates system and purchase orders through coding (Violah, 2022). EDI presents a paperless world which brings about a quick response, though imperative EDI creates certain limitations in its costs such as costs and rigidity especially -HTML-Hyper-text mark-up language which has codes data to be inputted in the system. EDI also needs much integration in most procurement organisations and institutions if communication among departments is to be realised.

2.6 Theoretical Framework

Theories are constructed to explain, predict, and interpret occurrences, as well as, in many situations, to question and extend current knowledge within the boundaries of crucial confining assumptions, according to Abend, (2013). The theoretical framework of a research study is the framework that may hold or support a hypothesis. The theoretical framework explains and introduces the theory that explains why the research problem under consideration exists. A theoretical framework is made up of terms and definitions, as well as references to important scholarly literature, which are employed in your research. The theoretical framework must

demonstrate a comprehension of theories and concepts that are relevant to the research paper's topic and link to the larger fields of knowledge being explored (Abend, 2013).

2.7 The Value Chain theory

The term Value Chain' was used by Michael Porter (1985) in his book Competitive Advantage: Creating and sustaining superior Performance as cited in (LANGAT *et al.*, 2013). The value chain analysis describes the activities the organization performs and links them to the organizations competitive position. Value chain theory activities within and around an organization relates to an analysis of the competitive strength of the organization. Therefore, it evaluates which value each particular activity adds to the organizations products or services. This idea was 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 and systematic activates it will become possible to produce something for which customers are willing to pay a price. Porter (2018) argues that the ability to perform particular activities and to manage the linkages between these activities is a source of competitive advantage.

Further, Porter (2018) distinguishes between primary activities and support activities. Primary activities being directly concerned with the creation or delivery of a product or service. These can be grouped into 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 Research and Development), human resource management, and infrastructure (systems for planning, finance, quality, information management etc.). These linkages are crucial for corporate success, flow of information, goods and services, as well as systems and processes for adjusting activities (LANGAT *et al.*, 2013).

In this study the value chain theory is the underpinning theory which connects ZAMMSA it every function in and around the agency. If procurement does a good job by forwarding order information to suppliers on time then availability of orders. Customer services will then record the orders and pass them to inbound logistics and finally inbound to outbound so as to guarantee the delivery of medicines and medical supplies in a timely and effective manner. Therefore, the linkages are about seamless cooperation and information flow between the value chain activities which if not properly adhered would affect supply chain agility. In other words, the

supply chain becomes the value chain. Efficiency and effectiveness is created not just by the focal firm in a network, but by all the entities that connect to each other (LANGAT *et al.*, 2013).

2.8 Conceptual frame work

A researcher's conceptual framework explains a phenomena by combining past study and related work. It methodically outlines the activities required throughout the research study based on information gleaned from other ongoing studies and the perspectives of other researchers on the issue (Fink, 2014).

Conceptual frame work is an analytical tool with several variations and contexts. It is used to make conceptual distinction and organize idea. Strong conceptual frame works capture something real in a way that is easy to remember and apply (Ibid). The conceptual framework in this study gives an overview of the independent variables and dependent variables that defined the objective of the research. The independent variable is the Supply Chain Agility of the ZAMMSA and the mediating variables includes market sensitivity, flexibility, process integration, swift response. There is a correlation between the independent variable and the dependent variable.

2.8.1 Operationalisation of the Conceptual Framework

The intention for the restructuring and the new mandate of ZAMMSA was intended to make supply chain effective and efficient. However, in recent times there institution has continued to face stock outs and this has persisted to date. Below is the conceptual framework showing the independent and dependant variables.

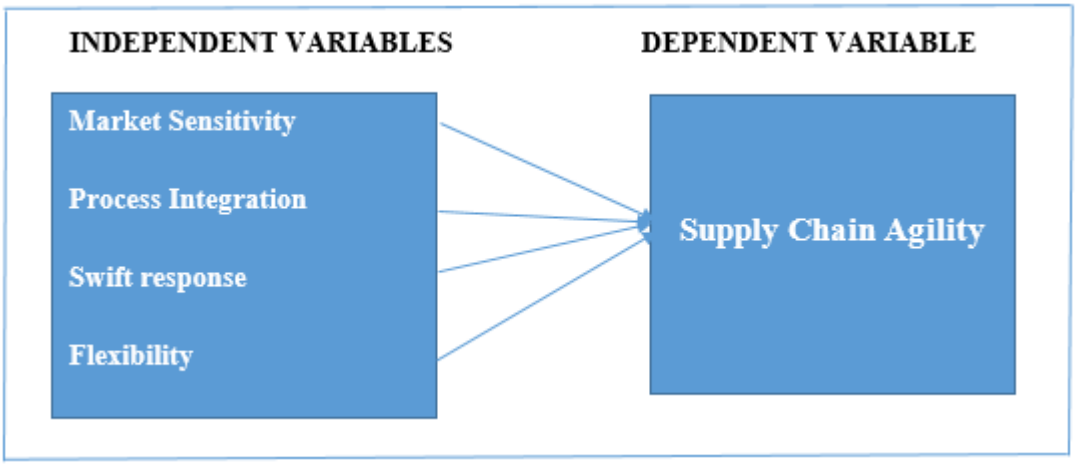

Figure 1: Conceptual framework

It is expected that with the change at ZAMMSA, supply chain agility will improve. As a public good, it is expected that the supply will met the demand responding to the market sensitivity. The optimisation requires process integration of all inventory through digitalisation and integrating all stages of supply chain, from the ZAMMSA to downstream. This would ensure that there is speed and swift responses in the supply chain system, though it require flexibility. The combination of these concepts would acuminate input a supply chain agility and lessen essential a medicine stock out. However, this study aim to establish whether these concepts are implemented and there are implemented what would be the cause of stock out of essential medicines and medical supplies the country of currently experiencing.

2.8.1.2 Mediating Factors affecting supply chain agility

As shown in the conceptual framework in figure 2.1, there are many factors that affect supply chain agility but in this research will look at market sensitivity, flexibility, Process integration and swift response.

2.8.1.2.1 Market sensitivity

Market-sensitive in terms of ZAMMSA means that the supply chain is capable of reading and responding to real demand and in this case the medicines and medical supplies made to various parts of the county (Zanjirani et al., 2013). This is a key attribute of modern approach from the traditional approach of managing supply chain. Market sensitivity is in total contrast to the traditional practices where majority of inventory was held as finished goods waiting to be sold (Zanjirani et al., 2013). Market sensitive supply chains try to hold majority of stock as work in progress inventory awaiting build/configuration information coming from the final customer or market. This is because the insight and information gained from customers would help to resolve problems regarding market uncertainty and assist supply chains tend to respond better to the final customer requirements (LANGAT *et al.*, 2013).

Market sensitivity incorporates demand for overall market, individualized products and services with quicker delivery time and fast response to sudden changes in order, quantity and specifications (Al-Shboul, 2017). It dictates that collaborative initiatives should be driven by quick response to customer requirements that entails agile supply chain that reads and responds to real customer demands. Sustainable advantages in supply chain agility can be achieved through learning market complex changing customer demands (Gligor *et al.*, 2019).

Furthermore, it has to be built on coordinated measures and a comprehensive examination in order not only to be able to design and implement it, but to also be able to control it with regards to the desired customer's needs. In addition to high quality standards and the price of products, the logistic factors, delivery time and delivery reliability take on progressively more important. Also possibilities with which a company can distinguish itself within the market, as the primary function for fulfilling orders, is thus increasingly called upon to improve effectiveness. The goal of market sensitivity is therefore, to organize the entire material flow in the supply chain, from procuring raw materials and preliminary products, through the entire production process including all of the interim storage stages, up to supplying distributors should be able to meet the expectation of the customers. Since agile supply chain improves efficiency and effectiveness in supply chain in mind of the customers' needs (Al-Shboul, 2017).

2.8.1.2.2 Process Integration

Process integration involves collaborative work between buyers and suppliers, joint product development, common systems and shared information which is a crucial element in agile supply chain. Costa, (2017) have classified integration in a supply chain context in various different types; these are customer integration, internal integration, material integration, service supplier integration, technology and planning integration, measurement integration and relationship integration. Supply chain agility recommends integration to achieve a long term competitive advantage. 'Process integrated' is added to emphasize and advocate a system in view of the whole supply chain. It is not useful to use only one partner in the supply chain rather the multiple partners to make each part work highly effectively in the performance of the entire chain.

To provide smooth and effective business process integration play a vital role in any effective supply chain. One key reason that this is necessary is because most current businesses are not very efficient, but that almost all businesses contain enormous amounts of waste: misdirected efforts, poor or missing information, ineffectual management, lack of leadership, authority or trust, power plays, delays and excessive inventory. Process Integration should involve all stake holders to be part and parcel in any physically and logically distributed system of interacting autonomous business entities (Piotrowicz, *et al.,* 2021).

The complex reality of day-to-day operation of companies in industry and the service sector demands highly diligent detailed work. Here, in contrast to some strategic concepts in company

management, the proof of truth namely, effectiveness shows up quickly and measurably. Errors and poor fusion between the customer and suppliers produce dissatisfied customers and employees, and thus poor business results (Rahiminezhad *et al.*, 2016).

The concept of integrating the links of an entire supply chain to the demands of the market is the answer to the inefficiency of supply chain. Process integration synchronized has been tested repeatedly and it does address the more common problems of the traditional approach. The key is communication from the market. Material and information is released into the system based on the consumption at the primary control point. Every supplier of raw material as well as every producer along the supply chain is linked to that actual demand. Strategically sized and located buffers of inventory are designed to absorb the unpredictable variability, and sufficient protective capacity is planned to maximize the velocity of the product flow (Sawyerr and Harrison, 2019).

2.8.1.2.3 Speed Response

Gligor *et al.*, (2019) defined speed response as the ability to accelerate the activities on a critical path that commences with the identification of a market need and terminates with the delivery of a customized product. In this context swift response should be considered as a concept which is solely customer focused. Today's volatile business environment is characterized by frequent supply chain disruptions from material shortages and drops in production capacity to sudden demand spikes. The responsiveness of supply chains to changing market requirements and their overall efficiency are important issues in supply chain design and management and therefore currently receive wide attention in the scientific community as well as in practice (Abdelilah, *et al*., 2018).

Responsiveness can be defined as the ability to react purposefully and within an appropriate time-scale to customer demand or changes in the marketplace, to bring about or maintain competitive advantage (Holweg, 2005, p. 605). In an efficient supply chain, suppliers, manufacturers and retailers manage – implicitly through independent ordering processes between tiers or through explicit coordination of ordering decisions of the different supply chain elements, their activities in order to meet predictable demand at the lowest cost. A responsive supply chain, in contrast, requires an information flow and policies from the market place to supply chain members in order to hedge inventory and available production capacity

against uncertain demand .Without a responsive supply chain this will certainly lead to ineffective and inefficient supply chain agility (Saleh, *et al*., 2018).

2.8.1.2.3 Flexibility

Flexibility is the ability of the firm to respond to a variety of customer requirements, which exist within defined constraints (Christopher and Holweg, 2011)). It is multi-dimensional and consist various elements and some are more important in certain environments depending to nature of the product. Some authors distinguish between internal and external flexibilities. Abdelilah *et al*., (2018) distinguishes machine-level flexibility from plant-level flexibility. The former being "predominantly technology based" and the latter being derived from a combination of technology, infrastructure, design and engineering capabilities, and the competitive goals and objectives of a firm. Internal flexibility was defined as the operations strategy and the set of capabilities a firm nurtures to respond to its environment and external flexibility as capabilities possessed by the firm and used to accommodate sources of variability to which the firm must respond and which are seen as flexible by the market. The external dimension fits the two major strategies proposed by Bernardes and Hanna (2009) for using flexibility: reactive and proactive. In the same vein, Abdelilah *et al*., (2018) also suggests two major strategies for using flexibility, adaptive and redefinition.

The adaptive strategy refers to the defensive or reactive use of flexible competencies to accommodate unknown uncertainty, while the redefinition strategy refers to the proactive use of flexible competencies to raise customer expectations, increase uncertainty for rivals and gain competitive edge. An organization is said to be flexible if it requires negligible effort and time in changing to a different process. Patel and Sambasivan, (2022b) describes five types or components of flexibility (new product; product mix; quality; volume and delivery).

Flexibility can exist in many different areas if the customer is willing to pay for the flexibility. Firms may be flexible in the quantity and the timing that a customer can order from them as indicated by Patel and Sambasivan, (2022b). Flexibility gives the customer the exact the service desired, or electronic accesses to place orders or receive intangible products. This flexibility has manifold implications for the firms upstream in the supply chain Patel and Sambasivan, (2022b). A firm may be flexible in its lead times to produce orders for customers. It may have a standard order lead time and a rush order lead time if it is an emergency for the customer. Flexible organization tends to adapt to changes in customers preferences, market

demands and any other exceptional market conditions, while on the other hand flexible supply chain can fulfil an extremely important order in an exceptionally short time as there are different kinds of flexibility according to the variable that raises the need for a change. We call product flexibility as the ability to adapt the product to customers' needs thus product flexibility manages the introduction of a new product (Abdelilah *et al*., 2018).

To achieve this kind of flexibility the company might need to buy flexible production systems and might want to carry components over, that is use components and subsystems from previous generations of the product. Such kind of flexibility is more and more important nowadays given the growing importance of new product and product novelty. Delivery flexibility is the ability to adapt deliveries to customers' needs. Volume flexibility is the ability to increase/decrease production and distribution quantities on a short notice. This flexibility is especially valued in markets with a sharply seasonal pattern such as Christmas. This flexibility can be gained through both spare resources (spare capacity), flexible resources, Or appropriate planning (produce/distribute all products with a predictable demand before the peak of the season so that during the peak can use the limited production/distribution capacity to manage just the uncertain part of demand).Flexibility to be embrace to ensure that effective supply chain is achieve in the increasing complex market (Abdelilah *et al*., 2018).

2.8.2 Measurement of supply chain agility

It is tempting to assume that concepts about supply chain agility are readily understood and easily measured, but this is not the case (Fadaki *et al*., 2019). Such concepts are likely to be complex in both definition and measurement. Nonetheless, as organizations continue to develop and adopt management practices to build supply chain agility, the need for valid and reliable instruments to assess supply chain agility increases .However this literature tend to downplay other factors like nature disasters or acts of God that directly or indirectly affects the supply chain agility such as wars, earthquakes floods and fires that tend to disrupt supply chain agility (Piotrowicz et al., 2022).

2.9 Empirical Review with a Global Perspective

This section presents empirical review from developed and developing countries on supply chain agility in the medicine and medical supplies sector. A summary is presented and selected by key evidence as presented from some regions.

2.9.1 Performance of Supply Chains in Developed Countries

According to a research by Dowling, (2014) titled 'Healthcare Supply Chains in Developing Nations: Situational Analysis,' it is beneficial to look at indicators for rich countries to offer some perspective on supply chain performance. Order fill rate, or the proportion of orders filled within a specified time frame, which is a popular statistic of supply chain performance in industrialized nations. In the United States, the average order fill rate from distributor to pharmacy is 95% within 24 hours after placing an order. Because the shop has stock, order fill rates from retailer to consumer are more than 99 percent.

According to Dowling (2014), 96 percent of orders were completed within 45 minutes of being made in a survey of European Union nations. Because of the enormous number of products carried, US outlets tend to have low inventory levels, requiring regular deliveries and 45,000 stock holding units in a typical outlet, and their high cost. Several times in a day is not uncommon. Stock levels in developed nations are measured in months due to few order cycles and large lead periods, whereas stock levels in underdeveloped countries are measured in days. For drug supply chains in wealthy countries, availability is practically a given; performance is measured in terms of efficiency and quality. Wholesale distributors in the United States claim that their net cost accounts is less than 2% of the total value given.

2.9.2 North America

Although agility has been highlighted as one of the most essential concerns in current supply chain management, the theoretical framework for understanding supply chain agility is fragmented, according to a research conducted in the United States by Gligor, Holcomb and Stank, (2013). By using a multidisciplinary literature analysis to get an in-depth understanding of agility, this study fills a gap linked to the uncertainty around the dimensions and definitions of firms supply chain agility. In addition, a thorough measurement instrument is designed and empirically verified, drawing on the foundations of social and life science theory. According to the findings, company supply chain agility is made up of five separate dimensions: attentiveness, accessibility, decisiveness, swiftness, and adaptability. A detailed definition of company supply chain agility is constructed based on these factors for further theoretical testing of the notion.

According to Mandal, (2018) study, healthcare supply chains must focus on resource deployment efficiency in order to achieve optimal supply chain performance. Health-care

organizations would be able to respond to their patients' needs more quickly if their supply chains performed well. This is the core of health-care agility. As a result, the focus of this article is on improving health-care agility through human capital, i.e., the firm's workers' original idea generating capabilities and specialized expertise. The study looked at the moderating role of three information technology capabilities, namely outside-in, spanning, and inside-out, because they play a dominating role in information interchange critical to supply chain operations. Because of the relationship between information technology skills and human capital, as well as between health-care supply chain performance and health-care agility (Mandal, 2018).

The study collected perceptual answers from top hospital managers since the constructs employed in the study mostly deal with challenges peculiar to hospitals and their associated supply chains. Face-to-face interviews with 212 hospital executives from various institutions were used to gather perceptions. Confirmatory factor analysis and structural equation modelling were used to analyse the replies (Mandal, 2018).

Human capital appears to have a beneficial impact on health-care supply chain performance and agility, according to the findings. Furthermore, improved health care agility was discovered as a result of improved health care supply chain performance. The study also discovered that outside-in, spanning, and inside-out information technology skills had a beneficial influence on human capital and health care supply chain performance, as well as health care supply chain performance and health care agility (Mandal, 2018).

Human capital offers speedier services to patients, such as agility in health-care supply chains through increased supply chain performance, according to the study. In addition, the research looked at the value of various information technology skills in enhancing the value of human capital in offering efficient and speedier services through effective supply chain performance.

2.9.3 Europe

Aronsson, et al., (2011) conducted a study in Sweden and Finland titled "Developing lean and agile health care supply chains." "with the goal of examining the factors to consider when developing a health-care supply chain, what is required to establish a supply chain orientation, and how lean and agile can be used as process strategies to improve supply chain performance. Illustrative examples of patient flow and planning procedures are offered from a Swedish health care context in order to develop an empirical foundation for employing both lean and agile

methodologies in health care supply chain management. In the health-care industry, supply chain management has the potential to be a useful concept for patient flow. However, it should not be limited to the use of the lean idea in health care, as is now the case. It's more about merging lean and agile process concepts to organize for rapid reaction and flexibility in a hybrid strategy. This can only be accomplished if a systems approach is combined with a strategic perspective, in which supply chain participants' cooperative efforts should coordinate and converge operational and strategic capabilities into a cohesive whole.

The paper's study emphasizes the need of concentrating on both agility and leanness in tandem. Hospitals or health-care systems that use such a strategy rather than depending solely on lean tactics may obtain competitive benefits as well as enhanced performance. Cost minimization without losing quality is critical in health care, much more so than in the manufacturing business. This article uses SCM approaches, tools, and concepts for patient flow in a health care context that have never been utilized before, integrating lean and agile in one analysis (Aronsson, et al., 2011).

Yaroson *et al.,* (2019) conducted a research titled "Resilience Strategies in the Pharmaceutical Supply Chain: The Role of Agility in Mitigating Drug Shortages" in the United Kingdom. According to the study's backdrop, supply chain resilience has been offered as a way to reduce the impact of supply chain disruptions. While this thesis appears to make sense in principle, there is little empirical evidence to back it up, since most research has focused on the influence of supply chain resilience on disruptions that are based on predetermined time frames, non-supply chain specific disruptions, and non-dynamic disruptive occurrences. According to this study, resilience techniques are dynamic, and their uses within supply chains fluctuate as a result. As a result, investigating the influence of resilience on a dynamic interruption within a given supply chain will be suitable. As a result, the research explores the application of agility within the pharmaceutical supply chain when dynamic interruptions such as medicine shortages occur using current literature. Alertness, accessibility, connectedness, and visibility are all elements of supply chain agility that can help reduce the effect of medicine shortages, according to the study.

2.9.4 Performance of Supply Chains in Low- and Middle-Income Countries

A number of difficulties limit an assessment of the effectiveness of Low and Middle-Income Countries' supply chains, including a paucity of performance data and the presence of several

confounding factors that affect pharmaceutical availability, particularly funding (Dowling, 2011). Many in-country supply chains do not frequently monitor and report on their performance, according to performance statistics. This is a strong predictor of subpar performance in and of itself. If monitoring is done, it is frequently based on data from periodic surveys for a small number of indicators. When it comes to confounding variables, it's frequently difficult to tell if poor performance on pharmaceutical availability is due to supply chain issues or other reasons, such as inadequate supply funding. Data on order fill rates for Low and Middle-Income Countries is uncommon. Order fill rates for Central Medical shops in Cameroon were 69.5 percent during a six-month period, whereas in Senegal they were 65 percent in 2005 and 49 percent in 1995 (as cited in Govindraj and Herbst, 2010).

The stock out rate is the most prevalent statistic of supply chain performance in developing countries: the percentage of sites that are out of stock of a certain item on the day the survey is conducted. A stock out can have serious health repercussions when facilities are resupplied infrequently (sometimes months between deliveries) and patients' alternatives are limited. Stock outs are often examined using a small number of goods (dubbed tracers) chosen for their value to human health (Dowling, 2011).

2.9.4.1 Asia

According to a research by Mubarik, Warsi and Malik, (2012), transportation outsourcing of logistics operations has been a crucial corporate approach to improve supply chain performance in recent years. A large body of empirical work has shown that transportation outsourcing has a major influence on the efficacy and efficiency of a company's supply chain management. The influence of transportation outsourcing on supply chain performance for the 30 pharmaceutical businesses operating in Pakistan was explored in this article. The findings revealed that transportation outsourcing by the mentioned industry not only improves supply chain management performance, but also has a substantial impact on supply chain effectiveness and efficiency in Pakistan's pharmaceutical sector.

'Healthcare supply chain management in Malaysia: a case study,' Mustaffa and Potter, (2009) research '', with a special focus on the distribution of medications from a wholesaler to clinics, aimed at analysing inventory management in the private healthcare sector in Malaysia. There are currently concerns with clinic service levels that need to be addressed. The data was gathered through process mapping, interviews, and data analysis, and the report took a case study method. Data flow diagrams are used to visualize the existing and future processes of an

organization's supply chain. Interviews are utilized to identify the primary supply chain challenges, and data analysis is used to triangulate these perspectives. The data reveal two major concerns inside the case study company: urgent orders and wholesaler stock availability. A future state supply chain design based on vendor-managed inventory is presented as a result of this. There are also certain roadblocks to overcome, such as taking into account Malaysia's present supply chain management skills.

Although two tiers are researched, only one case study supply chain is studied. While this may restrict the generalizability of the findings, it is essential to demonstrate the benefits that contemporary supply chain management approaches may offer to healthcare supply chains in underdeveloped countries. Modern supply chain management strategies can assist healthcare supply chains in underdeveloped nations, according to the report. The paper's usefulness stems from its extensive examination of a healthcare supply chain in a poor country. Only a handful of other research have been published in the literature (Mustaffa and Potter, 2009).

2.9.4.2 Latin America and South America

Dixit *et al.*, (2019) published a comprehensive literature analysis of healthcare supply chain and implications for future study, which examined the literature in numerous domains to identify gaps. Between 1996 and 2017, 143 research publications were examined. A critical review was conducted in several dimensions, including research methodologies and methods, which included empirical, case study, and literature review, as well as inquiry modes of research methodology, which included qualitative, quantitative, and mixed, country-specific, targeted area, research goal, and publication year. Supply chain operations, performance measurement, inventory management, lean and agile operations, and the use of information technology were all well studied and analysed, but employee and customer training, tracking and visibility of medicines, cold chain management, human resource practices, risk management, and waste management were felt to be important areas but not given enough attention. The research limits and consequences were that the current study of healthcare supply chain focused primarily on medicine and vaccine supply chains, whereas supply chains including healthcare equipment and machines, hospitality, and drug production were omitted. The study's practical consequences include that the literature review has identified and examined different challenges related to the healthcare supply chain, as well as pointing the way for future research to construct a more efficient and effective healthcare supply chain. The broad understanding of many facets of the healthcare supply chain was investigated in order to

develop a more efficient and competent healthcare supply chain. The study's findings may be used to determine the direction of future research.

Costa, (2017) performed a research in Brazil on the influence of regulatory policies on supply chain resilience: regulation as a supply chain resilience reduction in the medical and pharmaceutical supply chain. The goal of this dissertation is to look at how regulatory policies affect supply chain resilience by evaluating how they affect resilience-building capacities. Four medical and pharmaceutical firms, as well as one class association in Brazil, were interviewed in a total of 14 semi-structured interviews. The selection of such sectors is significant, owing to the high degree of regulation found across these supply chains, as well as their criticality, since interruptions in these supply chains might endanger the lives of those who rely on these products. The findings show that regulation's complexity, time, and additional safeguards, together with the regulatory body's bureaucratic and procedural flaws, limit the regulatory body's flexibility/redundancy, speed, and visibility. The findings also highlight the need of the medical and pharmaceutical industries creating supply chain resilience during the planning phase. This research contributes to a better knowledge of the problems of building resilient supply chains in various industries in Brazil as a management contribution. This study adds to the body of knowledge on the role of external factors in supply chain resilience while also broadening research on resilience-reducing elements.

The goal of the Costa, (2017) dissertation was to look at how regulatory policies affect supply chain resilience by analysing their effects on formative resilience capacities. Four medical and pharmaceutical businesses, as well as one industry group in Brazil, were interviewed in 14 semi-structured interviews. The choice of such sectors is important, first and foremost, because of the high amount of government control that runs across their supply chains. Second, because of their criticality, supply chain interruptions may jeopardize the lives of those who rely on medical and pharmaceutical items. The findings show that the regulation's complexity, duration, and additional safeguards, together with the regulatory body's bureaucratic and procedural challenges in Brazil, diminish the regulatory body's flexibility/redundancy, velocity, and visibility. Furthermore, the findings underscore the relevance of supply chain resilience in the preparedness phase for the medical and pharmaceutical industries. This research contributes to a better knowledge of the issues of developing resilient supply chains in various sectors in Brazil as a management contribution. This study adds to the body of knowledge by looking at the role of environmental variables on supply chain resilience. It also adds to the body of knowledge regarding supply chain resilience reducers (Costa, 2017).

2.9.4.3 North Africa and the Middle East (MENA)

Because of their cultural, sociological, economic, and geopolitical proximity, Al-Shboul, (2017) conducted significant research in North Africa and the Middle East. "Infrastructure framework and manufacturing supply chain agility: the importance of delivery reliability and speed to market," according to the report. The primary goal of this research is to look at the impact of delivery reliability and time to market on the relationship between infrastructure and supply chain agility. The effects of supply chain agility on company performance are also investigated. 113 top executives and managers in purchasing, operations, providing, planning, and other supply chain responsibilities at significant manufacturing enterprises in the MENA area, which encompasses 12 countries, were surveyed (Jordan, Lebanon, Egypt, Saudi Arabia, United Arab Emirates, Kuwait, Oman, Bahrain, Qatar, Morocco, Tunis and Algeria). The data was collected via a large-scale survey questionnaire. The hypothesis-testing deductive technique was used to test the study framework. The findings are based on covariance-based analysis and structural equation modelling with software called Analysis of Moment Structures.

The findings suggest that infrastructural framework elements have a little impact on supply chain agility. Delivery reliability and time to market are also discovered to partially mediate the link between infrastructure framework elements and supply chain agility. Furthermore, it has been discovered that supply chain agility is linked to improved firm performance. Delivery dependability and speed to market are effective logistics techniques for mitigating the effects of infrastructural framework and supply chain agility, according to this study, which presents an overview and empirical evidence. These connections point to a theoretical contribution that explains how infrastructure framework pieces might generate supply chain agility by synchronizing logistical practices that are suitably matched (Al-Shboul, 2017).

2.9.4.4 West Africa

'Does Human Capital Improve Health Care Agility via Health Care Supply Chain Performance?' ask Rungsrisawat and Jermsittiparsert, (2019). The study 'The Moderating Role of Technical Orientation' was completed. It argued that supply chain consequences are not limited to manufacturing or production-oriented companies, but also exist in the healthcare sector. With good human capital care, such a healthcare supply chain may operate even better. The agility of the industry is impacted by an increase or improvement in human capital. The

influence of human capital on health care agility in Thailand's health care industry was investigated in this study, as well as the mediating function of healthcare supply chain performance in the connection. In addition, the moderating influence of technology orientation in the link between human capital and healthcare supply chain performance was investigated. Data was gathered from a number of Thai hospitals, and questionnaires were delivered to the institutions' administrative employees. After that, the responses were examined using a Software package for social sciences and a variety of screening and structural equation modelling tests. Human capital considerably improves agility in the healthcare industry, according to the findings, and healthcare supply chain performance strongly mediates this link. The study's implications are mostly focused on the service industry, which may improve its agility through stronger human capital and improved supply chain performance.

2.9.4.5 East Africa

'Reaching the Last Mile: Tanzania's Medical Supply Chain,' according to Wong *et al.*, (2020). Tanzania's health logistics supply chain faces various obstacles after a decade of progress. The most major impediments include inconsistent data quality, a lack of physical infrastructure, a scarcity of human resources, and unequal policy execution. Despite continuing gaps in Tanzania's health logistics supply chain, the government has made remarkable progress in reaching the "last mile" by participating in clinical outreach, hiring community health workers, creating ADDOs, and committing to direct delivery through Medical Store Depots.

In Uganda, a research titled 'Health supply chain system in Uganda: existing challenges, structure, performance, and implications for systems strengthening' by Lugada *et al.*, (2022) indicated that the health supply chain system is critical for the healthcare system's optimal performance. Despite increased investments in the health supply chain system, Uganda's access to high-quality essential medicines and health supplies remains a major challenge. The structure, performance, and difficulties of Uganda's health supply chain system are discussed in this article. It contains insights and implications for continuing system-strengthening efforts. Discussions: The findings point to a number of concerns and obstacles that prevent the health supply chain system from performing at its best at all levels of the health system. Ineffective planning, coordination, and management structures, insufficient funding, a shortage of skilled staff, weak regulatory and governance structures at national and subnational levels, and slow adoption and use of Electronic Logistics Information Systems to support supply chain processes and functions are among the challenges identified. Greater investments in policy

creation and execution, infrastructure, equipment, and support systems, supply chain staff expertise and skills, additional financing, and improved governance and accountability will be required to overcome these issues.

2.9.4.6 Southern Africa Development Community

According to Bvuchete, Grobbelaar and Van Eeden, (2018), 'A Case of Healthcare Supply Chain Visibility in South Africa,' South Africa spends 8.5 percent of its yearly gross domestic product on healthcare, but the country still has poor healthcare results. The South African public healthcare system continues to face issues, including rising healthcare expenditures and medication shortages. With the healthcare supply chain accounting for 25 percent to 30 percent of costs and 80 percent of the population relying on the public healthcare system, there is undeniably a significant opportunity for more effective management and improvement of the healthcare supply chain in terms of cost reduction and medicine access. Trying to strike a balance between lowering healthcare supply chain costs and increasing access, on the other hand, increases healthcare supply chain complexity. According to the research, supply chain visibility and demand-driven supply chain management systems can assist handle these complexity and issues. As a result, the primary goal of this research was to find out what supply chain visibility is, why it's important in healthcare, how the Vodacom/Mezzanine ware Stock Visibility Solution can help with supply chain visibility, and how the Stock Visibility Solution can help with demand-driven supply chain management.

Rural clinics have low information connection and limited capacity to conduct out stock requisitioning, according to Yadav, (2015) paper, 'Health Product Supply Chains in Developing Countries: Diagnosis of the Root Causes of Underperformance and an Agenda for Reform, Health Systems and Reform.' In such cases, combining data collecting and product distribution may be beneficial. In Zimbabwe, for example, under the Delivery Team topping up system, district staff visit each health centre to collect stock information and resupply all at the same time. In Mozambique, a comparable method for vaccinations has resulted in considerable improvements in supply chain performance.

The most common structure for distribution once medicines arrive in the country is warehousing and storage at the Central Medical Store. Products are initially dispersed from the Central Medical Store to regional or district level stores, depending on the country's size, administrative structure, and number of health institutions. Kenya, for example, has devised a distribution system that incorporates direct delivery from the Central Medical Store to health

institutions. The majority of the time, distribution from the central Medical Store to the regional or district stores is handled by a Central Medical Store-owned and managed transport fleet. In some countries, such as Zambia and Tanzania, distribution from the Central Medical Store to downstream tiers occurs every month, while in others, such as Kenya, the Gambia, and Mozambique, it occurs every three months (Ibid).

2.9.4.7 Zambia

There are over 40 licensed wholesalers in Zambia, but only five or six account for a significant portion of the market. In Francophone African countries, there are fewer licensed wholesalers and importers. Except for Burundi, Mali, and Rwanda, which have 14, 23, and 32 wholesalers or importers, each country has an average of five wholesalers or importers (Yadav, 2015).

It is vital to have fewer layers and less institutional complexity in a supply chain if information systems across different tiers are insufficient. Fewer levels and lower total institutional complexity can decrease resource waste, enhance information flows and coordination, accelerate product and information movement across the supply chain, simplify planning, and reduce uncertainty. A recent quasi-randomized research in Zambia found that lowering the number of levels in the supply system resulted in significant increases in product availability. In Zambia, recent supply chain reform has demonstrated that thorough analysis, political resolve, and great managerial ability may result in better-performing supply chains and lower disease morbidity and mortality (Ibid).

The main reasons of stock outs at health clinics, on the other hand, might be due to regional or district procurement, forecasting, and requisitioning issues, clinic tardiness or poor forecasting, or a shortage of transportation at any point in the system. However, the lack of an accountability system is at the root of many of these issues. The Ministry of Health, the Central Medical Store, and district and clinic health professionals frequently have overlapping responsibilities and control. In Ethiopia, Kenya, Mozambique, and Zambia, for example, the Central Medical Store, ZAMMSA in Zambia, has direct authority over only its own warehouses and distribution up to the region/district level; other sub-national institutions in the supply chain are under the supervision of other ministry of health departments. This results in a system of diffuse responsibility, in which one player can blame other actors in the system for the supply chain's poor performance. The risks of corruption in procurement and distribution are exacerbated by such a general lack of accountability. Products are frequently diverted from public sector

warehouses or health clinics for sale in private clinics and pharmacies due to a lack of accountability and the inability to track flows through the supply chain (Ibid).

ZAMMSA has been able to create performance incentive schemes to enhance efficiency and cost reduction. The incentive included retaining flexible human resource, or by hiring form the private sector. Also made some investment in technology in the warehousing and transportation systems. However, cost due to storage and transportation was still a problem (Government of The Republic of Zambia, 2019).

2.10 Knowledge gaps

The challenge of designing, integrating and implementing cost-effective and at the same time effective medical health care systems is to apply an interdisciplinary systems approach, where the production processes and flow of customer or patients are in focus. It is believed that a prerequisite is to widen the system borders, allowing the system in focus to include multiple sub-systems which are optimized by their own, in order to achieve a supply chain agility but since the system is synonymous with corruption, fraud and under dealings, nepotism, and the concept of supply chain could still a pipe-dream at ZAMMSA.

Furthermore, literature reviewed indicates factors which affects supply chain performance, stockouts, and supply chain strategic decisions of essential drugs in the supply chain management, particularly in sub-Sahara Africa. Also, some optimisation initiatives have been pointed out. However, there was no comprehensive identification of challenges in supply chain performance, stockouts, and supply chain strategic decisions of drugs or pharmaceutical commodities and their related optimisation initiatives. Thus this research proposes to identify the challenges and their specific optimisation strategies. However, there is need to establish evidence on how optimisation of the supply chain performance, stockouts, and supply chain strategic decisions are applied as agility factors to enhance the supply chain.

2.11 Emerging Issues

Currently, technology is grossly embraced at the centre stage of supply chain agility (Rungsrisawat and (Jermsittiparsert, 2019). It is a key infrastructure supply chain performance, stockouts, and supply chain strategic decisions, alongside warehousing and transportation in distribution of medicines and medical supplies to the last mile. Other than technology, human capital is a key resource in facilitating supply chain agility which includes leadership because

agility as derived from sports and military is a human capital centred concept. This is also echoed by Dixit, Routroy and Dubey, (2019), that employee and customer training, tracking and visibility of medicines, cold chain management, human resource practices, risk management, and waste management were felt to be important areas but not given enough attention.

2.12 Lessons Learnt

The review informs that supply chain agility is a contextual phenomenal. It is experienced differently from one country to another, and from organisation to another. However, some experiences are common across regions especially that most developing countries adopted the Central Medical Stores or Centralised Distribution of medicines and medical supplies. This entails that this study will delve on the state of supply chain in relation to agility in a centralised medicine and medical supplies model.

2.13 Chapter Summary

The chapter has provided a discussion on supply chain performance, stockouts, and supply chain strategic decisions and agility. This study aim to link assess the interaction of supply chain performance, stockouts, and supply chain strategic decisions and supply agility in addressing the erratic supply chain of medicines and medical commodities at ZAMMSA. The next chapter is the research methodology.

CHAPTER 3

RESEARCH METHODOLODY

3.1 Introduction

This chapter demonstrates how data was generated to contribute to the discourse on the topic area. The chapter highlights the procedure and methodology that will be used in collecting and analysing the data for this study and it includes the research philosophy, target population, sample design and methodology to use in the study. It includes the target population, sample design data collection procedure to be applied, the data analysis method and ethic consideration.

3.2 Research Philosophy:

Research philosophy unveils the development of research assumptions, knowledge and its nature.

3.2.1 Positivism and Interpretivism

Among the philosophy of social research is the broad model, the paradigm theoretical framework. Within the philosophical framework are different school of thoughts which guide the scientific community. They include the positivism, post-positivism, Interpretivism, the critical theory, and the pragmatism. Positivism school of thought posited in verifying, while the post-positivism have interest in predictability of events or outcome of interest. The Interpretivism is focussed on understanding phenomenon and interpret from the point of view of person with empathy (Creswell, 2014).

3.2.2 Phenomenological

Phenomenon logical assumption aims to comprehend and characterize a phenomenon's universal essence. The method looks at people's ordinary lives while suspending the researchers' prior notions about the issue. In other words, phenomenology research examines lived events in order to learn more about how individuals interpret them (Creswell, 2014).

3.2.3 Ontological

Ontological, or the reality's nature, concerns about the nature of reality and its properties. Researchers accept the concept of many realities and report on them by examining various sorts of evidence from other people's viewpoints and experiences (Saunders, 2013).

3.2.4 Epistemological

Epistemological, how researchers come to know what they know, aim to be as close to the participants as feasible. Individual perspectives from field research are used to provide subjective evidence (Fink, 2014).

3.2.5 Axiological

Axiological is based on values in Research. Researchers disclose their values in the study and actively reflect their values and biases, as well as the value-laden character of data acquired in the field (Abend, 2013).

3.2.6 Methodology

Methodology, is the procedures employed in the research process. It is either inductive or deductive, emergent, and formed by the researcher's data collection and analysis experience (Creswell, 2014). The researcher therefore used the methodological approach to explore the topic.

Philosophy underpinned the Study

Basis of Assumption	Question	Quantitative	Qualitative
Methodological	What is the process of the research: Survey and phenomenology design to capture the current state of supply chain at	Deductive approach and generalisable.	Inductive, mutual and simultaneous shaping of factors, Context bound, accuracy achieved through verification. Validation form both methodologies.

	ZAMMSA and gain in-depth knowledge on optimisation at ZAMMSA		Inductive to deductive approach upon analysis.
Methods	Methods and tools of inquiry:	Questionnaires using Online platform	Instruments/tools: Interview guides. Notebooks for taking filed notes to capture interesting happenings related to the subject of interest.

Table 1: Philosophy underpinned the Study

Source: Author (2023)

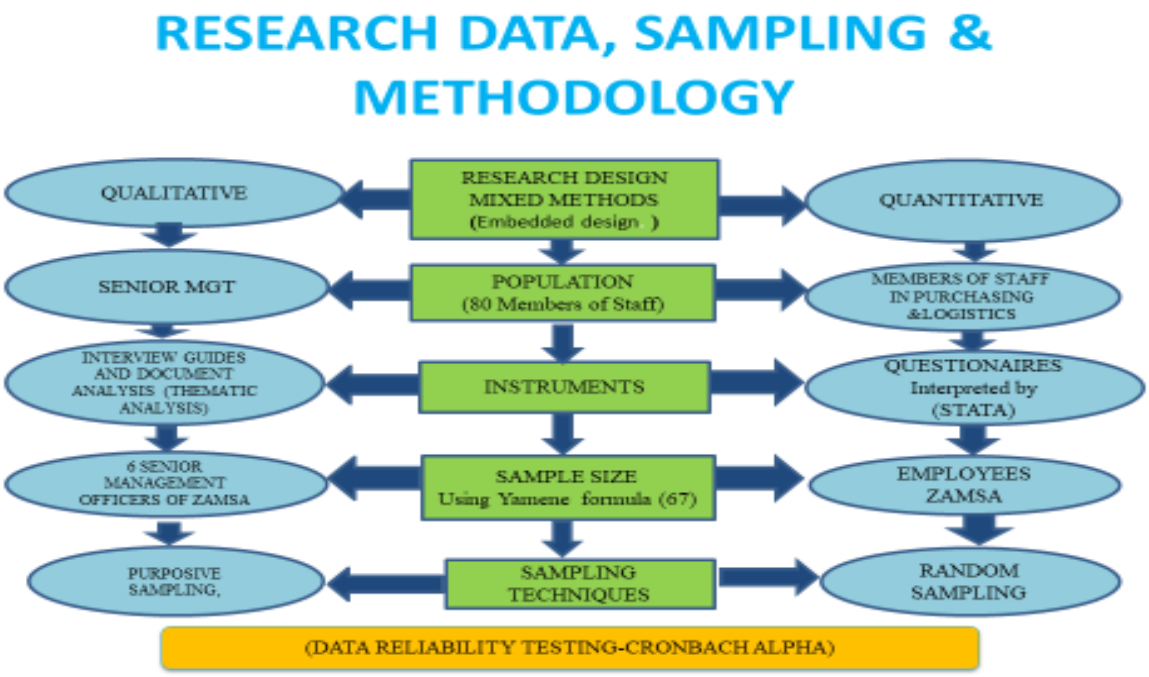

Figure 2: Research data, Sampling and Methodology

Source: Author (2023)

3.3 Research Design

Data was collected in a short period of time which required the use of cross sectional design for the kind of data collection. It also required corresponding qualitative design to be carried out in a short period of time, hence Phenomenology design was used. The combination of the two designs enabled for concurrent collection of data in a complementary manner (Chopra and Meindl 2005; Creswell 2014). While the cross section component focused on numerical data the phenomenology looked at the lived experiences as narrated by the participants on their interaction with supply chain agility or the absence of it

3.4 Target Population

Stratified all the departments at ZAMMSA .The target population was the staff of ZAMMSA, in particular only those that interact with supply chain management processes where considered in the study. A census would not help in getting the desired results as other departments such as the laboratory, Human resource and audit among others could not provide the desired outcome of the research. There were approximately 150 staff from various departments at ZAMMSA Headquarters in Lusaka District.

3.5 Research Approach

Two research approaches were used in this study (Mixed-methods approach). The rationale for mixing the quantitative and qualitative methods was that the study required to establish the numerical data and narrative data on each of the research objectives. Quantitative and qualitative approaches were used for complementing of the data and these were concurrently conducted, and both the approaches were descriptive level of analysis.

3.5.1 Quantitative Approach

The rationale for applying quantitative approach was because it is appropriate and effective in gathering huge data across sections, and there are statistical software used to summarise the huge data, thus it is also referred to as Macro Research Approach (Saunders and Tosey 2013;Creswell 2014). Gathering data from across a section of respondent at ZAMMSA on supply chain agility and related factors provided proportion of the topic which the qualitative approach cannot do. Proportion quantifies the size and magnitude of the variables on the topic area for easier interpretation and operation recommendation. However, the use of quantitative

approach only sometimes may not provide depth of the topic area. Hence, the use of rich and in-depth approach alongside with equal weight concurrently.

3.5.2 Qualitative Approach

Concurrent application of quantitative and qualitative approach on each study objective will ensure that the data complementation and triangulation is enhanced. Because the qualitative provided in-depth data is derived from the perceptions of the participants in the manner their self-constructed reality around the market sensitivity, process integration, flexibility, swift response and optimisation of warehouse and transportation (Creswell 2014). Self-construction of reality is from the lived experiences, on how the supply chain agility in relation to market sensitivity, process integration, flexibility and swift response, optimisation of warehouse and transportation at ZAMMSA.

3.6 Determination and Sampling Techniques

The Slovin formula was used to determine an appropriate sample size for a given population of 80 respondents. It was expressed as:

Where:

- n was the required sample size.
- N was the total population size (80).
- e was the desired margin of error (expressed as a decimal[0.05]).

The formula helps ensure that the sample size accurately represents the population while allowing for a specified level of confidence and margin of error in the results.

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

Therefore, using the formula above, the sample size was 67 study respondents.

The qualitative side of the study involved in-depth interviews with a selected group of 18 participants. The respondents were purposefully drawn from the management level. Saturation in qualitative data relates to the number of interviews conducted. The selection of these 19 participants followed a saturation concept. The concept points to a data collection process that ensures that all data collected gives concerted conclusions and that any other data collected is of no added value. Thus the sample size was considered to be appropriate for the qualitative

facet of the study, supporting a comprehensive exploration of participants' experiences and perspectives.

3.7 Data validity and reliability

There were respondents that were selected to be interviewed for a pilot data collection instrument with questions categorised according to the research objectives. Thirty (30) respondents were decided on because it is a least required number in quantitative research data analysis that can show precision and consistent pattern of the collected data (Denscombe, 2007); Creswell 2014). Below is a figure that summaries validity.

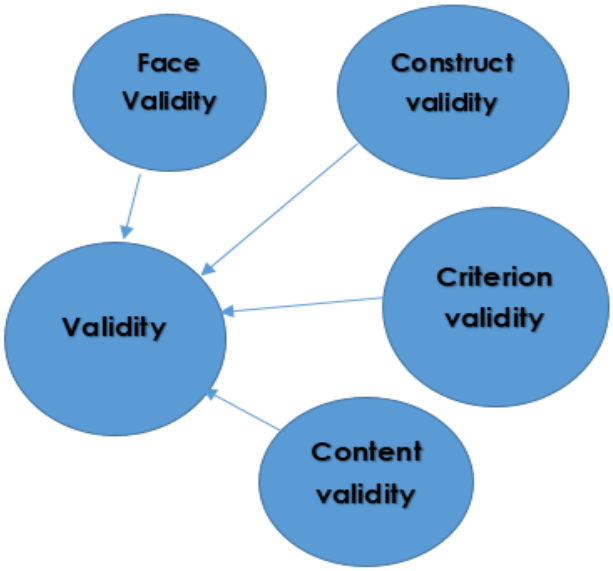

Figure 3: Validity

Author (Source 2023)

3.7.1 Data Validity

Face validity: The face validity may be similar to construct validity but the difference is face validity is like the face value because the tool measuring the data has to show by its appearance that is able to measure what it ought to by looking at the tool generally. The similarity is that they all have to measure what they intended for.

Construct validity: In contrast to face validity, construct validity looks how the question is constructed with aim of ensuring that data collection tools have list of questions that are will

measure in specific terms each question to attain the study objectives. Construct validity goes deep then the face value of face validity. In this study it will be ensured that measure market sensitivity, process integration, flexibility, swift response and optimisation of warehouse and transportation and the questions and items will be standardised.

Content validity: The study questions will mirror the study objectives and the meaning of each of the variables on market sensitivity, process integration, flexibility, swift response and optimisation of warehouse and transportation being measured. For example, when measuring market sensitivity questions or items under this variable must have words and verbs that are related to market sensitivity not process integration or other variables. The study will ensure that the questions are properly phrased in a closed ended manner for the quantitative approach, and in a closed need manner for qualitative approach.

Criterion validity: This is the extent to which a tool or set of questions or items can predict the same situation over time or in a different situation. Thus, structure of questions or items in a questionnaire or data collection/measuring tool should be of higher level of prediction. This study will ensure that the questions are more objective for the quantitative approach and more explorative for the qualitative approach so that face value responses on optimisation are in-depth knowledge is gained.

3.7.2 Data reliability

Internal data will be ensured by making the data collection tools uniform so that data can be collected consistently. Furthermore, the data collection tool for the quantitative will be subjected to Cronbach alpha to check for reliability of the questions. This will be tested on a scale of 0-1 on a threshold of 0.73 and above (Cho, 2016).

In the second objective of this study, the Cronbach Alpha coefficient was used to measure reliability. According to Cho (2016), data is considered reliable if the coefficient is larger than 0.73, but unreliable if it is less than 0.73. Market sensitivity (0.807), rapid reaction (0.80), process integration (0.82), flexibility (0.79), and supply chain agility (0.809) were the construct reliability analyses (0.75). Because the Cronbach Alpha Coefficient was larger than 0.73, the data was qualified for further analysis, as indicated in table 3 below.

Performance objectives	Items	Cronbach's Alpha	Core status
Market sensitivity	6	0.807	Accepted
Swift response	6	0.8	Accepted
Process integration	6	0.82	Accepted
Flexibility	6	0.79	Accepted
Supply chain agility	4	0.75	Accepted

Table: 2 Cronbach alpha reliability test

Source: Author (2023)

3.8 Data collection and Method, Instruments and Management

Data Collection will assist in evaluating possible outcomes. Qualitative and quantitive data will be used while questionnaires will be self-administered and interviews will be conducted for key informants.

3.8.1 Data collection and method

Questionnaires were used to collected data which was either self - administered or interview was conducted. An interview guide was used to collect cross sectional data through a semi-structured guide. The interview schedule had open ended questions for cross sectional design and open ended questions for the in-depth interviews (Creswell, 2014).

3.8.2 Instruments

The interviewing instruments used were questionnaires and an interview guide. Questionnaires were administered to respondents who had options to choose from open ended questions, and closed ended questions which had open spaces for narrations to be written. Interview guides were also administered were the research had to narrate the responses accordingly.

3.8.3 Management

Data was entered and collated where preliminary summary of the data was automatically done. Stata an analysis tool was used.

3.9 Data analysis

The spreadsheet from the entered data containing responses was exported to the Microsoft Excel spreadsheet for data editing in preparation for specific analysis for each study objective. Data was analysed together where numerical data was reported using frequencies and percentages followed by narrative summaries which were analysed using thematic framework. This is because the quantitative and qualitative methods carried the same weight, hence the analysis was combined (Wilson 2006; Malhora 2010).

3.9.1 Quantitative Data Analysis

The quantitative data was collected numerically in categorical form. The data were collated by grouping it in different themes such as social and demographic variables of age, gender and education level.

Categorical data was quantified into frequencies and percentages. These were shown in tables and charts for easy illustration and short description of key issues were done for each table and figure. The bivariate or cross tabulation was done using the Chi square statistical test. This was done to demonstration relationship between the independent variable and dependent variable which is a binary categorical outcome. Significant relationship between independent variable to the dependent variable was measured at the threshold of 0.05 (Creswell 2014).

In the research analysis, Likert rating system of 5 to 1, with 5 being the highest and 1 being the lowest was applied in objective one to three. The following criteria were used to analyse the responses of the respondents: 5 meant strongly, 4 meant agree, 3 meant neutral, 2 meant

disagree, 1 meant strongly disagree. The mean, and standard deviation were reported in chapter 4.Additionally, further analysis was carried out to attain objective three. The analysis consisted of Z test of the mean differences, and pairwise ranking of the performance objectives based on the mean. Under the Z test, frequency, mean, mean differences, confidence interval at 95 % and two tailed probability (P) value were reported.

3.9.2 Qualitative Data Analysis

Qualitative data was written up in narrative form and this was analysed using thematic framework. This involved the identification of single unit of meaning derived from the text recorded from the responses, the single unit is called 'code'. The codes with similar meanings were grouped together, and a summary was written and labelled with a theme. Similar themed summaries that form a pathway pattern were grouped under a broader theme. Each summary written up was aligned with verbatim quotation from the respondents (Denscombe 2007).

3.9.3 Integration of quantitative and qualitative data analysis

Integration of the data analysis for the two components was done under the results chapter, discussion and conclusion alongside each other or in a complementary manner. Any differences in the interpretation of the data between the two components were stated. That is if the quantitative and qualitative data presented different aspects were explained in the results section, discussion and conclusion (Saunders et al 2009; Creswell 2014).

3.9.4 Ethical Considerations

The research study was cleared by the ethics committee of the University of Zambia, and permission to collect data was obtained from the ZAMMSA.

Ethical consideration is a set of principles that influence research projects and techniques. Scientists and researchers must always follow a rigid code of ethics while collecting data from humans. Human research has several purposes, including learning useful facts, studying effective remedies, exploring behavioUr, and improving health in numerous ways. What you choose to do and how you do it raises serious ethical concerns (Tashakkori and Cresswell, 2007).

Before the research begins, permission to conduct the study and authorisation to extract data will be secured from the University of Zambia and the ZAMMSA through the Office of Chief

Executive Officer (CEO) and subsequently Human Resource to proceed, respectively. Individuals who desired to take part in the study were shown the letter from the University of Zambia and endorsed by CEO and Human resource Manager for further authorisation. Participants were told all of the study's specifics before they choose to participate. Threats, on the other hand, are not included in the study.

The main data was obtained before participants in the research were asked to offer their informed consent. Participants were advised that participation in the study was fully voluntary, and that they could withdraw at any time and for any reason. Participants were notified that they would not be compensated for their time and effort. All data would be kept in strict confidence, and all studies would be de-identified so that study participants cannot be linked to the information they provided.

All secondary sources were cited using the Harvard reference format, which is recognized by the University of Zambia. A referring manager named Mendeley was used to ensure that the reference style was done appropriately. The dissertation might be run via 'Turnitin,' a similarity index algorithm that verifies the material's originality. In addition, the ethics committee of the School of Humanities and Social Sciences assessed the study proposal to ensure that all ethical issues were addressed.

3.10 Informed Consent

With the support of informed consent, participants may make educated, voluntary, and informed decisions about whether or not to participate in the study (Creswell, 2014). Knowing the purpose of the research, how long it will take, and the methods involved, and who should contact the questions is what informed consent is all about. In this examination, the importance of informed consent in the study will be assessed.

Respondents were given a detailed information sheet about the study. The goals, importance, risks, and benefits of research and participation in it will all be thoroughly described to study participants. This is a summary of the social contract that the Chief Investigator signed and for which he or she may be held liable.

3.11 Confidentiality

The study's confidentiality was agreed upon by both the researcher and the participants, describing how personally identifiable information about participants will be handled,

managed, and communicated (with informed permission). By collecting data in a regulated administering of questionnaires and interviews, respecting respondents' independence in selecting whether or not to engage in the study, and without gathering identifiers such as contact information or names or associating with them as persons, the study will maintain respondents' anonymity (Denscombe, 2007).

Confidential problems were considered from the start of the inquiry through the publication of the findings. Protections were in place to preserve privacy. The study was only to collect that bore minimum personal data for validation and relevant demographic samples. Personal identifying data was not collected or stored. Employees in the research field, if engaged should get confidentiality training (Abend, 2013).

3.12 Privacy

Privacy is a basic human right that is required for the protection and maintenance of human dignity, as well as the foundation for many other rights. In order to protect ourselves from unwelcome distractions, privacy allows us to build barriers and manage boundaries in our life, as well as debate who we are and how we want to interact with the world around us. We may utilize privacy to limit who has access to our bodies, places, and things, as well as how we interact with our data. In the face of tremendous power inequalities, privacy rules allow us to exercise our rights. As a result, secrecy is a critical tool for protecting ourselves and our community from abuse and power abuse by restricting what we can and cannot do for ourselves while hiding us from others who may seek to exert authority (Denscombe, 2007).

The study was conducted in a confidential manner. The confidentiality of study participants was safeguarded as there were no collected identifiers such as phone numbers, emails, or names. The respondents' autonomy was respected, and they were allowed to withdraw from the study at any moment, with no explanation or repercussions.

We make everyday decisions about privacy because it is so important to who we are as people. It gives us the freedom to be ourselves without fear of being condemned, to think freely and without prejudice, and to choose who we know. To minimize disruption or the exposing of questions or replies to other unauthorized parties, this will ensure that the questionnaire is finished by assisting respondents (Creswell, 2014).

3.13 Plagiarism

Plagiarism occurs when you use someone else's words, ideas, assertions, facts, or figures without their consent (Saunders and Tosey, 2013). The sources used in this study are cited. As a scholar, I swear that I will not cheat and that I will cite all of my data sources. In addition, without proper reference and, if required, license, I will not exhibit or use any other work, whether published or unpublished.

3.14 Coercion

Coercion occurs when another person purposefully poses an evident or subtle threat of damage in order to compel obedience. For example, an investigator may warn a potential relative that if he or she does not engage in the study, they risk losing access to critical health care (Creswell, 2014). Respondents' right to choose whether or not to participate was maintained in order to protect them. Members of staff at ZAMMSA were not be persuaded to participate in the study. As part of the study process, excessive internet use or time spent filling out data gathering tools was not paid for. The data collection tool took less than 10 minutes to complete.

There was no cooperation whatsoever. There were no enticements, favours, or incentives, and no requests for assistance from the supervisor, ethics committee, or examiners, therefore the study was entirely voluntary. ZAMMSA was sought for assistance in gathering data solely for academic purposes; no financial or material assistance was requested, and the findings had no direct importance for the agency outside of the principal investigator's academic activities.

3.15 Transparency

Transparency in research is defined by Creswell, (2014) as reporting that is honest, objective, and offers enough information about how the work is done for others to repeat it and be valuable in future analyses. As a result, because the study proposal is too little, the supervisor will be unable to review it. Behavioural examinations will assure individual protection and effective clinical procedures. Another public contract to demonstrate community participation. The study's findings will be addressed during the oral defense.

The study design, data collection, oral defense, and examination were all carried out in a clear and open way. There was open and constant communication between the investigator and the supervisor. Concerns and recommendations, as well as accomplishments, were discussed. The examiners' comments and clarifications were handled, and the responders and the ethics

committee were provided comprehensive information about the study. The ethics committee was updated on the study's progress.

By randomly picking research participants and enabling them to choose whether or not to participate, bias was decreased. Cronbach alpha was utilized to assess the validity of the study questions as well as the data collection methods. To ensure that the data was reliably measured, the questions were also pre-tested and standardised. To determine sample size, the target demography of workers and clients was used, and a representative sample size was determined. This ensured that all respondents were fairly represented, lowering the chances of bias being revealed. Furthermore, the data was analysed using statistical tools, which reduced human subjectivity.

3.16 Chapter Summary

Chapter three demonstrated the procedure used to conduct the study. The procedures were done as guided by the study objective started in chapter one to address the action-knowledge research gap stated under the statement of the problem in chapter one and as gap analysis in chapter two. Overarching research approach and design was mixed method which aimed at complementing the study findings. Next chapter presents the findings in alignment to the research objectives and questions; the findings are presented in tables and charts with short descriptions of the key findings.

CHAPTER 4

PRESENTATION OF RESEARCH FINDINGS

4.1. Introduction

In chapter three, the research methodology was presented illustrating how the study was carried out using a mixed methods approach. This chapter displays study findings that were generated upon the application of the research methods in line with the study objectives. First, the characteristics of the study sample are presented using descriptive statistics. The rest are the key study findings in narrative (qualitative) form for objective one; in descriptive statistics for objective two; and in descriptive inferential statistics for objective three. Generally the findings are presented in tables and with brief narration, and description. The chapter ends with a summary.

4.2 Characteristics of study respondents

A targeted group of respondents were interviewed and it was felt that a census would not capture the desired results as the study was about the determinants of supply chain agility which would only apply to those directly involved in supply chain. The following departments were interviewed, Logistics inbound and outbound, Procurement and Customer Service. Those interviewed were from senior management, middle management and unionised staff.

The vast majority of the respondents were males (83.3.7 % [56/67]); aged 23-35 years (61.1 % [41/67]); all with tertiary education level (100 % [67/67]); at middle management level of employment (55.6 % [37/67]); working the inbound or receiving department (33.3 % [22/67]); and with 1-6 years and 6-10 years working experience at ZAMMSA (Table 4.1).

Characteristic	**Frequency** (n=67)	**Percent** (100%)
Gender		
Male	56	83.6
Female	11	16.4
Age		
23-35	41	61.1
36-40	15	22.2

41-50	7	11.1
Above 50 years	4	5.6
Education level		
Tertiary	67	100
Level of employment		
Senior management	19	27.8
Middle management	37	55.6
Operational level	11	16.7
Department		
Inbound/receiving	22	33.3
Warehouse	19	27.8
Outbound/Dispatch	11	16.7
Customer service Centre	15	22.2
Experience at ZAMMSA		
1-5 years	22	33.3
6-10 years	22	33.3
11-15 years	19	27.8
16-20 years	4	5.6

Table 1: Characteristics of study respondents

Source: Field (2023)

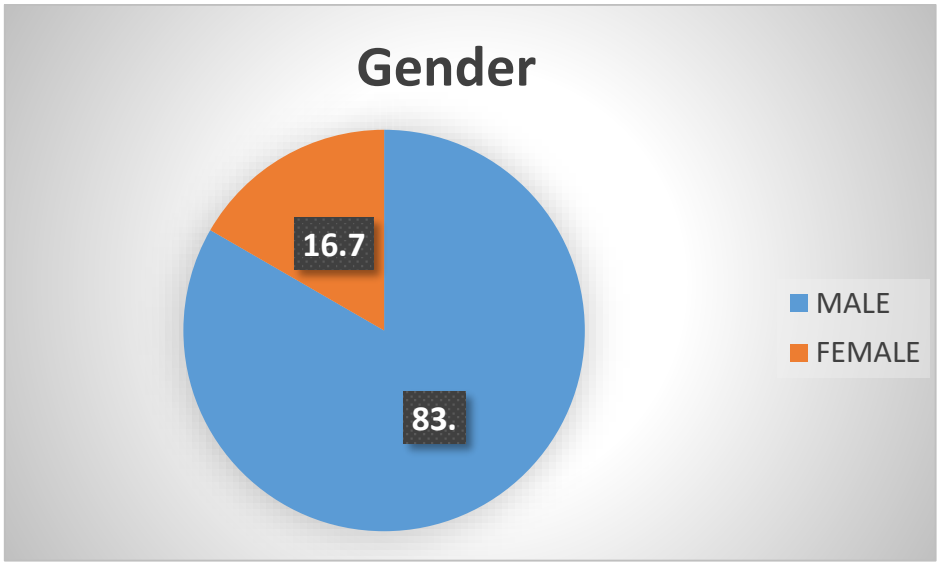

Figure 4: Gender of respondents

Source: Field (2023)

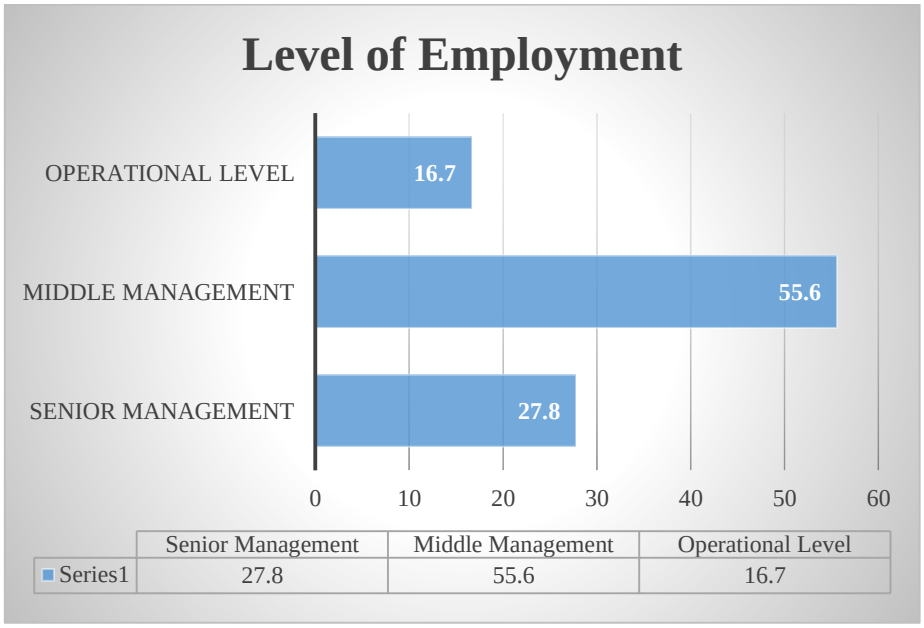

Figure 5: Levels of Employment

Source: Field (2023)

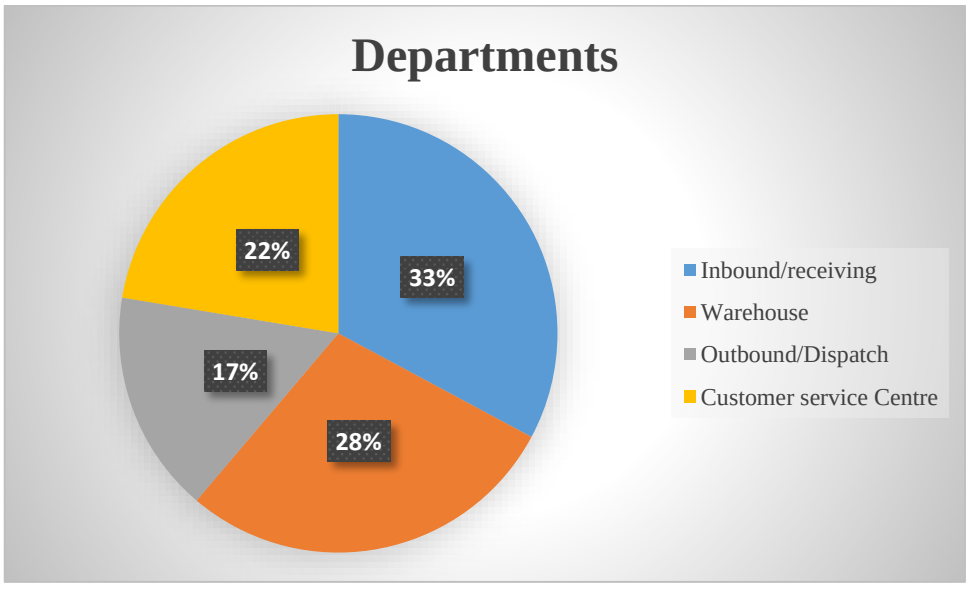

Figure 6: Departments of Respondents

4.3 Current State of Supply Chain Agility

The mandate of the agency others felt the change is not really there yet.

There were five thematic are that were identified to attain objective one. These are presented in table 2 and narrative are provided under each theme.

Theme	Participants	Quotation
Procurement optimization	18/18	"…mandate of the agency is to procure, store and distribution of all medical supplies…"
Electronic logistics management and information system	16/18	"…ELMIS is able to obtain data concerning stocks levels and demands and process the same through warehouse management system…"
Timely delivery	16/18	"The whole process is system driven from inbound and outbound…"
Stakeholder engagement	5/18	"By engaging clients from time to time on stock availability…"
Flexibility	18/18	"..Different tactics are put in places to ensure agility…"
Staff training	2/18	"…staff undergo trainings so are to improve on their skills…"

Table 4: Thematic analysis of the current state of supply chain agility

Source (Field, 2023)

The participant that have observed change said that due to the change, the supply change is responsive such that it is now ease to amend supply chain contracts in a short period of time when there is a problem. Other felt that the agency has become commercial hence the effective operation now. However, 2/18 participants stated that the changes have not affected anything (Table 2). "Currently our IT system are far from improving any abilities to sense and respond to market changes and customer demand" a participant. The mandate of the agency others felt the change is not really there yet. The participants that have observed change said that due to the change, the supply change is responsive such that it is now ease to amend supply chain contracts in a short period of time when there is a problem. Others felt that the agency has

become commercial hence the effective operation now. However, 2/18 participants stated that the changes have not affected anything (Table 2). "*Currently our IT system are far from improving any abilities to sense and respond to market changes and customer demand*" a participant.

4.3.1 Market sensitivity and Supply Chain agility

According to the 67 participants, the turnaround for ZAMMSA agility was when the institution become more autonomous in the procurement of medicines and medical supplies. The mandate was given to ZAMMSA to procure drugs as an intervention to optimize agility of its operations. The institution became more sensitive and aware to meet supply demand. Thus in their responses they added that the institution has become logistic oriented which has made it more agile in the procurement, storage and distribution because all logistics are done within unlike the situation before. One of the participants said that "*The mandate of the agency is to procure, store and distribution of all medical supplies, ZAMMSA is working around the clock to pursue that demand of medicines in all government hospitals and clinics is* enlisted *according to the healthcare system in Zambia*." A participant adds "*Procuring of medicines has now been brought to a level of customer demand hence reducing on dead stock unlike before, it is also worth noting that the system is now a source of ordering and eventually procuring medicines and medical supplies*". Another stated "*Zambia is leading in terms of the new mandate in the region and looks forward to the regions hub for procuring and distribution of medicines*". Initially, procurement was solely done by the two ministries; Ministry of Finance and Ministry of Health thereby disregarding the medicines and medical supplies needed hence medicines bought would be overtaken by time due to the long procurement processes and procedures.

4.3.2 Process integration on supply chain agility (Electronic logistics management and information system)

The 60/67 participant stated that the installation and Operationalisation of electronic logistics management and information system (ELMIS) has improved procurement, inventory, and distribution. Stocks are monitored in real-time from the inbound to the outbound through to the distribution or dispatch point around across the country. They said the automated internet powered system has increased effectiveness and efficiency. All the processes at ZAMMSA are integrated which is easy to respond to demand and follow through the supply chain. One of the participant explained that "*The agency through the ELMIS is able to obtain data concerning*

stocks levels and demands and process the same through warehouse management system, which has improved efficiency tremendously by meeting market demand".

Although, there was a general acceptance that the changes have brought about improvement to the mandate of the agency, others felt the change is not really there yet. The participant that have observed change said that due to the change, the supply change is responsive such that it is now ease to amend supply chain contracts in a short period of time when there is a problem. While others felt that the agency has become commercial hence the effective operation now. However, 7/67 participants stated that the changes have not affected anything. "*Currently our IT systems are far from improving any abilities to sense and respond to market changes and customer demand*" a participant.

4.3.3 Timely delivery

The transfer of ZAMMSA to procure and integrate of the ELMIS has enhanced timely delivery of medicines and medical supplies. Volumes stocks are up, accuracy and ease detection of errors in the inventory which used to slow down supply chain are a thing of the past as narrated by the 60/67 participants. The information is available to check on supply in transit to health facilities. *"The whole process is system driven from inbound and outbound process all system driven with a solid trail to show all the activities. This has made our work easier and effective"* said a participant.

They added on that strategic decentralisation of the regional hubs made the distribution timely and sensitive to market demand. *"Yes, with the introduction of regional hubs, the agency is able to respond in real-time on demand in terms of market sensitivity and rectify errors hence more accurate delivery*", explained a participant. Participants explained that, ZAMMSA as an institution has responded well to the changes. Demands from facilities are met quickly, on time, and as such emergency orders have drastically reduced.

4.3.4 Stakeholder engagement

The 19/67 participants explained that stakeholder engagement especially on the downstream side has assisted to manage stock levels well. This has prevented stock outs. The stakeholders which are the health facilities are continuously engaged to share stock level status from the Agency side and demand side. A participant narrated that "*By engaging clients from time to time stock availability and also sharing stock status has greatly improved service delivery*".

Another participant stated "*that there is however a delay at times by the health facilities to post their stock levels which unfortunately creates a perception by the public, that ZAMMSA is at fault and has no drugs. When drugs are available orders are filled and processed and if not available the health facilities are informed immediately.*

4.3.5 Flexibility

All the 67 participants agreed that ZAMMSA system is flexible. They said that it responds to the demands of the customers in various facilities. The system is adjustable to suit demand patterns, which is done after thorough analysis of the situation. They said that that system is designed to be customer-centric. *"Yes meeting customer needs is our number one priority. Different tactics are put in places to ensure agility as long as they do not go outside the business standard operation procedures"*, added a participant. Others also added *"that the response to different calls like pandemics i.e. covid, cholera and typhoid among other pandemics, is done swiftly as government puts in emergency funds. Emergency orders are dealt with by sourcing for medicines or medical supplies firstly within the hubs and health facilities. An example was given on a cholera outbreak which may need drugs that another health facility or region may not have a similar situation as a result the medicines are channelled to the relevant health facilities as required".* This implies that the agency is capable and ready to respond to real demand in terms of market sensitivity they said.

4.3.6 Staff Training

Of the 67 participants, two said that there is need to equip some members of staff with skills to cope up with the changes implemented. They said some members of staff require training to move with time in using the technology. This should be done as technology tactics change from time to time and the cooperating partners are readily available to train. "*Looking at the era we are now in, we need to move with time, staff need to undergo trainings so as to improve on their skills. Management should put up departmental trainings based on the areas of expectation to help employees acquire necessary skills. Cooperating partners should also train users in currents features added like, dashboards*".

4.4 The linkage between stockouts with supply chain agility

The linkage between stockouts and supply chain agility was examined through the analysis of performance objectives using composite score data derived from a Likert scale. This analysis

involved computing mean scores and conducting Pearson correlation tests, as outlined in Tables 3 and 4, respectively.

4.4.1 Analysis of the Mean Scores

The composite score analysis presented the performance objectives of market sensitivity, swift response, process integration, and flexibility concerning supply chain agility, based on the mean and standard deviation (std) from Table 3. This examination aimed to understand the relationship between these key factors and the agility of the supply chain, particularly in the context of addressing stockouts.

	Mean	Std. Deviation	N
Market Sensitivity	3.766	.8007	67
Swift Response	3.667	.4419	67
Process Integration	3.460	.6221	67
Flexibility	3.688	.7157	67

Table 2: Mean Analysis

Source: Field (2024)

4.4.2 Market Sensitivity

With a mean of 3.766 and a standard deviation of 0.8007, market sensitivity appears to have a moderate influence on supply chain agility. While it contributes to agility, variations across different observations suggest that some organizations may struggle to adapt swiftly to market changes, impacting their ability to manage stockouts effectively.

4.4.3 Swift Response

The mean response score of 3.667, coupled with a low standard deviation of 0.4419, suggests that swift response indeed plays a significant role in enhancing supply chain agility. This agile responsiveness plays a crucial role in mitigating stockouts and ensuring timely delivery of medical supplies to meet customer demands.

4.4.4 Process Integration

Process integration, with a mean of 3.460 and a standard deviation of 0.6221, appears to have a somewhat lower influence on supply chain agility compared to other factors. While it facilitates communication and collaboration with suppliers, improving operational efficiency, its impact on stockout management may vary across different organizations.

4.4.5 Flexibility

Flexibility, with a mean of 3.688 and a standard deviation of 0.7157, emerges as a significant factor contributing to supply chain agility. By adapting swiftly to changing market conditions, organizations can effectively address stockouts and ensure uninterrupted service delivery to customers.

4.4.6 Pearson Correlation Analysis

Below is the recast of Table 6, presenting a bivariate analysis of the performance objectives of supply chain agility using Pearson correlation statistical analysis of composite score data. The analysis explores the relationship between different aspects of supply chain agility and their potential impact on mitigating stockouts:

Performance Objectives		Market Sensitivity	Swift Response	Integration	Flexibility
Market Sensitivity	Pearson Correlation	1	.515**	.126	.263*
	Sig. (2-tailed)		.000	.308	.032
	Sum of Squares and Cross-products	42.311	12.034	4.157	9.933
	Covariance	.641	.182	.063	.150
	N	67	67	67	67
Swift Response	Pearson Correlation	.515**	1	.321**	.349**
	Sig. (2-tailed)	.000		.008	.004
	Sum of Squares and Cross-products	12.034	12.888	5.831	7.294
	Covariance	.182	.195	.088	.111
	N	67	67	67	67
Process Integration	Pearson Correlation	.126	.321**	1	.526**
	Sig. (2-tailed)	.308	.008		.000
	Sum of Squares and Cross-products	4.157	5.831	25.541	15.458
	Covariance	.063	.088	.387	.234
	N	67	67	67	67
Flexibility	Pearson Correlation	.263*	.349**	.526**	1
	Sig. (2-tailed)	.032	.004	.000	
	Sum of Squares and Cross-products	9.933	7.294	15.458	33.810
	Covariance	.150	.111	.234	.512
	N	67	67	67	67

**. Correlation is significant at the 0.01 level (2-tailed).

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

Table 3: Correlations of factors of Supply Chain Agility

Source: Author (2023)

4.6.1 Marketing Sensitivity

Positive correlation with Response (0.515**): The p-value of 0.000 indicates that this correlation is highly significant. Organizations with higher levels of marketing sensitivity are significantly more likely to demonstrate swift responses within their supply chains, potentially mitigating the impact of stockouts.

Positive correlation with Flexibility (0.263*): With a p-value of 0.032, this correlation is statistically significant at the 0.05 level. It suggests that organizations emphasizing market sensitivity also tend to prioritize flexibility within their supply chain operations, which could aid in addressing stockouts more effectively.

4.6.2 Swift Response

Positive correlation with Market Sensitivity (0.515**): With a p-value of 0.000, this correlation is highly significant. It reaffirms that swift responses are often aligned with heightened marketing sensitivity, potentially enabling organizations to react promptly to stockouts and minimize their disruptive effects.

Positive correlation with Integration (0.321**): The p-value of 0.008 indicates a significant correlation at the 0.01 level. Organizations with a swift response capability also tend to have well-integrated processes within their supply chains, facilitating agility in managing stockouts.

Positive correlation with Flexibility (0.349**): With a p-value of 0.004, this correlation is statistically significant at the 0.01 level. It underscores the importance of flexibility in complementing swift responses, allowing organizations to adapt quickly to stockouts and implement contingency measures.

4.6.3 Process Integration

Positive correlation with Response (0.321**): The p-value of 0.008 indicates a significant correlation at the 0.01 level. A moderate positive correlation implies that well-integrated processes often support swift responses to stockouts within supply chains, ensuring smoother recovery from disruptions.

Positive correlation with Flexibility (0.526**): With a p-value of 0.000, this correlation is highly significant. It suggests that process integration is closely linked to organizational flexibility, enabling agile responses to stockouts and enhancing supply chain resilience.

4.6.4 Flexibility

Positive correlation with Marketing Sensitivity (0.263*): The p-value of 0.032 indicates statistical significance at the 0.05 level. While moderate, this correlation signifies that organizations prioritizing flexibility also tend to exhibit a degree of marketing sensitivity, which could contribute to better anticipation and management of stockouts.

Positive correlation with Response (0.349**): With a p-value of 0.004, this correlation is statistically significant at the 0.01 level. Flexibility complements swift responses, ensuring agile reactions to stockouts and minimizing their impact on supply chain performance.

Positive correlation with Integration (0.526**): The p-value of 0.000 indicates high significance. Strong correlation emphasizes that organizational flexibility is closely intertwined with well-integrated processes, supporting agility in addressing stockouts. Considering both the correlation coefficients and their associated p-values allows for a more robust interpretation of the relationships between factors influencing supply chain agility, particularly in the context of managing stockouts.

4.7 To recommend Supply Chain Agility Strategies

Further, the aggregated mean score for market sensitivity (3.8) is higher than swift response (3.7), process integration (3.6) and flexibility (3.7). However, the Z score test for mean differences indicates that using the market sensitivity as the highest mean score to compare with the rest of the performance objectives there was no statistically significant differences across the performance objectives in influence supply chain agility (swift response 0.1, 95 % CI: - 0.1 , 0.2, 0.2, p =1.0; process integration 0.2 95 % CI: -0.1 , 0.2, p = 1.0; and flexibility 0.1 95 % CI: -0.1 , 0.2, p =1.0) This shows that the influence on supply chain agility is influence by all the four performance objectives (table 4.6).

Aggregated mean scores comparison					
Performance objectives	**N**	**Mean scores**	**Mean differences (Z score test)**	**95 % CI**	**P**
Market sensitive	67	3.8	1	1	1
Swift response	67	3.7	0.1	-0.1 , 0.2	1.0
Process integration	67	3.6	0.2	-0.1 , 0.2	1.0
Flexibility	67	3.7	0.1	-0.1 ,.02	1.0

Table 4: Aggregated mean score comparisons

Source: Author (2023)

Furthermore, the preceding in table 7 shows that the correlation coefficient reveals a stronger relationship between market sensitivity and swift response, process integration, and flexibility.

The study discovered a perfect positive correlation significance of +1 between market sensitivity and swift response, a strong positive correlation significance of 0.9 between market sensitivity and process integration, and a strong positive correlation significance to process integration of 0.9.

4.9 Chapter summary

The chapter has demonstrated that the study objectives have been attained, and study questions answered. It has also shown that the applied research methodology has generated findings sought out for. Qualitative findings answered the first questions, and quantitative answered the second and third questions. The next chapter discusses the study key findings.

CHAPTER 5

DISCUSSION OF RESEARCH FINDINGS

5.1 Introduction

In chapter four, the presentation of the study findings were presented in alignment to the study objectives. This chapter discusses the findings in the context of what is currently obtaining in the country and in the context of these findings. The findings were drawn from research questions and interviews, were aspects of supply chain agility were explore. A thematic analysis clearly stated that supply chain of ZAMMSA was is largely based on administrative and operational intervention. The chapter ends with summary.

5.2 Socio-demographic Characteristics of Survey respondents

This finding holds significant implications. Firstly, it indicates that the study's sample represents a broad cross-section of the organization's workforce, encompassing individuals from various demographic backgrounds and roles. This diversity ensures that the insights gained from the study are applicable and relevant across different segments of the organization, enhancing the validity and reliability of the findings. Furthermore, the fact that the majority of respondents possess tertiary education suggests a high level of educational attainment within the organization, which can positively influence the quality of feedback and insights provided. The distribution of respondents across different employment levels and departments also implies that perspectives on supply chain agility are gathered from individuals occupying various positions and functions within ZAMMSA, leading to a more comprehensive understanding of the challenges and opportunities related to supply chain management. Overall, this finding underscores the importance of considering diverse perspectives and experiences within ZAMMSA to develop effective strategies for improving supply chain agility and organizational performance.

5.3 Current State of Supply Chain Agility

The study determined that the current state of supply agility at ZAMMSA refers to the status of agility at ZAMMSA which is transformational, largely administrative and operational. Administratively, the milestone has been increasing the mandate of ZAMMSA to procure medicines and medical supplies. This has scaled up the logistics role of ZAMMSA to be more effective and efficient. It is also envisioned that the commercial role of ZAMMSA will be

effectively undertaken with the transfer of the procurement mandate. This transformation is key for increasing supply chain agility because the administrative bottleneck will be resolved. The institution is becoming more autonomous to perform its mandate which should awake its supply chain agility.

However, the current context indicates that there is erratic supply of medicines in public health facilities which is shown by a wide public outcry (Kasonka, 2022;Kamuna, 2022;Chilala, 2022; Mwango, 2023). This entails that the transformation is still on going. For example, recently, ZAMMSA assured the public not to panic as steady supply of medicines and medical supplies have been procured (Mwango, 2023). Further, due to an annual stocktaking exercise that was going on, the agency partially suspended the normal supply chain which affected agility. The agency supplied medicines and medical supplies on emergency according to a communique by its public relation manager (Ndulinga, 2023).

ZAMMSA is not immune to the political atmosphere, with the change of government came drastic changes which in one or more ways affecting the supply change of medicines and medical supplies. For instance, entire management at the agency was sent on forced leave by the Minster of Health due to expired drugs. This implied that there was a leadership vacuum which affected supply chain agility (Kapambwe, 2022). Currently, the agency is seeking to procure medicines and medical supplies in Egypt (Zambian Ministry of Health, 2023), this shows that for supply chain agility to take off supply chain management should be well established as currently the agency is not yet settled. However, the current state of the agency is promising to having the mandate to procure, warehouse and distribute the medicines and medical supplies, this is an indication for effective and efficient supply chain agility. As the agency settles, the supply chain is anticipated to be more agile.

This on one hand, other than the other, the study, has established that the implementation of ELMIS has improved operations at the agency. Currently all the departments have been integrated to using ELMIS. This has brought about real-time procurement and supply from the warehouses to the facilities. The inventories are well monitored and accented for with transparency. The supply on transit or during distribution are tracked using global information system and deliveries are confirmed in real-time. Even emergency orders are easily facilitated because of the automated system.

When the administrative bottle necks in procurement are resolved, the agency will be more agile because the operation will be well integrated to meet demand on time in the public health

facilities. The system has the capability to effortlessly identify errors, enhance precision, while information is readily accessible for utilization and examination. It is therefore sensitive to the market and this has made it possible and effective for the agency to work with the primary stakeholder on the downstream side and the public health facilities. The public health facilities are easily engaged because of the real-time system in place. This has reduced on time, clarity and prevented unforeseen stockouts. Thus this entails that the system is flexible to demands of various health facilities.

However, implementation of the various intervention requires building capacity in the staff particularly to keep up with technological changes such as the use of ELMIS. Although the staff are coping, there is need to update all the staff of any digitalised changes to ensure agility skills are acquired by members of staff. This will make the agency to quickly adjust to any change.

5.4 Linkage between stockouts with supply chain agility at ZAMMSA

The study established that market sensitivity has a huge influence on supply chain agility at ZAMMSA. It is responsive to a range of suppliers, flexible to lead-time change and expediting in emergency both on the demand and supply side, to inventory turnover and dead stock, and above all responsive to number of frequencies of order or demand. It is therefore, well acknowledged that these characteristics have an impact on supply chain agility particularly, responsive to number of demand across the health facilities.

5.4.1 Market Sensitivity

Market sensitivity emerges as a pivotal determinant of supply chain agility at ZAMMSA. The agency's responsiveness to fluctuations in customer demands and adaptability to changes in the market landscape underscore its commitment to agility (Selen and Soliman; Langat et al., 2013). This aligns with prior research highlighting the critical importance of market sensitivity in orchestrating efficient supply chain operations, ultimately fostering customer satisfaction and organizational resilience. Particularly concerning stockouts, market sensitivity enables ZAMMSA to promptly respond to disruptions and adjust its procurement and inventory management processes to mitigate their impact. By staying attuned to market dynamics, ZAMMSA can anticipate potential stockouts and take proactive measures to prevent or minimize their occurrence, thereby ensuring uninterrupted supply of medical goods to healthcare facilities.

In the context of stockouts, market sensitivity allows ZAMMSA to accurately gauge demand fluctuations and adjust its inventory levels accordingly. This proactive approach helps the agency maintain optimal stock levels to meet healthcare facility requirements while minimizing excess inventory carrying costs. Additionally, market sensitivity enables ZAMMSA to identify emerging trends and changing preferences in the healthcare sector, allowing it to adapt its product offerings and procurement strategies to align with evolving market demands. By leveraging market intelligence and customer insights, ZAMMSA can enhance its agility and responsiveness, thereby mitigating the impact of stockouts on service delivery.

Moreover, market sensitivity facilitates effective communication and collaboration with suppliers, enabling ZAMMSA to rapidly address stockouts through timely procurement and replenishment activities. By maintaining strong relationships with suppliers and monitoring market trends, ZAMMSA can leverage alternative sourcing strategies and expedited delivery options to mitigate the impact of stockouts on healthcare facilities. This proactive approach not only minimizes disruptions in service delivery but also enhances customer satisfaction and organizational resilience. Overall, market sensitivity serves as a cornerstone of ZAMMSA's supply chain agility, enabling the agency to navigate through challenges such as stockouts with efficiency and effectiveness.

5.4.2 Swift Response

Swift response capabilities are essential for addressing stockouts effectively within ZAMMSA's supply chain framework. The agency's ability to make timely decisions and procure necessary supplies enables it to navigate through disruptions seamlessly (University of Tennessee, 2013; Langat et al., 2013). This aligns with established research emphasizing the critical role of swift response mechanisms in ensuring operational efficiency and adaptability, especially in dynamic market environments. Swift responses to stockouts allow ZAMMSA to minimize delays in delivering medical supplies, thereby maintaining service levels and meeting healthcare facility demands.

In the face of stockouts, swift response capabilities enable ZAMMSA to deploy alternative sourcing strategies and expedited procurement processes to replenish inventory levels rapidly. This proactive approach helps mitigate the impact of stockouts on healthcare facility operations, ensuring uninterrupted access to essential medical supplies. By leveraging technology and real-time data analytics, ZAMMSA can identify stockouts promptly and initiate

response actions swiftly, thereby minimizing disruptions in service delivery and maximizing customer satisfaction.

Furthermore, swift responses to stockouts demonstrate ZAMMSA's commitment to operational excellence and customer service. By prioritizing timely action and effective communication, the agency can instil confidence among healthcare facilities and stakeholders, reinforcing its reputation as a reliable supplier. Moreover, swift responses to stockouts contribute to overall supply chain resilience, enabling ZAMMSA to adapt to unforeseen challenges and maintain service continuity. Through continuous improvement and investment in response capabilities, ZAMMSA can enhance its agility and responsiveness, ensuring that stockouts have minimal impact on healthcare delivery in Zambia.

5.4.3 Process Integration

Process integration plays a vital role in enhancing supply chain agility at ZAMMSA, facilitating seamless communication and collaboration with suppliers (Rungsrisawat and Jermsittiparsert, 2019). By optimizing internal processes and strengthening partnerships with suppliers, ZAMMSA enhances its ability to manage stockouts effectively. This aligns with prior research highlighting the significance of process integration in fostering agility and ensuring business continuity within supply chain networks. Efficient process integration enables ZAMMSA to streamline its response to stockouts, minimizing disruptions and maintaining operational resilience.

Effective process integration enables ZAMMSA to implement proactive measures to prevent stockouts, such as demand forecasting and inventory optimization. By aligning internal processes with supplier capabilities and customer demand patterns, ZAMMSA can anticipate potential stockouts and take pre-emptive action to replenish inventory levels promptly. This proactive approach reduces the likelihood of stockouts occurring and mitigates their impact on healthcare facility operations. Additionally, process integration facilitates real-time information sharing and collaboration across the supply chain, enabling ZAMMSA to coordinate response efforts efficiently during stockout situations.

Moreover, process integration enables ZAMMSA to implement contingency plans and alternative sourcing strategies to address stockouts effectively. By leveraging existing relationships with suppliers and establishing backup supply channels, ZAMMSA can minimize the disruption caused by stockouts and maintain continuity in medical supply delivery. This

strategic approach enhances ZAMMSA's resilience to supply chain disruptions and strengthens its ability to meet the healthcare needs of the population. Overall, process integration plays a crucial role in enhancing supply chain agility at ZAMMSA, enabling the organization to respond swiftly and effectively to stockout situations while maintaining operational excellence.

5.4.4 Flexibility

Flexibility emerges as a crucial enabler of supply chain agility at ZAMMSA, allowing the organization to adapt swiftly to changing market conditions and customer demands, including stockouts (Christopher and Towill, 2002; Gligor et al., 2019). By prioritizing flexibility, ZAMMSA can navigate uncertainties and disruptions effectively, ensuring continued operational performance and customer satisfaction. This aligns with existing literature emphasizing the critical role of flexibility in facilitating agile responses to fluctuations in the market landscape. The agency's emphasis on flexibility empowers it to proactively address stockouts and capitalize on emerging opportunities, ultimately enhancing its competitiveness in the healthcare sector.

The flexibility embedded within ZAMMSA's supply chain operations enables the organization to deploy alternative sourcing strategies and adapt procurement practices swiftly in response to stockouts. By maintaining diverse supplier relationships and exploring innovative procurement methods, ZAMMSA can mitigate the impact of stockouts on its ability to fulfil medical supply orders. Additionally, the flexibility to adjust inventory levels and reorder points dynamically allows ZAMMSA to optimize its inventory management processes and minimize the occurrence of stockouts. This proactive approach ensures the availability of essential medical supplies while enhancing operational efficiency.

Furthermore, flexibility empowers ZAMMSA to implement agile distribution strategies to address stockouts effectively. By leveraging technology and data analytics, ZAMMSA can optimize delivery routes, expedite order fulfilment, and prioritize critical medical supplies during stockout situations. This strategic allocation of resources enables ZAMMSA to minimize disruptions to healthcare facility operations and maintain high service levels. Additionally, the flexibility to modify service agreements and contractual terms with suppliers enables ZAMMSA to negotiate favourable terms and conditions that facilitate rapid response to stockouts. Overall, flexibility serves as a cornerstone of supply chain agility at ZAMMSA, enabling the organization to navigate stockout challenges seamlessly while delivering value to its stakeholders.

In summary, the linkage between stockouts with supply chain agility at ZAMMSA is evident across market sensitivity, swift response, process integration, and flexibility. These interconnected factors underscore the organization's ability to manage disruptions effectively and maintain operational resilience in a dynamic healthcare landscape. By aligning operational strategies with these key determinants of agility, ZAMMSA can enhance its responsiveness to stockouts and ensure the timely delivery of medical supplies to healthcare facilities, thereby fulfilling its mission of serving the healthcare needs of the population effectively.

In conclusion ZAMMSA continues to experience stockouts which primarily is external and while a few are internal factors;

- Medicines and Medical supplies face a down time when it comes to deliveries i.e from supplier contractors or delivery to the hubs. This supplier contracts after optimisation has not been stable and has further been hampered by Government audits of suppliers. This has greatly affected the agency as the PESTLE factors affect the procuring of medicines and medical supplies.

- Demand forecasting is instituted however the delays in procurement processes and procedures, and policies affects delivery of drugs by suppliers which continues to pave way for expiration of drugs both at the health facilities and hubs.

- Though strides are seen in the logistics area, there is a lack of a monitoring system that tracks the delivery from Headquarters to the hubs and health facilities as a result ZAMMSA uses inbound and externally sub contracted transport. The trucks have no GPS that tracks its movement or route. Even when the truck breaks down or is delayed due to heavy traffic on the road, no tracking information is communicated in real time. Information is usually passed on by the driver if faced with any challenges, of which mostly this information is relayed to headquarters.

The Main Warehouse has continued to experience thefts and this is as a result of compromised security at the warehouse which causes pilferage. This in turn causes disruptions in service delivery. Reports continue to be published concerning thefts (Mwamba, 2022).The ELMIS is ZAMMA’s integrated system which is functional, however, a remote backup-system is not available. The country’s has been striving to offer good connectivity of internet which is quite intermittent, and this is a critical challenge faced by facilities as they do not have server’s but

depend on routers. This affects the facilities who cannot order drugs other than in the system (ELMIS). A remote system enables firms to work on backed up systems which is also in real time. The system also has limited data set to be entered in the system which therefore does not address issues that facilities may want to report. Focus on elements of inventory management should be monitored and collaborated so as to have a smooth continuation and implementation of Supply Chain Agility.

5.5 Supply Chain Agility

The study clearly indicated that all the performance objective have similar effects on supply chain agility. All the four variables are applied by the agency to scale-up supply chain agility. This shows that the influence on supply chain agility is influenced by all the four performance objectives. Additionally, the study contends that the performance objectives are interdependent, there is no objective which is more superior or effective than the other.

Agility as business-wide capability embraces organizational structures, information systems, logistics processes and, in particular, mind-sets that implement fully SCA. During the study, the researcher observed that supply chain agility at ZAMMSA is affected by a number of issues as discussed below:

5.5.1 The Organisational Structure

At the time of the research many positions were vacant. The more departments and management becomes a reality in an organisation decision making is a priority which eventually increase the supply chain network (Novoszel and Wakolbinger, 2022). Once these positions are filled the organisation is expected to run smoothly as it will be optimised.

5.5.2 Information Systems

Characteristics such as adaptability, responsibility, expertise, and rapidity are all required to achieve supply chain agility (Bvuchete, *et al*., 2018). Therefore ICT enables partners to closely synchronise operations and enable real-time fulfilment (Violah, 2022). Technology makes organisations to be one step ahead from others and gives them an advantage when it comes to service delivery. ELMIS and other supporting systems are critical to the running of the agency. Hence a holistic approach should be embraced.

5.5.3 Logistics Processes

Order fulfilment as a first process in service delivery to health facilities starts with interactions in ELMIS. Inventory then covers delays that might occur, protects the company from demand fluctuations, takes advantage of quantity discounts and hedges the company against inflation. ZAMMSA is a national procuring agent for medicines and medical commodities for health facilities therefore inventory management is key to its operations any roughness in the SC can adversely affect the whole system. Furthermore logistics requires interconnectedness components, from transportation to storage, stacking inbound and outbound (Xiaoting (2019). Warehousing deters wastage and pilferage and is critical to the operations of the agency. Distribution to the different health facilities is part of the order fulfilment demands.

5.5.4 Mind-sets

Agility also has the ability to foresee, resist, and recover from unexpected and disruptive occurrences (Anesanb, *et al.*,2018). Stockouts can be quite disruptive when it comes to service delivery in health facilities. Thus foreseeing the unexpected and excepted can sever ZAMMSA from recurrent trends that can be avoided. Forecasting can greatly help the agency in its SC activities. Government involvement can also be analysed by applying policy that will cartel future interferences that have in the past affected service delivery.

The Ministry of Health and cabinet should ensure that ZAMMSA acquires full autonomy to procure medicines and medical supplies without micro managing it. ZAMMSA has been faced by unstable management due to the macro factors such as Political, Environmental, Economic, Social and Technological. These factors primarily affects ZAMMSA while it has no control over them. Policy and legislative has to be drawn so as to allow the agency to operate independently according to the mandate. Autonomy will also allow management to make required decisions for the benefit of all its stake holders.

According to Yarosen *et al*., (2019) agility is the ability of the supply chain team and its members as a whole to quickly adjust the network and operations to changing and volatile consumer demands. The agency should comprehensively and deliberately or intentionally adopt the combination of market sensitivity, swift response, process integration and flexibility as a model for supply chain agility. The concept is one that enables organisations to respond quickly to the customer needs. ZAMMSA's response to the health facilities' request through ELMIS means that health facilities would have also responded to their client's needs.

5.6 Chapter Summary

The chapter presented key findings pertaining supply chain agility at ZAMMSA. The chapter described indicated that the four performance objectives are a favourable model to attain supply chain agility at ZAMMSA. It has also showed that currently the huge challenge is procurement which is the mandate of the agency but there is sluggish to actualise this mandate due to political supervision. The next chapter provides a concise conclusion on the study findings and implication.

CHAPTER 6
CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

In chapter five, study objectives and questions were presented. The chapter further presented recommendations on the current state of supply chain agility, performance objectives and made recommendations for administrative and operation of ZAMMSA. A future study was also suggested under this chapter.

6.2 Conclusion

In conclusion the study sought to investigate the determinants of supply chain agility at ZAMMSA in Lusaka District by looking at the variables that affect supply chain agility at the agency. The combination application of market sensitivity, swift response, process integration and flexibility makes a model that ZAMMSA has embraced and should be comprehensively implemented.

It was further concluded that all the four variables are an ideal model that the agency should deliberately indulge in implementing. It is definitely laid bare that currently the impediment are on the administrative side that the agency and cabinet are sorting out. The agency has shown lack of operational autonomy. This therefore calls for strengthened structure which addresses the current administrative challenges especially in the procurement.

On the other hand political interference has shown that it has affected operational agility of supply chain. This will continue to happen as long as autonomy is not entirely given to the agency through the board of directors predominantly when there is change of government. The board of directors are usually at the mercy of incumbent Minister of Health, as the standard practice. It was further observed that there is no stability at the agency as directors have been dismissed time and again. Despite the noted gaps and loopholes in supply chain, the agency has demonstrated that the four performance objectives are a fit model for the agency to attain supply chain agility.

6.3 The current state of supply chain agility at ZAMMSA

The concept of agility is borrowed from sports and military which defines agility as the ability to decelerate, accelerate, and change direction while retaining good body control and

minimizing transition time (Aronsson et al., 2011). The study determined according to objective one and research question one, that the current state of supply agility at ZAMMSA is transformational thereby alleging that it was largely administrative and operational.

Market sensitivity, swift response, process integration and flexibility are performance objectives of supply chain agility that ZAMMSA is currently implementing and effecting. Overall, the new mandate for ZAMMSA to procure medicine and medical commodities is still facing administrative bottlenecks which are affecting supply chain agility. These bottlenecks are the organisational structure which has not been fully implemented due to unstable management. At the time of research the entire board of Directors had been dismissed and dissolved respectively leaving acting officers in the current management team and ministries to act.

6.4 The linkage between stockouts with supply chain agility at ZAMMSA

Objective two shows the linkage between stockouts with supply chain agility at ZAMMSA was of more agile supply chain which is better equipped to respond to changing conditions, making informed decisions, and maintaining a reliable flow of products to the customers, reducing the risk of stock outs and associated disruptions to business operations. Major contributors to stock-outs include an absolute shortage of funds; human resources for health issues, including absolute shortages, skill deficits and urban concentration; and inefficiencies and malpractice in the supply chain exacerbated by a lack of reliable information on medicine needs and usage (Wales et al., 2014).

Although the objectives play a key integrated role, the process of integration is at a centre of agility through the automation of the system used called ELMIS. ELIMIS also has its own limitation especially when there is no power and when there is no connectivity. Orders and stock monitoring is done through ELMIS and any down time affects service. The sooner the procurement mandate is finalized and stabilizes the model using the four objectives will effectively and efficiently take off. Therefore, the implementation of the ELMIS at ZAMMSA is a core intervention to enhance all the performance objectives of supply chain agility. It has great influence that has strengthened other objective performances. It is a cornerstone of supply chain agility at ZAMMSA.

6.5 Recommended strategies that can be employed in Supply Chain Agility

The researcher recommended some strategies which can help ZAMMSA close up gaps in supply chain agility. One of the strategies recommended is the acquiring of autonomy in its operations in response to objective number three. However, in as much as ZAMMSA has the mandate to procure, store and distribute medicines, it still lacks total autonomy due to political influence as observed during the study.

The researcher suggests the following to senior management at ZAMMSA based on the three objectives of the study to enhance operations and reduce medical stockouts.

i. To design, and implement a remote backup-system which can be used between the facilities and the Agency. A remote system will enable both parties "ZAMMSA and health facilities" to communicate and record data even when the system is not online. This system can be available even when the system or network issues arise. This is necessary as ELMIS is a critical drive of supply chain agility at ZAMMSA.

ii. Create a robust delivery system to help track medicines and medical supplies to the health Facilities and hubs. Drugs are requested for through ELMIS and once loaded there is no tracking system that health facilities and hubs to know what time the medicines and medical Supplies will arrive.

iii. Introduce a buffer for stock supplies to avoid and or reduce supply stock outs. This strategy will strengthen the link between stock out and supply agility according to objective number two.

iv. Enhance security at the main warehouse so as to avoid pilferage. These recommended strategies will help curb pilferage which is not only a cost to the agency and but will reduce disruptive risk to patients.

6.6 Future Studies

The scope of the study focused on Supply Chain Agility and was limited to Zambia Medicines and Medical Supplies Agency while interviews and questionnaires targeted sampling randomly and purposively staff from lower levels, middle management and senior management. The weight was on Supply Chain agility objectives which were market sensitivity, process integration, flexibility and speed response. Agility is therefore existent at ZAMMSA yet a full

implementation is pending due to some administrative challenges among them Political and technological.

Thus future studies should triangulate the supply chain agility model of ZAMMSA from the perspective and experiences on the demand side and when or if possible from the supply end as well. Encompass investigating the roles of partners, donors, health facilities and hubs as part of having a holistic view of supply chain agility at ZAMMSA and examine the role of government.

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