SCHOOL OF COMMERCE

DEPARTMENT OF LOGISTICS AND SUPPLY CHAIN MANAGEMENT

FACTORS INFLUENCING THE PHARMACEUTICAL SUPPLY CHAIN PRACTICES IN THE CASE OF ETHIOPIAN PHARMACEUTICAL SUPPLY SERVICE (EPSS)

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Thesis Approval

This is to certify that the thesis carried out by Mahlet Sisay Gebregiorges, entitled: Factors Influencing the Pharmaceutical Supply Chain Practices in the case of Ethiopian Pharmaceutical Supply Service (EPSS) and submitted in partial fulfilment of the requirements of the Degree of Master of Art in Logistics and Supply Chain Management complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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DECLARATION

I, the undersigned, declare that this thesis entitled Factors Influencing the Pharmaceutical Supply Chain Practices in the case of Ethiopian Pharmaceutical Supply Service (EPSS) is my original work and to the best of my knowledge has not been presented for the degree by any other person, and all sources of materials used for the thesis have been duly acknowledged.

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mahlet

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Certification

This is to certify that **Mahlet Sisay Gebregiorges** has carried out this research work on the entitled topic Factors Influencing the Pharmaceutical Supply Chain Practices in the case of Ethiopian Pharmaceutical Supply Service (EPSS) under my supervision. This work is original in nature and has not been presented for a degree in any University and it can be submitted for the partial fulfilment of the requirements for the award of the degree of Master of Art in Logistics and Supply Chain Management.

Tesfaye Belay

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Date_____

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Acronyms and Abbreviations

PFSA: Pharmaceuticals Fund and Supply Agency

EPSA: Ethiopian Pharmaceutical Supply Agency

EPSS: Ethiopian Pharmaceutical Supply Service

IPLS: Integrated Pharmaceutical Logistics System

WHO: World Health Organization

FMOH: Federal Ministry of Health

PSCM: Pharmaceutical supply chain Management

L/C: Letter of Credit

SOP: Standard Operating Procedure

FEFO: First Expiry First Out

Abstract

This study aimed to evaluate the factors influencing the pharmaceutical supply chain practices in the case of Ethiopian Pharmaceutical Supply Service (EPSS). With the study of both qualitative and quantitative data, the researcher used a descriptive research design. 100 employees from the case company's distribution and fleet, warehouse and inventory management, and procurement directorates were the target population. Primary data was gathered using a questionnaire, and after being statistically evaluated using frequencies, means, and standard deviation, the results are shown in tables. The study's findings showed that there is a positive correlation between the independent variables and dependent variable. The organization's overall supply chain practise is impacted by challenges of quantification, procurement, warehousing, inventory management, and distribution operations. Out of these, distribution challenges are not statistically significant to affect the supply chain practice of the organization. The most common challenges the respondents mentioned are inadequate warehouse capacity, lack of coordination between procurement and inventory management departments, limited vehicle capacity and limited supplier for essential medicines. Despite the limitations, EPSS needs to strengthen communication internally and externally with other stakeholders, improve and enforce standard operating procedures and should fully implement effective computerized logistics system in all the core processes to increase data visibility and support in informed decision making for effective and efficient delivery of service.

Key words: *Pharmaceutical, Supply Chain, Procurement, Warehousing, Inventory management, Distribution*

Chapter One

Introduction

The main purpose of this study is to assess the factors influencing the pharmaceutical supply chain practices in the case of Ethiopian Pharmaceutical Supply Service (EPSS). This chapter presents the background of the research, statement of the problem, research question, objective of the study, significance and scope of the study, definition of terms and organization of the study.

1.1 Background of the study

Supply Chain Management (SCM) is defined as the integration of key business processes across the supply chain for the purpose of creating value for customers and stakeholders. Indeed, supply chain management integrates supply and demand within and across companies in an efficient business model. The Council of Supply Chain Management Professionals defines supply chain management as planning and management of all activities involved in sourcing, procurement, conversion, and all logistics activities. There are various aspects of optimizing in the supply chain; eliminating bottlenecks, balancing between lowest material cost and transportation, optimizing manufacturing flow, maintaining the right mix and location of factories and warehouses, vehicle routing analysis, dynamic programming and efficient use of capacities, inventories, and labours are of main aspects of supply chain optimization. All stockholders need to institute the right configuration and adaptability to create best practice and to overcome the obstacles in a continuous changing environment (Jaberidoost, 2013). Supply chain management in general refers to the process of managing the flow of goods and services, from raw materials to the final product, in order to maximize customer value and reach to end users. It involves coordinating the logistics of all aspects of the supply chain, including planning, sourcing, manufacturing, delivering, and returns, to minimize scarcities and costs to perform in the most effective and efficient way possible.

The pharmaceutical industry supply chain refers to the entire process of managing and distributing drug products from the point of production to the end user, which can include drug wholesalers, hospitals, pharmacies, and patients. It encompasses all the steps involved in getting prescription medicines to the people who need them, including manufacturing, procurement, distribution, and delivery. Indicators of

pharmaceutical supply chain practices include several supply chain management protocols in the different functional areas and are developed by WHO at different levels. These indicators measure the efficiency and effectiveness of a country's pharmaceutical situation, including drug availability, procurement, distribution, and management system weaknesses.

The pharmaceutical supply chain is the means through which medicines and medical supplies are manufactured and delivered to patients. But the supply chain network is actually very complex, requiring several steps that must be taken to ensure medications are available and accessible to patients. In such a complex process, the stakes are high for pharmaceutical supplying organizations. An ineffective supply chain could disrupt the healing processes of patients and produce negative effects on public health. Overall, the pharmaceutical supply chain is vital for patients to receive the medications they need without having to deal with stress or roadblocks along the way. The various challenges of this process such as lack of coordination, inventory management, absent demand information, human resource dependency, order management, and shipment visibility make it difficult for organizations to properly address challenges such as supply shortages (Mcgrail, 2020).

All pharmaceutical supply chains are at risk from disturbances that can negatively affect them. Therefore, it is crucial that supply chain managers identify these potential disturbances and develop mitigation and contingency plans to increase or improve resilience. Vulnerabilities that impact the supply chain include its globally distributed, disconnected, and fragmented nature, a lack of diversity in suppliers, and a lack of visibility that makes it difficult to respond to unexpected or sudden changes in demand. The pharmaceutical industry supply chain is also beset by a continued reliance on time-consuming manual and paper-based processes (Mcgrail, 2020).

Identifying challenges and mitigating them in pharmaceutical companies not only can lead to process optimization, productivity increase and increased service, but also will help health systems to meet goals of supply chain practices which are accessibility, quality, and affordability. By addressing gaps in supply chain visibility, organizations in the pharmaceutical industry can gain more control of their supply chain and can mitigate issues before they cause significant loss. Organizations can also optimize their inventory levels,

increase flexibility in response to short-term demand fluctuations and avoid product overages/shortages (Jaberidoost, 2013).

In Ethiopia, the pharmaceutical supply chain practice is developing gradually but with several challenges. Approximately, seventy-five percent of medications are imported, but just twenty five percent are produced locally. The phases in the pharmaceutical supply chain in the agency include estimating demand based on input from health facilities, purchasing from domestic and international vendors, importing, storage, and distribution to health facilities and end users (PFSA, 2016).

The Ethiopian Pharmaceuticals Supply Service (EPSS), formerly known as the Pharmaceuticals Fund and Supplies Agency (PFSA) is the only government agency in Ethiopia that purchases pharmaceuticals from domestic and foreign suppliers and distributes them to all government health facilities via its branches, which are spread out across the nation. It was created legally by the Federal Democratic Republic of Ethiopia (FDRE) government to guarantee the public's access to affordable drugs on a consistent basis. EPSS was created in September 2007 by Proclamation No. 553/2007 with the goals of enabling public health institutions to provide quality-assured essential pharmaceuticals to the public at reasonable prices in a sustainable manner. It also aims to play a complementary role in the development of efforts for the expansion and strengthening of health services by ensuring an enhanced and sustainable supply of pharmaceuticals. It obtains medications from all over the world in one location and distributes them as needed to all branches and subsequently to the appropriate healthcare facilities. The agency's headquarter is in Addis Ababa, and it manages medicines from there. The governmental hospitals and health centres purchase roughly 70% of all the medications used in Ethiopia through EPSS. (www.epsa.gov.et, accessed at 05 January, 2023).

In 1998, as a component of the new health care finance strategy, the government of Ethiopia backed the establishment of revolving drug funds (RDF) to address difficulties with drug accessibility and affordability. Through the selling of medications with a markup, these funds seek to augment facility resources by raising money for the purchase of new drugs and quality enhancements. The strategy intends to improve public access to inexpensive, sustainable healthcare, raise the standard of care delivered generally, and encourage the sustainability of health care. Net income from the supply of medicines in accordance with the

proclamation, funds allotted from the government in kind or in cash, and grants in kind or in cash from donor organisations are the major sources of funding for EPSS (PFSA, 2016).

In addition to establishing a revolving drug fund, EPSS has created and implemented a number of ground-breaking programs to improve the accessibility, cost, and availability of vital pharmaceuticals with the requisite levels of quality, safety, and efficacy. One of the key initiatives is the Integrated Pharmaceutical Logistics System (IPLS), which connects all supply chain operations and aims to provide a robust, unified healthcare supply chain. It also provides accurate and timely data for decision-making. (EPSA, 2019).

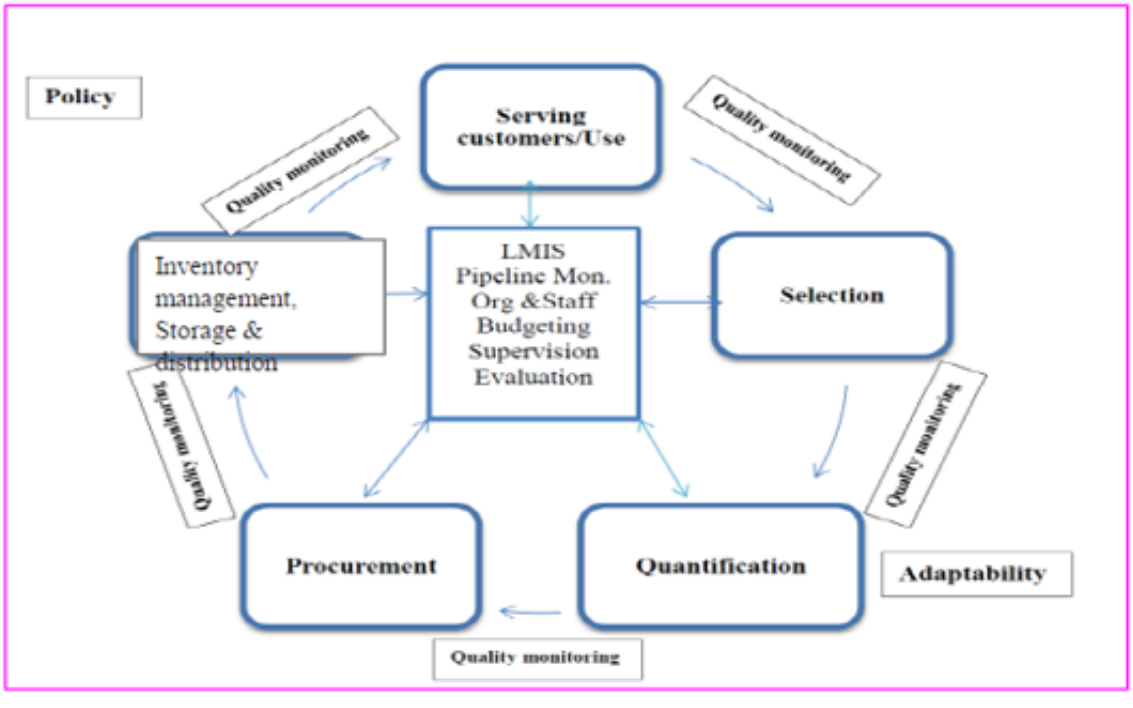


Figure 1.1 Pharmaceutical Supply Chain Practice in Ethiopia (PFSA, 2016)

1.2 Statement of the problem

The pharmaceutical supply chain is different from other organizational supply chains owing to the scale of the operation and the volume/variety mix of its product. A given hospital could purchase approximately 4,000 lines of stock and this indicates that the range of stock held, and the volume of lines processed per day are extremely high in the downstream supply chain. It starts with the initial sourcing of raw materials

from approved suppliers, flows through the manufacturing and packaging of pharmaceutical products, and ends with the delivery of approved medications to dispensers and consumers. It includes globally dispersed parties involved in the sourcing, production, storage, transport, and distribution of medications (Jaberidoost, 2013). It is estimated that each year twenty five percent of total health expenditure worldwide is spent on pharmaceuticals. Regrettably, and for a variety of reasons, a significant proportion of these resources are resulting in significant losses, in terms of both health and economics (WHO, 2011).

Access to essential medications is dependent on efficient supply chain systems that carry medications from the manufacturer to the final consumer. Many public supply chains like EPSS are responsible for delivering a larger number and volume of pharmaceuticals while being budgeted with limited resources. The availability of essential medicines is a persistent challenge in developing countries and especially in Ethiopia. Average availability of medicines in public sector health facilities across WHO regions was as low as 29.4% and the health consequences from such low levels of medicine availability are pronounced (Vledder, 2019).

Sustainable access to essential medicines is always crucial, especially when health-care systems are operating at maximum capacity and there is an increased demand for life-saving supplies. Moreover, in pandemics, not only health care systems but also global medicine supply chains were under severe stress. Shortages of medicines, which were common before 2020, have been exacerbated by the coronavirus (COVID-19) pandemic because of increased demand, lockdowns, border closures and hoarding. Faced with more frequent shortages of medicines, many countries have acted to improve the management of supply chain interruptions. With greater supply chain transparency, governments would be able to work more proactively and collectively to identify limiting factors in the supply chain and, thereby, avoid shortages (Ardal, 2021).

EPSS being the service delivery point for government health facilities in Ethiopia, is faced with several challenges of supply chain practices operating in programs that simply deal with the visible signs of the underlying structural and functional unit integration problems. The agency's primary causes of stock outs may include delays in ordering or poor forecasting by the health facility, problems with procurement, forecasting, and requisitioning by the region or district, or a lack of transportation at any point in the system.

Moreover, throughout the pharmaceutical supply chain of the organization, there are problems with stock leakage and security due to poor product tracking. Inadequate storage conditions including cold chain for temperature-sensitive goods, irregular distribution, inadequate inventory management and low adherence to recommended inventory practices such as batch control show that the pharmaceutical supply chain in Ethiopia is plagued by many challenges significantly hindering it to improve its efficiency and visibility of end-to-end operation (PFSA, 2016).

Stock availability is one of the most crucial indicators of a health logistics system's supply chain practices. But medicine unavailability is not the only problem, overstocking is another issue. Overall, this results in a supply chain that is inefficient due to resources being used to hold huge volumes of product in small spaces, danger of expiration, and slow-moving inventory. The Ethiopian Pharmaceutical Supply Service (EPSS) faces similar issues, including lack of availability, increased cost, poor demand forecasting, inadequate storage, insufficient stock management, and a weakened distribution infrastructure with limited vehicle capacity and poor fleet management. Additionally, because there aren't enough local suppliers who can compete, EPSS is heavily dependent on foreign suppliers which leads to lengthy procurement procedure (PFSA, 2016).

Interventions to improve supply chains have included changing procurement and financing, training and management, data visibility and system redesign. The supply of medicines could also be improved by increasing the transparency of the complicated and fractured supply chain (Vledder, 2019). It is thus important to assess the challenges of supply chain activities in EPSS and its general effect on delivering pharmaceuticals to public health facilities and provide insights to improve efficiencies, avoid disruptions and delays, and ensure that medicines are delivered on time and in full demand.

1.3 Objectives of the study

1.3.1 General Objective of the study

The main objective of this study is to assess challenges affecting the supply chain practices in Ethiopian Pharmaceutical Supply Service (EPSS).

1.3.2 Specific objectives of the study

- To identify the procurement challenges influence on the supply chain practices of EPSS.
- To investigate the warehousing challenges influence on the supply chain practices of EPSS.
- To inspect the inventory management challenges influence on the supply chain practices in EPSS.
- To identify distribution challenges influence on the supply chain practices in EPSS.

1.4 Research questions

- To what extent procurement challenges impact supply chain practices in EPSS?
- To what extent warehousing challenges impact supply chain practices in EPSS?
- To what extent inventory management challenges impact supply chain practices in EPSS?
- To what extent distribution challenges impact supply chain practices in EPSS?

1.5 Significance of the study

A pharmaceutical supply chain is circular in nature, with each function relying on the one before it and logically leading to the next. Costs rise, stock shortages become more frequent, and service quality declines if each function is carried out separately rather than as a component of an integrated system (Pan American Health Organisation, 2006). Procurement, warehousing, inventory management, and distribution are the four fundamental tasks of pharmaceutical supply management. As a result, it is essential to manage the purchase, storage, and distribution of pharmaceutical supplies because they account for a sizable portion of healthcare expenses. In addition, pharmaceuticals can be expensive to purchase and distribute, but shortages of essential medicines, improper handling of medicines, and purchase of unnecessary or low-quality medicines also have a high cost in terms of wasted resources and preventable illness and death (Uthayakumar, 2013).

Similarly, these types of supply risk are frequently observed in EPSS operations as shortage and unavailability of medications and medical supplies to public health facilities, which the agency should primarily supply. The unavailability can be attributed to challenges in the four basic functions of supply chain. Due to these, essential medications intended for patients with critical health conditions can be out of stock for months. On the contrary, the internal challenges also manifest as excess inventory and expired medication in warehouses which represents a serious threat to the effectiveness of the operations especially in an emergency. The challenges in the separate basic functions of the organization affects its overall supply chain practices and in effect the wellbeing of the community at large.

As to the knowledge of the researcher, there has been few research done on EPSS investigating challenges of procurement, warehousing, and inventory management separately but there has been no research conducted to assess the challenges of all the four basic functions of supply chain management as an integral system. Thus, this thesis is done with the hope that the findings would add to the expanding body of knowledge to enhance the coordination, warehousing, and inventory management systems in the pharmaceutical distribution system. Additionally, the findings of this study are anticipated to provide policymakers, pharmaceutical importers and distributors, healthcare facilities, healthcare providers, donors, and all other stakeholders with crucial information for organizing and managing Ethiopia's pharmaceutical supply chain system. The study's findings will most importantly be helpful for EPSS management in taking corrective actions that will enhance supply chain procedures.

1.6 Scope of the study

The scope of the study is delimitation geographically, conceptually, methodologically as well as time.

- **Geographically**, this study will be conducted on Ethiopian Pharmaceutical Supply Services (EPSS) Head Office located in Gullele sub city Addis Ababa
- **Conceptually**, the concept of study comprises the assessment of challenges in supply chain management in Ethiopian Pharmaceutical Supply Services. The independent variable in the study will be the challenges in procurement, warehousing, inventory management and distribution practices while the dependent variable is availability and accessibility of essential medicines in stock.

- **Methodologically**, cross sectional survey design will be used. With respect to the research design, cross sectional descriptive and explanatory research design will be applied. The researcher will take a representative sample from Ethiopian Pharmaceutical Supply Services. This research will cover a total of eight months duration.

1.7 Limitation of the study

The limitation of the study is lack of related articles on pharmaceutical supply chain practices of a central distributing organization EPSS. The EPSS context of operation is peculiar as it is a government owned pharmaceutical distribution centre where a major share of medications for the country is imported. Other countries depend mostly on private distribution centres or manufacturing companies. This limits the paper to compare results with other similar research done in other countries. Additionally, the data for this research is collected from employees of the organization. Assessment form retailers, wholesalers or health facilities was not incorporated which limits perspective from external users.

1.8 Organization of the paper

There are five chapters in the study. The statement of the problem, the research questions, and the study's objectives are all included in Chapter One's introduction. Chapter Two reviews the literature pertinent to the issue of the investigation while Chapter Three provides a detailed overview of the design and methodological components used. Chapter 4 contains the study data analysis, the results presentation, and the corresponding remarks. The conclusion of the thesis is presented in Chapter 5, which also contains recommendations based on the study's findings.

1.9 Definition of Terms

1.9.1 Conceptual definition

- ✓ **Logistics services** include general services such as transportation, distribution and storage of different types of products and merchandises, as well as other more specialized services that are considered additional services such as point of sale management, labelling and marking of prices, invoicing, after sales, collection management, etc. (Dictionary of International Trade)

- ✓ **Supply Chain Management**: is the management of the flow of goods and services and includes all processes that transform raw materials into final products. It involves the active streamlining of a business's supply-side activities to maximize customer value and gain a competitive advantage in the marketplace (Investopedia).
- ✓ **Pharmaceuticals:** A drug or combination of substances used in the diagnosis, treatment, mitigation, or prevention of disease (Investopedia).
- ✓ **Essential medicine:** are the medications that satisfy the population's primary health care needs. Which should be available in adequate quantities (Investopedia).
- ✓ **Public health centre:** an institution that gives health service for the community and governed by the government in primary health activities (Investopedia).
- ✓ **Distribution:** Distribution is the process by which products are physically transferred from their point of production or upstream warehouse to the point at which they are available to the final customer (Investopedia).
- ✓ **Inventory management:** is the management of materials in motion and at rest. Inventory management involves developing and managing the inventory levels of raw materials, semi-finished materials (work-in-progress) and finished good so that adequate supplies are available and the costs of over or under stocks are low (MSH/SIAPS, 2014).
- ✓ **Efficiency:** is the capacity to reduce waste and increase inventory turnover while making medications available to end users. (Investopedia).
- ✓ **Pharmaceutical warehousing:** the activities involving storage of pharmaceuticals on a large-scale in a systematic and orderly manner and making them available conveniently when needed. In other words, it is the physical movement of stock into, through and out of a medical store warehouse (MSH/SIAPS, 2014).
- ✓ **Pharmaceutical procurement** refers to the process of obtaining of pharmaceuticals by any competitive bidding means (Wikipedia).

- ✓ **Tender:** refers to the formalisation of the process for requesting bids, the publication of the desired drugs' specifications, and the opening of the contract to competitive bidding. (USAID/Delivery,2011).
- ✓ **Duration of procurement: t**he length of the procurement process or the amount of time needed to carry out procurement logically (USAID/Delivery,2011).
- ✓ **Stock Out**: refers to the absence of a medication, health product, or vaccine at the patient's point of service. (USAID/Delivery,2011).

1.9.2 Operational definition

- ✓ **Inventory turnover**: is the sum of all consumed inventory divided by the average inventory value during a specified period.
- ✓ **Inventory record accuracy** refers to how closely the inventory records on hand in a manual or computer record correspond to the actual quantities in the warehouse.

Chapter Two

Literature review

In this section theoretical review, empirical study review and conceptual framework will be discussed.

2.1 Theoretical Review

Any healthcare system must provide equity and equality in access to medications. To do this, a system that guarantees high-quality medicines need to be available in the required quantities, at the right time, and to the appropriate consumers. To get the intended results, this system often referred to as a supply chain must be efficiently managed. The goal of supply chain management is to ensure that a product or service is appropriate for the end user, distributed in the appropriate quantity, and delivered to the appropriate location at the appropriate time. Cost-effectiveness and customer satisfaction are two important objectives of this system which are described by availability and affordability to the consumer. The pharmaceutical supply chain is at its best when serving clients since every step is designed to satisfy their needs. According to pharmaceutical supply chain practices, the appropriate medical supplies are selected and quantified. The goods are purchased, stocked, transported, and distributed. This entire procedure is regularly assessed to monitor the overall process is undertaken according to the regulatory requirements (Chukwu, 2016).

The health supply chain ecosystem faces several difficulties, from the policy level, where choices in products may be restricted, to the service delivery point, where frequent stock outs may occur as a result of poor forecasting, a lack of transportation, storage issues, or a variety of other issues. Inefficient supply chains result in wasted resources, increased costs, stock outs, and labour redundancy, all of which have a negative impact on health (UN CoLSC, 2014). In addition, the lack of real-time visibility and tracking in the pharmaceutical chain can lead to inventory management challenges and on-time delivery failures, resulting in lost sales and revenue (Moosivand, 2019).

The WHO report from 2011 said that an estimated 5.3 trillion dollars are spent year on health care globally. According to estimates, pharmaceutical costs account for 25% of all health expenditures. Due to poor medication selection, ineffective procurement procedures, inadequate inventory management, and

distribution issues, a sizeable amount of these resources are having a negative impact on both health and the economy.

The pharmaceutical industry worldwide loses $34 billion annually due to supply chain temperature-control failures (Moosivand, 2019). The shortage of raw materials and unprecedented changes in demand patterns are among the top industry concerns. In addition, inaccurate forecasting, long lead times, lack of optimum target inventory, and high supply chain costs are also significant challenges. To overcome these challenges, pharmaceutical companies are focusing on improving supply chain performance through collaborative relationships with suppliers, investing in new technologies to increase data visibility and tracking. Supply chain management measures, such as supply chain risk orientation, visibility, flexibility, agility in supply chain, and collaboration can also help improve pharmaceutical supply chain practices. In U.S., steps are being taken to strengthen their manufacturing capacity for critical and essential medicines and using sustainable digitalized supply chain management to help reduce operational costs and improve assets in the pharmaceutical industry.

The importance of supply chain management is widely acknowledged in developing countries, however, challenges in access to quality essential medicines in countries such as in Africa continues to be more prominent. Poor infrastructure, weak distribution systems, and high incidence of counterfeit drugs are some of the challenges faced by the pharmaceutical supply chain in Africa. Political, economic, social, technical, and legal factors also contribute to the challenges faced by pharmaceutical supply chains in Africa.

A number of strategies have been put into place in some developing countries to address some of these issues and boost the effectiveness of the pharmaceutical supply chains, including the creation of the National Drug Policy, the National Drug Distribution Guidelines adopted from WHO guidelines, the regulation of human resource development, and the hiring of professionals or personnel with the necessary qualifications. Despite these tactics, supply chain infrastructure is still underdeveloped and ineffective (Olutuase, 2022).

To track the difficulties encountered in the purchase, storage, and distribution of medicines and health supplies, Ethiopia undertook a comprehensive review of the pharmaceutical supply management system. The study found that the country's pharmaceutical supply management system was severely constrained by

lengthy procurement lead times, poor storage facilities, inefficient inventory management procedures, and disorganised distribution practises. (FMOH 2005, cited in Asenakew, 2020 P.11).

The Ethiopian Ministry of Health (MoH) is trying to establish an efficient and high-performing healthcare supply chain to guarantee that all Ethiopians have fair access to cost-effective pharmaceuticals and related supplies. Even though there has been significant progress in recent years, there are still many challenges to be overcome, such as the insufficient supply of high-quality, reasonably priced essential pharmaceuticals for the general public due to poor storage and poor stock management, which have resulted in high levels of waste and stock-outs (EPSA, 2019).

World Health Organization (WHO) Good Distribution Practices (GDP) guideline helps to guarantee the identity and quality of pharmaceutical products throughout all phases of the distribution process. These aspects include.

1.Demand quantification and procurement activities
2.Warehousing activities
3.Inventory Management activities
4. Distribution activities

2.1.1 Demand quantification and procurement activities

The most crucial phase of the supply chain practice for pharmaceuticals is the acquisition of health commodities. It is the procedure of purchasing medical supplies following a carefully chosen list of goods. The sort of organization, whether public or private, centralized, or decentralized, autonomous or semiautonomous, determines the procurement system or model. The goals of the procurement system are to provide the proper drug, in a suitable quantity, of an adequate quality, at the right time, and for the least amount of money possible using ethical and legal methods. After personnel costs, pharmaceutical purchases account for the majority of developing nations' highest single health expenditure.

The public health system oversees managing the supply and purchase of products used in public health. It necessitates the creation of an effective procurement system as part of an all-encompassing supply chain system. Without a methodical and fair approach, purchasing pharmaceuticals can frequently result in out-

of-stock situations, overstocks, interruptions in the supply of life-saving medications, resource waste, the purchase of poor-quality products, and even the loss of human life (PFSA, 2016).

Quantification is the process of estimating the quantity of the products required for a specific health programme (or service). To guarantee an uninterrupted supply of pharmaceutical items, quantification also determines when the products should be purchased and distributed. Quantities of products must be purchased following the creation of a supply strategy as part of the quantification procedure. Demand forecasting is crucial first step in pharmaceutical forecasting. The main forecasting methods used in healthcare settings include historical data analysis, which makes use of previous data to make predictions about future demand. One of the thorniest challenges for pharmaceutical supply chain professionals is accurately forecasting demand so that all pharmaceutical products are procured on time and successfully delivered. The difficulty of obtaining accurate data on drug intake is one issue with this situation. Additionally, the choice of numerous drug brands by doctors adds to the difficulty of forecasting demand. (Rachmania et al, 2013).

Most pharmaceutical supplies in underdeveloped countries are imported from other nations hence it can be difficult to obtain health supplies without interruption. Unknown demand, opaque procurement processes, a lack of effective planning, and insufficient budget allocation were the key obstacles to the supply of pharmaceuticals in most African nations (WHO, 2006). Another study on public procurement in Africa discovered that the most prevalent issues with procurement were a lack of the necessary knowledge, skills, and capacity, noncompliance with supply chain management (SCM) policy and regulations, inadequate planning and the linking of demand to the budget, accountability, inadequate monitoring and evaluation of the supply chain, and unethical behaviour. (Harvard medical school, 2012).

Similarly, costly procurement orders, limited procurement visibility, a lack of comprehensive plans, non-need-based donations, a lack of supplier contractual performance evaluations, and poor contract administration are some procurement challenges that limit the effectiveness of the procurement, according to the Pharmaceuticals Supply Core Process (PSCP) report of Ethiopian Pharmaceutical Supply service (EPSS). The report also highlights how the absence of a forum for joint discussion with important stakeholders like banks, insurance, Ethiopian Airlines, Ethiopian Shipping Line, suppliers, the Ethiopian

Revenue and Customs Agency, and the Ethiopian Food and Drug Authority caused a significant delay in the timely delivery of pharmaceuticals. The aforementioned issues may be related to the lack of strong stakeholder participation in the procurement process, inconsistent national rules and regulations on procurement process, lengthy bureaucracy and procedures, or inaccurate planning in the procurement process, among other things. The end effect of these issues may be a disruption in the flow of goods, the waste of costly resources, customer unhappiness, or even the loss of priceless human life.

The processing of Letters of Credit (LC) and various changes from banks, as well as the issuance of paperwork by Ethiopian Shipping and Logistics Service Enterprise to release the products, are two additional significant factors that cause procurement delays. Most of the difficulties encountered in procurement activities include lack of coordination and/or standardisation of the products to be purchased, lack of use of procurement flexibilities, and insufficient use of master supply agreements with the best price (possible based on volume discount). Record keeping is another significant challenge because relatively few public bodies have designated records management. The lengthy procurement procedure used by the government and the selection of the most acceptable procurement techniques, with adequate justifications, are two additional and common problems in Ethiopia's public procurement process (PFSA, 2016).

Furthermore, poor collaborative planning between quantification and procurement demand forecasting is another factor related to procurement challenges. EPSS conducts demand forecasting every year by collecting average monthly consumption of all essential medicines of public health facilities. Due to lack of proper tracking of consumption data by the facilities, accuracy of the overall collected data is compromised. Inaccurate demand forecasting hence will lead to procurement of understock or overstock of the actual required quantity affecting the availability of medications to the community.

2.1.2 Warehousing activities

Warehousing is the management of storehouses, the operation of holding and storage of pharmaceuticals and the safe custody and protection of stock. Receiving, storing, and distributing medications is the main function of a pharmaceutical warehouse. Up until pharmaceuticals are given to customers, it guarantees the safety and integrity of the products and the packaging across the numerous storage facilities. To provide clients with high-quality products, adequate well-organized storage areas are vital (EPSA, 2019). As a crucial component of pharmaceutical supply chain management, warehousing makes sure that important

quality health commodities are always available and moving through the supply chain system in the right amounts, on time, and at the lowest possible cost (MSH/SIAPS, 2014). The prime objective of most warehouse is to facilitate the movement of goods through the supply chain to the end customers.

The warehouse is a crucial part of supply chain procedures for medical supplies. The basic purpose of shops is to provide service to customers and protect against unforeseen events; specifically, it is a way to store and safeguard goods for later use, as well as the system through which such goods are managed and controlled for quick retrieval. This is crucial in contexts with limited resources because they serve as a buffer against supply chain disruptions and uncertainty. The warehouse offers a steady supply of goods as they are required when it is properly maintained and stocked. Pharmaceutical companies have long used a professional, organized approach to warehousing because they understand how crucial it is to total cost effectiveness, customer happiness, and supply chain effectiveness. As a result of realizing the value of effective warehouse management as a resource to the supply chain practices, organizations working in pharmaceutical supply chain in developing countries have started to pay more attention to medicine storage (USAID/Deliver, 2014).

Pharmaceutical warehousing presents several challenges that must be carefully managed to ensure the quality and safety of pharmaceutical products. Effective temperature control, proper inventory management, adequate security measures, and compliance with regulatory requirements are all essential for successful pharmaceutical warehousing. pharmaceutical warehouses must comply with strict regulatory requirements. The pharmaceutical industry is heavily regulated, and warehouses must comply with regulations related to drug storage, handling, and distribution. This includes requirements related to documentation, labeling, and record-keeping.

The warehousing practice, according to research conducted at EPSS, has flaws because there are poor warehousing techniques, such as an unorganized product flow, the potential for mixing up incoming and outgoing products in the warehouse, the placement of newly received products in any empty space, which makes it difficult to access the item during order picking activities and the underuse of storage space (some location are over stacked while others are under stacked). In addition, it is a regular practice to return some things to the center from regional warehouses because they were delivered incorrectly, which adds extra

work for the staff.

2.1.3 Inventory Management activities

Inventory management is the core of the pharmaceutical supply system and is involved in ordering, receiving, issuing, and reordering of products. It is the process of always maintaining stock properly at all levels of the supply chain and keeping the right amount of inventory on hand which is essential for effective inventory management. An excessive amount of inventory takes up warehouse, costs money, and raises the risk of damage, spoilage, and loss. On the other side, inadequate inventory frequently causes a disruption in corporate operations and raises the risk of poor customer service. One of the major challenges faced by pharmaceutical organization is the need for proper inventory management. Pharmaceutical products have a limited shelf life, and their expiry dates must be carefully monitored to prevent the distribution of expired drugs. Additionally, warehouses must manage their inventory to prevent stockouts and overstocking, which can lead to waste and increased costs.

Pharmaceutical inventory management is a complicated process, and issues with excessive losses, incorrect technology use, poor monitoring of prescription expiration dates, distribution issues, and irrational drug use are frequently seen when inefficiencies in inventory tracking are present. This increases the likelihood that vital pharmaceuticals will run out of stock or be overstocked, wasting money, or preventing access to them (Emelia, 2014).

Improving pharmaceutical inventory management enables health institutions to reconcile budget requirements', adhere to regulatory requirements, maintain sufficient stock of items, and reduce risks related to patient safety. The adoption of modern inventory management systems thus helps organizations reduce the likelihood of having either too little or too much in terms of raw materials or finished goods. Essentially, inventory management has two fundamental purposes. First and foremost, the availability of items is a result of effective inventory management. To provide a certain level of service, it is crucial for operations to run smoothly that all necessary supplies be present in the proper quantity, quality, and timing. To attain this service level at the lowest possible cost is the second objective. An organization's service level may be

negatively impacted by a subpar inventory management system. When inventory management decisions have been successful, models for inventory planning have typically been created and put into use, with a particular emphasis on the twin issues of inventory size and timing. Organizations need to create and maintain efficient inventory management systems to function well in a competitive economy. Utilizing inventory management systems enables a company to establish and maintain the ideal level of inventory investment necessary to deliver the needed operational performance.

The Integrated Pharmaceutical Logistics System (IPLS), which connects all levels of the healthcare supply chain and offers precise and timely data, is one of the important projects implemented in Ethiopia in terms of inventory management. In order to ensure that facilities have optimum inventory to satisfy their clients and discourage them from placing urgent orders, IPLS uses a minimum-maximum inventory control system.

In order to address the shortage of high-quality, reasonably priced critical medications, EPSS created and started implementing the Integrated Pharmaceutical Logistics System (IPLS) in collaboration with its partners in 2009. EPSS established an integrated health commodity supply chain with the introduction of the IPLS, which includes all health program commodities. The system also aims to ensure that all levels, from health facilities to EPSS's central stores, are connected with accurate and timely data for decision-making (EPSA, 2019).

While simultaneously identifying areas that require improvement, IPLS is enhancing information recording and reporting, storage and distribution systems, and expanding data visibility in the availability of vital commodities at healthcare facilities. Every logistics system is built upon the recording and reporting of logistics data from IPLS. The goal of the records is to record crucial logistics information at every level of the health system. The combined data from the logistics records is then utilized to create logistics reports, which are used for forecasting, procurement, and resupply quantity decisions (EPSA, 2019). Even though the IPLS is set up several years ago in EPSS, the organization still faces issues of understock and overstock of pharmaceuticals. Moreover, there is limited data visibility of the end-to-end operation of the supply chain which leads to inaccurate decision making for procurement activities subsequently affecting on the overall decision making by the management.

2.1.4 Distribution activities

The process of physically moving goods from their point of production to the location where they are available to the final consumer is known as distribution. To ensure that resources are being used as efficiently as possible, maintaining a consistent supply of pharmaceuticals at the locations where they are required is the major objective of medicine distribution. A good distribution system is one that offers an adequate quality of service at a reasonable price. Since items are rarely produced and consumed in the same place, distribution activities are essential to every supply chain. Most supply chains suffer considerable costs, and distribution is one of them. The successful operation of any supply chain is directly related to the efficient utilization of transportation. The overall cost of the supply chain is effectively reduced by the deployment of responsive transportation systems.

Once a product has been acquired and received by the health facility or programme, it must be disseminated to the level of service delivery where the client will get it. To reach end consumers, pharmaceutical distribution must therefore be carefully considered. An overall more responsive and effective system with less resources locked up in inventory will result from higher supply chain velocity, or the amount of time it takes for products to move through the supply chain from purchase to customers' hands.

Pharmaceuticals are distributed through EPSS in accordance with the Integrated Pharmaceuticals Logistics System (IPLS), which enables the coordinated management of all pharmaceutical requests, reports, and deliveries. Every two months, EPSS normally delivers supplies directly to medical facilities, or in the case of difficult-to-reach institutions, it delivers to the regional or woreda health offices, which then arranges for facility pickup or woreda delivery. Increased direct health product supply to all healthcare facilities is one of EPSS's goals and duties (EPSA, 2019).

Pharmaceutical distribution encounters several challenges in the supply chain with weak distribution system including weak fleet management. EPSS faces similar issues with limited vehicle capacity, weak planning and coordination leading to items available in the central hub but stock out in the hubs at field offices.

2.1.5 Supply Chain Practices

Pharmaceutical supply chains have become more complex in recent years because of economic globalization and greater outsourcing. The risk of supply chain disruption is increased by the additional effects of extreme weather, climate change, geopolitical conflicts, and a global pandemic. The pharmaceutical supply chain practices have great responsibility for ensuring that the right medication reaches the right patient at the right time and in the appropriate condition to combat illness and suffering. Because of the direct influence on health and safety, it is a very sensitive supply chain where anything less than hundred percent customer service level is unacceptable. The solution adopted by many pharmaceutical industries is to carry a huge inventory in the supply chain to ensure a fill rate close to 100%. However, ensuring full product availability at an optimal cost represents a huge challenge unless the supply chain processes are streamlined towards customer needs and demands. Product perishability is another critical issue. Hence, pharmaceutical supply chain practices are significant because a shortage of medicines and improper use of pharmaceutical products lead to financial losses and have a significant impact on patients.

Supply chain practices refer to the processes and activities involved in the planning, sourcing, procurement, warehousing, transportation, and distribution of pharmaceuticals from the point of origin to the point of consumption. These practices can involve multiple stakeholders, including suppliers, manufacturers, distributors, retailers, and end users, and can be affected by a wide range of factors, including financial and economic conditions and internal organizations process. Effective supply chain practices require efficient and transparent coordination and communication among all stakeholders (internal and external), as well as the use of appropriate technologies and tools to support planning, monitoring, and evaluation of the overall supply chain performance.

Supply chain management in public sector health systems has become more of a problem in recent years for many developing nations as governments struggle to deliver an expanding quantity of pharmaceutical items. Despite these measures, it is clear that there are still supply chain breakdowns due to interruptions, which not only cause immediate harm to the pharmaceutical firm in question but also put people's health and wellbeing in danger by leading to a lack of medical supplies (Morris, 2019). Therefore, pharmaceutical companies must create an integrated strategy that includes all supply chain operations. This will improve

supply chain procedures while increasing the effectiveness of the system and the affordability and accessibility of medications.

2.2 Empirical Review

To examine the difficulties encountered in the purchase, storage, and distribution of medications, Ethiopia undertook a comprehensive review of the pharmaceutical supply management system. According to the study, the country's pharmaceutical supply management system was severely hampered by protracted lead times for purchases, inadequate storage facilities, and disorganised distribution practises (FMOH, 2005, cited in Asenakew, 2020).

The function of pharmaceutical procurement is crucial to the supply chain management of public health. According to Berhie on the assessment of factors influencing good pharmaceuticals procurement practice in EPSS, the respondents identified unethical activities as the second-most important factor, followed by a lengthy procurement duration taken, a lack of ICT use, employee capabilities, and record keeping. The analysis also showed that the procurement function was poorly managed and that the influence of each element on moral procurement practises was substantial. Furthermore, it was found that record keeping was inadequately managed, and the majority of staff members believed that regular training was not offered. (Berehie, 2017).

It is essential that there exist storage spaces with adequate capacity to allow for the storage of the various types of pharmaceutical goods that pass through the warehouse. Based on the intended purpose or properties of the goods to be stored in them, warehouse storage space should be segmented into parts or zones. The main issues with EPSS's warehousing practices, according to Alene's research, are the absence of a receiving standard operating procedure (SOP), extremely long vehicle unloading times, the lack of separate receiving areas in the warehouse, which could result in a disorganized flow of products, and the potential for mixing up incoming and outgoing items in the warehouse. Receiving new arrivals will take longer if the paperwork for the items is incomplete, and it will be too late to prepare them for distribution. A significant warehouse space issue existed for PFSA. Additionally, it shows that the stores are unable to accommodate all the

arriving materials. The capacity of the warehouses can be increased by building further stores or by disposing of unnecessary materials from the store.

One of the main problems with PFSA's warehousing strategy was found to be the storing of medications prior to delivery to customers. Finding storage areas with the size to allow orderly storage of the multiple product types that travel through the warehouse is listed as the second major problem after finding warehouse storage space for different product categories according to the features of the items. According to the respondents' ratings, the most frequent issues were lack of allocated area for receiving new arrivals, a lack of handling equipment for loading and offloading, lack of storage space to locate different categories of products, a long search time to collect customer orders, a lack of standard packing materials. And scattered warehouses which causes delay in collecting products for a customer (Alene, 2018).

Even though the Pharmaceuticals Logistics Master Plan (PLMP) was used to build Ethiopia's Pharmaceutical Supply System (EPSS), poor pharmaceutical inventory management practices prevented Ethiopia's health facilities from reaching their objectives. A significant weakness in the country's supply chain performance is usually cited as the pharmaceutical inventory control issue in EPSS. Its inefficiencies have been resulting in non-availability of essential drugs, wastage due to poor storage, poor stock management and irrational use (Jobira, 2021).

The pharmaceutical sector relies heavily on inventory management because it ensures accurate, continuing batch tracking and controls the amount of goods that are always available. According to Mulatu' research on assessment of inventory management practice in EPSS, respondents viewed that EPSS management did not make sufficient investments to improve the inventory management practices. They discovered significant flaws in the mechanisms for standardizing and enforcing inventory management at EPSS. The absence of cyclic inventory counts, a loose implementation of the FEFO principles, and inconsistent batch tracking were seen as the three main issues that hindered the effectiveness of the current inventory management practice. The respondents emphasized that senior management did not strongly support modernizing the overall inventory management system at all levels of the supply chain. The fact that top management does not fully support the current information system was also criticized by participants in the in-depth interview. Participants named a number of problems as important obstacles facing EPSS's existing information technology, which has an effect on how well inventory management works. These problems

included a lack of disciplined system use, poor supply chain decision-making using the available data, a lack of a standardized directory service, and a lack of ownership. Key informants added also that the existing inventory management system at PFSA lacks more robust information management system supported by the application of technologies.

The paper also emphasizes the use of industry-standard inventory management approaches, such as vendor managed inventory and rigorous adherence to FEFO principles, as a crucial step towards effective inventory management, which also requires a lot of management support and funding (Mulatu, 2017).

The supply chain relies heavily on distribution activities to get vital drugs to end users. On research done on the challenges of distribution activities in EPSS, the following are the primary problems: incorrect demands from branch offices, a lack of vehicles, a lot of emergency requests, a lack of certain medications, hubs/health facilities not picking their forecasted quantity, and a lack of proximity between warehouses to collect and distribute pharmaceuticals on time (Teketel, 2017).

2.3 Conceptual framework

The strategic plan for Ethiopian Pharmaceuticals Supply Service and the literature reviews are used to build the conceptual framework below. The challenges associated with supply chain practices are viewed as independent variables in this paradigm, whilst supply chain practices are seen as dependent variables. The conceptual model for this investigation is displayed in Figure 2.1 below.

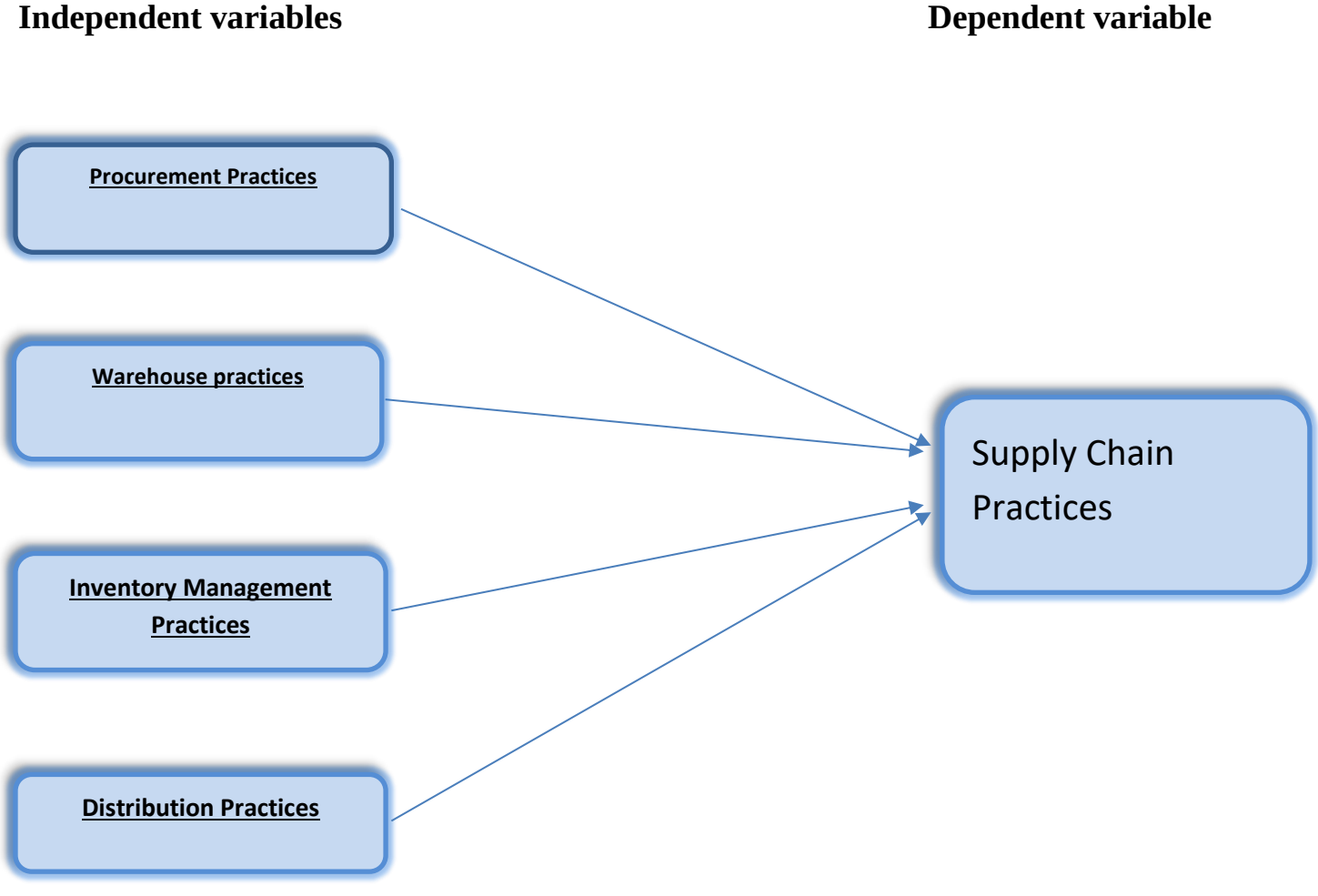


Figure 2.1 Relationship between independent and dependent variables

Source: Adapted from PFSA, 2016 and Mwencha 2017

Chapter Three

Research Design and methodology

3.1. Introduction

The study is focused in assessing the factors influencing the pharmaceutical supply chain practices in the case of Ethiopian Pharmaceutical Supply Service (EPSS) headquartered at Gullele Sub city, Addis Ababa, Ethiopia.

This chapter's primary goal is to present the study methodology, research design, population and sample, data source and type, data collection process, instrument reliability and validity test, ethical consideration, and data analysis method.

3.2. Research approach

On this research both quantitative and qualitative (mixed) research approach was used. It is suitable to adequately understand and assess the research problem. The researcher used both close and open-ended questionnaire.

3.3. Research design

The study employed explanatory and descriptive research design. The purpose of this research design is mainly to understand and assess the challenges of supply chain practices in EPSS.

The study used descriptive research design to assess the challenges of the supply chain practices using frequencies, mean and standard deviation. A correlation analysis method was implemented to analyze the relationship between the independent variables and the dependent variable and a regression analysis to understand and analyze the effect of the independent variables of the model on the dependent variable.

3.4. Sampling design

3.4.1. Target Population

The total group of persons or objects of interest that the researcher wants to study is referred to as the population. The total set of units for which survey results are to be utilized to draw conclusions is the target population for a survey. Thus, the target population for this study constitutes all employees who work in the department distribution and fleet directorate, warehouse and inventory management directorate, quantification and procurement located in the head office which are around 150 staff. The mentioned departments are the core operational units in the organization relevant to the overall supply chain and since procurement process is only done at the head office level employees of these directorates in the head office are selected for this research.

3.4.2. Sampling Frame

The sampling frame for this research is Ethiopian Pharmaceutical Supply Service (EPSS) at central head office, which is located in the capital of Ethiopia, Addis Ababa. Detailed primary data regarding challenges of the overall supply chain is collected through questionnaire from directors, managers, team leaders and senior logistics officers.

3.4.3. Sampling technique and procedure

In quantitative research, the variables chosen to have a direct impact on the inferences that can be made about the study's findings. This study employed a non-probability purposeful sampling method, sometimes known as purposive sampling. In non-probability sampling, objects that are thought to be representative of the population are chosen using the researcher's discretion. In other words, purposeful or deliberate sampling gives the researcher the freedom to select respondents in a way that bests serve the study's goal. Despite the fact that not all members of the target population (universe) have an equal probability of being selected for the sample, the researcher chose deliberate/purposive sampling as the best method for this study based on its objectives.

Accordingly, the sample population for this research is employees who are directors, managers, team leaders, logistics officers and advisors in the procurement, warehouse, inventory management and distribution unit of the organization.

As a result, using this sampling technique, 100 sample units were purposefully selected based on the ease of access to information and the degree of familiarity with the functioning of the case organization. Due to the small sample population, the research used a census technique to gain more insight into the challenges of supply chain practices.

Open ended and close ended questionnaire was used from people who have first-hand knowledge about the operation. Hence, in this study all directors, managers, team leaders and logistics officers of the unit's distribution and fleet directorate, warehouse and inventory management directorate, quantification and procurement directorate were selected as a sample for the study which are deemed to have the best knowledge on the operations of the case organization.

3.4.4. Sample size

The sample size selected for the questionnaire is 100 employees of Ethiopian Pharmaceutical Supply Services who work in the capacity of manager, director, team leader, logistics officers and advisors.

3.5. Sources of Data

Data was collected from primary sources and the type of data is both qualitative and quantitative. Primary data was collected through questionnaire from directors, managers, team leaders and officers of the case organization using semi structured questionnaires.

3.6 Data Collection methodology

The questionnaires were distributed through hard copy to the sample population. After collecting the questionnaire, notes of the answers and any additional comments and impressions were taken. For open ended questions, all the interview notes and discussion points were typed onto one word processing document. The close ended questions were collected and organized into a summary excel table for easy analysis of the data.

3.7 Data collection instrument

The primary data was collected through hard copy semi structured questionnaire.

3.8 Data analysis methods

In this study both quantitative and qualitative data was collected. The quantitative data collected was analyzed by descriptive and inferential statistics methods. In this study, statistical package for social sciences (SPSS) software was used to analyze quantitative data. This software is primarily appropriate for this kind of research. Close ended questions were utilized to capture measures of central tendencies such as frequency distribution, means, and standard deviation. Regression analysis and correlation were both utilized to determine the relationship between the dependent and independent variables. Tables presenting the results are then followed by discussions providing further context for the findings. During the research's interpretation and discussion phases, the qualitative data that had been gathered had been used to support the quantitative data.

3.9 Validity and Reliability

According to Creswell (2009), a test's validity refers to the extent to which it captures the intended outcomes. It is the extent to which findings from data analysis accurately reflect the phenomenon being investigated. Before implementing the final step, a pilot study was undertaken to polish the technique and test tool, such as a questionnaire. As indicated by (Adams et al., 2007), questionnaires are evaluated on potential respondents to ensure that they are objective, relevant, appropriate for the situation, and dependable. Consequently, a pilot study was conducted to evaluate the validity of the data gathering form. Participants in the pilot study did not take part in the main investigation. Respondents' concerns were gathered, and questionnaires were adjusted as a result. Finally, the improved version of the questionnaires was used.

Reliability test

A cronbach's alpha estimates the proportion of variance in the best scores that can be attributes to the true score of variances (Brown, 2002). The researcher used the cronbach's alpha to estimate internal consistency & reliability for the scales. The Reliability test is a tool to measure a questionnaires internal consistency (Brown, 2002). Reliability testing is quite important if a researcher wants to be certain that the consistency of his questionnaire is correct. If a person's responses to inquiries are consistent over time, the questioner is considered to be credible. It can be carried out with the use of SPSS software. Many academics concurred that if a construct or variable is delivering value and its Cronbach Alpha value is more than 0.70, it is deemed

to be reliable. The Cronbach alpha coefficient is an indicator of internal consistency of the scale. In this study Cronbach alpha coefficient for all independent variables was found to be greater than 0.70 showing that internal consistent.

Table 3.1: Cronbach alpha coefficient

Variables	Number of items	Cronbach's alpha
Quantification and procurement challenges	16	0.70
Warehousing challenges	10	0.86
Inventory Management challenges	9	0.86
Distribution challenges	11	0.80
Overall	47	0.98

From the above table, the Cronbach alpha coefficient for the above variables was found to be greater than 0.70 showing that the questionnaire is reliable and internally consistent.

3.10 Research Ethics

While conducting the research, ethical considerations might assist in defining what behaviors are acceptable and undesirable. Research ethics are crucial because they guard against the fabrication or falsification of data and so support the pursuit of knowledge and truth, which is the main objective of any research. (CIRT, retrieved on December 6, 2018).

The major ethical issues that were taken into consideration by the researcher in this study were informed consent, confidentiality, misrepresenting results, plagiarism, and academic fraud.

Before interview questions were collected, consent was requested from EPSS with formal letter from the university and the organization's internal procedure for collecting data was followed. In addition, anonymity and confidentiality was maintained in the span of this research.

Chapter Four

Result and Discussion

4.1 Introduction

The objective of this section is to present, examine, and interpret the information gathered via self-administered surveys. Employees at the EPSS main office completed a self-administered questionnaire to gather primary data about the agency's challenges with procurement, quantification, inventory management, and distribution. Each responder received a questionnaire in person, and both quantitative and qualitative data were gathered. Considering this, the results were presented, examined, and evaluated as shown below.

4.2 Response rate

For this research 100 questionnaires were distributed, and 95 of them were correctly completed and returned, yielding a 95% response rate. The responses provided served as the basis for the analysis that followed. The frequency, percentage, mean, and standard deviation of the data were used to create the following summary and presentation.

4.3 Demographic Characteristics of respondents

Based on their features, the demographic data of the respondents who took part in the collection of both quantitative and qualitative data were shown in table form. In order to conduct the research, it was necessary to collect data on respondents' personal and professional characteristics, including gender, education level, organizational position, and years of experience.

Majority of the respondents are female 52(54.7%) and 73(76.8%) of respondents are bachelor’s degree holders. Regarding years of experience in EPSS, most of the respondents worked from eleven to fifteen years 37.9% followed by 30.5% less than five years 30.5%. Majority of the respondents were working under warehouse and inventory Management directorate 44.2%, followed by distribution and fleet Management 28.4%, Quantification and Market Shaping 11.6%. Concerning position of the respondents in EPSS, 48.4%

were at position of officer III, 21.1% officer II, 16.8% officer I, 5.3% technical advisor, 4.2% team leader, 3.2% director.

Table 4.1: Socio-demographic characteristics of the respondents

No.	Variables	Frequency	Percent
1	**Sex**		
	Male	43	45.3
	Female	52	54.7
2	**Educational status**		
	Bachelor's degree	73	76.8
	Master's degree	22	23.2
3	**How many years have you worked in EPSS**		
	One to five years	29	`30.5
	Six to ten years	15	15.8
	Eleven to fifteen years	36	37.9
	Over fifteen years	15	15.8
4	**Current Directorate**		
	Warehouse and Inventory Management	42	44.2
	Distribution and Fleet Management	27	28.4
	Quantification and Market Shaping	11	11.6
	Procurement and Contract Management	5	5.3
	Tender Management	5	5.3
	Quality Control and Assurance	5	5.3
5	**Position in the Directorate**		
	Director	3	3.2

	Team Leader	4	4.2
	Officer III	46	48.4
	Officer II	20	21.1
	Officer I	17	17.8
	Technical advisor	5	5.3

Source: Own survey, 2023

4.4 Findings and discussions

Respondents were asked to rate their opinion about the agency's challenges with quantification, procurement, warehousing, inventory management, and distribution. A series of questions were asked of respondents under each component, asking them to rate how much they agreed with it on a Likert scale from 1 (strongly disagree) to 5 (strongly agree). Additionally, open-ended questions were asked to the respondents to elucidate on the difficulties faced by the agency.

Accordingly, using a 5-point Likert scale with 1, 2, 3, 4, and 5 standing for strongly disagree (SD), disagree (D), neutral (N), agree (A), and strongly agree (SA), respectively, respondents indicated their level of agreement for each related item. Frequencies, percentages, means, and standard deviation were used to present the response.

4.4.1 Challenges of quantification and procurement activities

This subsection shows that the actual procurement challenges that can affect the supply chain practices of the organization. In relation to this, the results are shown in table below.

Table 4.2: Mean and Standard Deviation of Quantification and Procurement Challenges

Variables	Mean	SD
Lack of reliable data from facilitates for estimation of annual pharmaceutical need	4.17	0.52
Requested quantities for procurement are based on reliable estimate of actual need	3.05	1.01
Long and tedious international tender process and contract management	3.94	0.7
Lack of supplier for some essential medicines	3.93	0.49
Suppliers delay delivery of pharmaceuticals as per awarded quantity	3.62	1.01
Lack of prompt and reliable payment mechanism for suppliers	3.54	0.77
Lack of follow up with key procurement performance indicators	3.11	0.74
Lack of market research before procurement planning	3.64	0.63
Lack of establishment of long-term relationship with suppliers	3.49	0.63
Lack of regular communication and transparency between the agency and suppliers	3.47	0.76
Lack of supplier qualification based on product quality, service reliability, and financial viability	3.29	0.84
Lack of the involvement of different experts, stockholders and suppliers in developing specification for each item to be procured	3.39	0.94
There is lack of sufficient budget for purchasing pharmaceutical products required to meet the demand	3.15	0.96
There is limited information technology system for exchange of procurement related documents and transactions with suppliers	3.42	0.97
Lack of foreign currency and delay in getting approval	4.03	0.18
Lengthy government customs clearance procedure	4.02	0.39
Overall mean	**3.58**	**0.72**

Source: Own survey, 2023

From the findings, majority of the respondents 70.5% agreed lack of reliable data from health facilitates for estimation of annual pharmaceutical need and 45.3%, also agree requested quantities for procurement are not based on reliable estimate of actual need. This is a major cause of either shortage or overstock of medicines. On top of this 70.5% agreed that there is long and tedious international tender process and 53.7% agree suppliers delay delivery of pharmaceuticals as per awarded quantity. This has additional effect in getting medication on the right time. This result aligns with National Survey of the Integrated Pharmaceutical Logistics System (2015) that completeness of the facility Request and Requisition Form (RRF) which is essential in indicating the consumption of data from facilities was found to be good however, data quality of the RRF is an issue in most health facilities. The quality of data sent from the health is poor which make the quantification and forecasting poor.

In terms of supplier relation, 47.4% agree there is lack of market research before procurement planning, 75.8% agree lack of supplier for some essential medicines, 45.3% agree lack of prompt and reliable payment mechanism for suppliers, lack of establishment of long-term relationship with suppliers was agreed by 56.8% of respondents, 63.2% agree lack of regular communication and transparency between the agency and suppliers and 45.3% agree lack of supplier qualification based on product quality, service reliability, and financial viability. This is in line with Berhie's research in which lengthy procurement process in EPSS influences the procurement activities of the organization.

It is also observed from the findings that 38.9% of the respondents disagree that there is low budget to procure essential medicines and the same percentage of respondents also disagree that there is no lack of involvement in developing specifications with of pharmaceuticals in collaboration with suppliers and other stakeholders.

It was also assessed that 70.5% of respondents agree that there is limited information technology system for exchange of procurement related documents with suppliers. This is in line with Berhie's research that the technical experts in procurement unit should be well trained on uses of information technology which significantly influence the good procurement practice in EPSS. The overall mean and standard deviation for quantification and procurement challenges was 3.58 and 0.72 respectively.

In this study an expert working in EPSS with more than 15 years interviewed and said '' there is lack of transparency in procurement process and using inaccurate data for quantification and poor forecasting are

among challenges in the quantification and procurement that affected pharmaceutical supply chain practice''.

In addition to this another expert with the position of technical advisor said that '' limited number of suppliers, inconsistency of the suppliers, shortage of hard currency, poor management and communication with the suppliers, turnover of experienced staffs as well as manual process of the organization are the challenges in the quantification and procurement that pharmaceutical supply chain practice''. This is supported by the data collected from this study that all respondents agree lack of foreign currency and delay in getting approval and 85.3% agree with lengthy government customs clearance procedure.

4.4.2 Challenges of warehouse activities

According to WHO, maintaining proper storage conditions for health commodities is vital to ensure their quality and accordingly serve customers. The design of large storage buildings should consider the storage conditions required for different products. Unlike other ordinary goods, storage conditions can easily damage health commodities. Recommended storage conditions should be maintained to maintain product quality (John snow,2003).

This subsection showed that the warehousing challenges of the agency against good pharmaceuticals warehousing practices. In relation to this, the results are shown in table below.

Table 4.3: Mean and Standard Deviation of Warehousing Challenges

Variables	Mean	SD
Inadequate warehouse capacity to store pharmaceuticals	3.67	0.62
Inadequate human power to load and offload pharmaceuticals	3.14	0.87
Inadequate equipment to load and offload pharmaceuticals	3.52	0.755
Lack of adherence to Warehouse Standard Operating Procedures (SOPs)	3.44	1.10

Poor organization of product location and delay in picking of products for loading	3.22	0.90
Poor record keeping and application of Information Technology (IT) for warehouse activities	3.10	0.88
Lack of coordination between warehouse activities and warehouse staff	3.10	1.08
Lack of warehouse monitoring and evaluation system	3.31	1.19
Lack of disposing damaged and expiry products on time	3.25	0.96
Poor and scattered location of warehouses	3.69	1.00
Overall	**3.34**	**0.935**

Source: Own survey, 2023

From the findings, 75.8% of the respondents agreed there is inadequate warehouse capacity to store procured pharmaceuticals, 46.3% agree there is inadequate labor to load and offload pharmaceuticals and 68.4% agree also there is inadequate equipment to load and offload pharmaceuticals. In addition, 53.7% agree there is poor organization of product in the warehouse lacking designated location which delays the picking and packing process and ultimately not delivering service on time. 44.2% agree there is poor record keeping and application of Information Technology (IT) for warehouse activities and 38% agree there is lack of disposing damaged and expiry products on time which decreases the warehouse space for usable pharmaceuticals. In addition to that 61.1% agree that there is scattered location of warehouses which creates a delay to collect the products for delivery to branch offices or health facilities.

On the contrary, 37.9% of respondents disagree there is lack of warehouse monitoring and evaluation of the warehouse activities, and the same percentage of respondents also disagree that there is limitation to coordination of warehouse staff in the department. In addition, 31.6% of the respondents disagree there is inadequate labor to load and offload pharmaceuticals and similar percentage of respondents disagree that there is poor organization of products in the warehouse with no designated location that causes delay in picking and packing of items for delivery.

The overall mean and standard deviation for ware housing challenges was 3.34 and 0.935 respectively.

The above result is similar with the report of (USAID publication in 2009) where store management in EPSS warehouse is generally poor. Stocks are stored wherever space is available. Inaccurate put away has

led to inventory not being available at the desired location during the picking process that might lead to unfulfilled/ delayed health facility orders (USAID, 2009). It is also in line with Alene's research which revealed that as there is no sufficient storage space to store pharmaceuticals as per their category or characteristics in EPSS warehouses.

Interview conducted also supported the quantitative study ''rented and scattered warehouses, lack of World Health Organization standard warehouse, warehouse space shortage especially for cold chain products, difficult to manage donation products in respect to space available, low knowledge of staffs or experts' affect the supply chain practice and few respondents suggested there is poor coordination and communication among the warehouse staff in EPSS that affect supply chain practice at EPSS''.

4.4.3 Challenges of Inventory Management activities

Lack of proper inventory management causes stock out of pharmaceuticals which eventually impairs service to health facilities. An excessive amount of inventory takes up warehouse space, costs money, and raises the risk of damage, spoilage, and loss. Contrarily, having insufficient inventory frequently causes the risk of providing inadequate and unsatisfactory customer service. To ensure sustainable supply of pharmaceuticals, it is essential to maintain an appropriate inventory level at each stage of the supply chain.

This subsection shows that the inventory management challenges of the agency. The results are shown in table below.

Table 4.4: Mean and Standard Deviation of Inventory Management Challenges

Variables	**Mean**	**SD**
Lack of inventory management practice that is in line with standard inventory management procedures	3.16	1.00
Lack of established policies for maximum and minimum stock levels at which full supply products should be maintained	3.15	0.96

Lack of transparent and efficient inventory procedure	3.24	0.95
Lack of coordination with procurement and inventory management team	3.70	0.58
Lack of enforcement of standard operating procedures for implementation of effective inventory management	3.42	0.88
Lack of available information technology system which supports implementation of inventory management	3.32	1.09
Inadequate data visibility with relevant directorate and stakeholder for decision making	3.73	0.9
Inadequate staff knowledge to perform effective and efficient implementation of inventory management	2.93	0.95
Lack of regular monitoring of stock out and overstocked items	3.15	1.16
Overall mean	**3.31**	**0.94**

Source: own survey, 2023

Majority of the respondents agree that most of the variables or challenges stated are observed in EPSS inventory management directorate. 76.8% of the respondents agree there is lack of coordination between inventory management and procurement unit. Inventory management unit calculates monthly consumption data which feeds into the quantification and procurement process. Similarly, information on the arrival of newly procured items and items in the pipeline is information that is useful for inventory management unit as it allows to keep optimum stock based on availability of medical items. Moreover, 61.1% of respondents agree that there is inadequate data visibility for all internal stakeholders and 55.8% also agree that there is limited use of information technology to increase the data visibility essential for decision making. 56.8% respondents agree that there is lack of staff knowledge and skill on inventory management and 53.7% indicated that there is lack of transparent and efficient inventory procedure and 62.1% agreed there is lack of enforcement of standard operating procedures to perform the activities in the department. Furthermore,

32.6% of the respondents do not agree that there is lack of monitoring mechanism for inventory management which is also similar with 31.6% which disagree lack of monitoring the minimum and maximum is a challenge in the department. The overall mean and standard deviation for inventory management challenges was 3.31 and 0.94 respectively.

The results of this study are consistent with Mulatu's research, which found that EPSS's inventory management practices should be in conformity with the current standard operating procedures. The results of his research's revealed that integrating activities with important stakeholders and gauging protocols with governmental policies during the design of inventory management were recognized as crucial interventions for the successful operation of inventory management. The findings of the study also demonstrated that EPSS management must work diligently to support the inventory management procedures. For the effective management of inventory and to determine which and how much goods to order at what time, it was proposed that conventional inventory management approaches be used, such as the adoption and strict enforcement of FEFO principles.

In the qualitative response ‘’ poor practice of adhering with SOPs, poor quality of inventory data including from facilities such as Report and Requisition Form (which is an indicator of stock consumption), poor clarity of report, data visibility at lower facility level are identified as the challenges of inventory management that affect supply chain practice at EPSS’’.

4.4.4 Challenges of Distribution activities

The fundamental objective of pharmaceutical distribution management is to keep the needed drugs and supplies available at all times to healthcare facilities (Management Science for Health, 2012). From its central hub in Addis Ababa, EPSS transports medications to its branch offices, which then dispatch them to healthcare facilities.

This subsection shows that the actual distribution challenges of the agency. The results are shown in table below.

Table 4.5: Mean and Standard Deviation of Distribution Challenges

Variables	Mean	SD
Lack of adequate type and number of vehicles to meet desired distribution schedules	3.74	0.93
Proper distribution planning of vehicles	3.51	0.86
Lack of ability to manage the flow of information for a reliable and secure delivery	3.51	0.86
Lack of adequate management information system used to control vehicles	3.68	0.91
Lack of preparing delivery documents timely	3.25	0.88
Poor communication between distribution officers and warehouse managers	3.42	1.06
Delay in loading of vehicles after receiving of delivery document	3.69	0.93
Resistance of drivers to carry full vehicle capacity	4.10	0.92
Lack of documented distribution schedule	3.08	1.01
Lack of adequate vehicle volume capacity	3.76	0.72
Lack of flexibility and adherence to guidelines from commercial transporters	3.63	0.48
Overall mean	**3.58**	**0.87**

Source: Own survey, 2023

From the findings of the assessment, it shows that 75.8% of the respondents agree that there is poor planning in terms of assigning daily vehicle for distribution and 68.4% perceive that there is lack of adequate vehicle volume capacity. In addition, 54.7% of respondents agree that there is lack of information management system to control vehicles, poor communication between distribution and warehouse unit and delay in preparing delivery document for loading of items for distribution to health facilities. 40% of respondents strongly agree that there is resistance from drivers to carry full vehicle capacity and by the same token 38.9% of the respondents agree to the same challenge in distribution activities. Similarly, 63.2% of respondents agree that there is lack of flexibility from commercial transporters in regard to loading full

capacity and limited adherence to guidelines as per good distribution practices. The overall mean and standard deviation for distribution challenges was 3.58 and 0.87 respectively.

The findings of this assessment are in line with research done by Teketel (2017) which stated that EPSS does not have weight/volume-based determination system to load pharmaceutical and utilize the full capacity. It is also stated that there is resistance from drivers to load maximum capacity of pharmaceuticals. Additionally, it is thought that the agency's communication with internal and external stakeholders regarding its distribution operation lacks formality and clearly laid out protocols.

An interview conducted with experts showed that ‘’lack of adequate transportation in number as well as capacity or loading volume, ways of transportation according to geographical location, security challenges, lack of workshop maintenance, poor volume estimation in the organization, lack of sufficient vehicles to transport cold chain products’’ are the major challenges of distribution that affect pharmaceutical supply chain practice at EPSS.

4.4.5 Supply Chain Practices

According to the World Health Organization, everyone has the right to seek medical care. Through EPSS, the Ethiopian government is working to make drugs available at a low cost and easily accessible to all individuals. The organization strives to give the correct medication at the right time at a lower cost. Due to the nation's rising demand for pharmaceutical items, there are still issues present. Pharmaceutical supply chain practices must be effective and coordinated with the various functions in order to deliver the proper items, quantity, and quality at the right time, place, and cost in order to ensure equitable access. However, it was noted that EPSS faces numerous difficulties brought on by the various functional units, which resulted in the non-availability, unaffordability, and wastage of pharmaceuticals (PFSA, 2015).

This subsection shows the overall challenges on supply chain practices of the agency. The results are shown in table below.

Table 4.6: Frequency of Supply Chain Practices

S/N	Supply chain practice	Scale					Mean	Standard Deviation
		SD	D	N	A	SA		
1	Supply chain practice of the organization is influenced by quantification and procurement challenges	0	0	0	94(98.9%)	1(1.1%)	3.57	0.25
2	Supply chain practice of the organization is influenced by warehousing challenges	0	0	1(1.1%)	93(97.9%)	1(1.1%)	3.34	0.63
3	Supply chain practice of the organization is influenced by inventory management challenges	0	0	6(6.3%)	88(92.6%)	1(1.1%)	3.31	0.66
4	Supply chain practice of the organization is influenced by distribution challenges	0	0	0	94(98.8%)	1(1.1%)	3.58	0.51
Overall mean pharmaceutical supply chain practices							**3.45**	**0.51**

Source: Own survey, 2023

From the table it shows that majority of the respondent agreed that pharmaceutical supply chain practices of the Ethiopian Pharmaceutical Supply Service is influenced by quantification and procurement challenges with 98.9%, supply chain practice of the organization is influenced by warehousing challenges 97.9%, supply chain practice of the organization is influenced by inventory management challenges 92.6% and supply chain practice of the organization is influenced by distribution challenges with 98.8%.

4.5 Inferential Statistics

4.5.1 Pearson Correlation analysis

Correlations estimate the strength of the linear relationship between two (and only two) variables. Correlation coefficients range from -1.0, a perfect negative correlation, to +1.0, a perfect positive correlation. The closer correlation coefficients get to -1.0 or 1.0, the stronger the correlation. The closer a correlation coefficient gets to zero, the weaker the correlation is between the two variables. Furthermore, according to Field (2005) general guidelines correlations of 0.1 – 0.29 are considered small, correlations of 0.30 – 0.49 are considered moderate and correlations above or equal to 0.5 are considered large. Correlation for the relationship between challenges of pharmaceutical supply chain practice and

independent variables (challenges of quantification & procurement, warehouse, inventory management and distribution), the Pearson correlation was computed. As it can be seen from the results in table below, there is positive and significant relationship between all independent variables and dependent variable. Quantification& procurement challenges (r =0.583, p < 0.01), warehouse challenges (r =0.866, p < 0.01), inventory management (r =0.841, p < 0.01), and distribution (r =0.834, p < 0.01). The relationship between these independent variables and dependent variable is positive relation.

Pearson correlation

Independent variables		**dependent variable**
dependent variable	Pearson Correlation	1
	Sig. (2-tailed)	
	N	95
Quantification challenges	Pearson Correlation	.583**
	Sig. (2-tailed)	.000
	N	95
Warehousing challenges	Pearson Correlation	.866**
	Sig. (2-tailed)	.000
	N	95
Inventory management	Pearson Correlation	.841**
	Sig. (2-tailed)	.000
	N	95
Distribution	Pearson Correlation	.834**
	Sig. (2-tailed)	.000
	N	95

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

4.5.2 Normality test

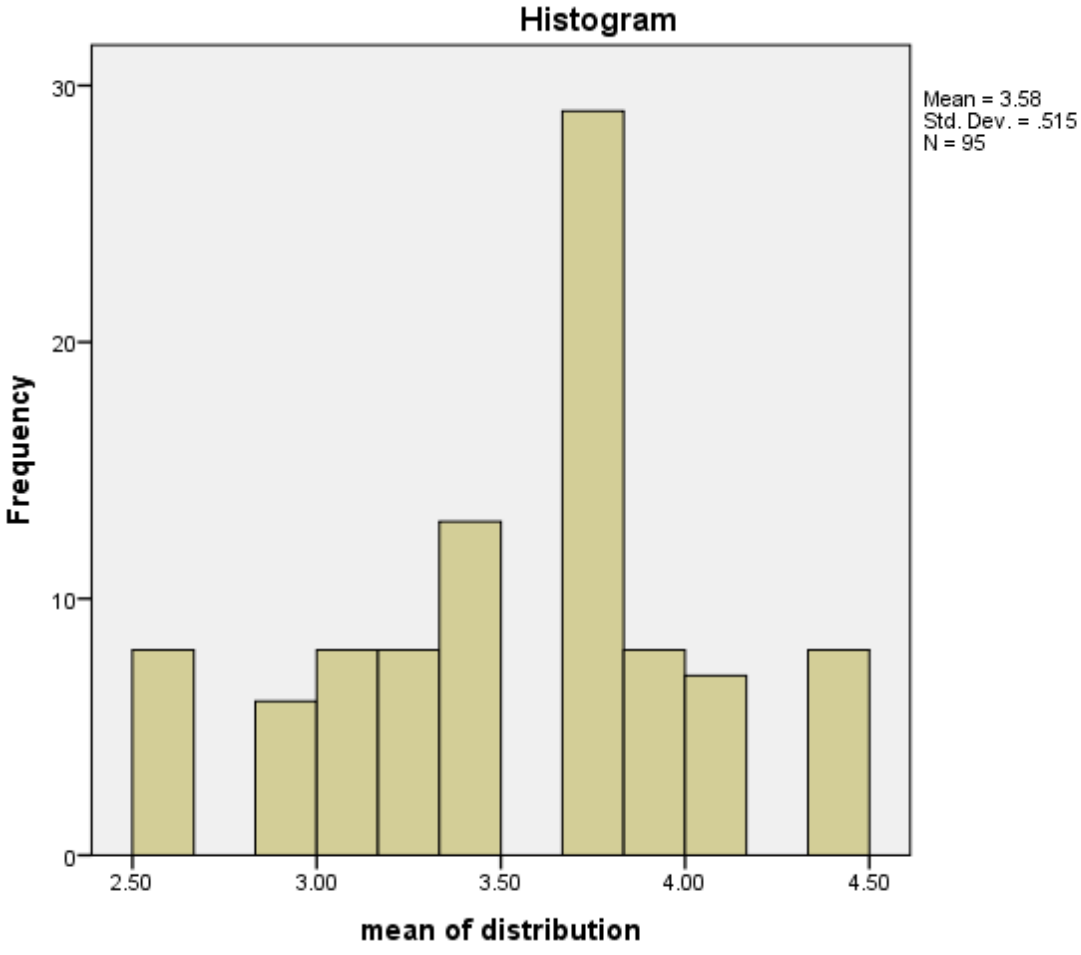
One way of measuring the normality of physical distribution is checking skewness and kurtosis. The range for normality of distribution is between 1 up to -1 (Matt et al, 2013)

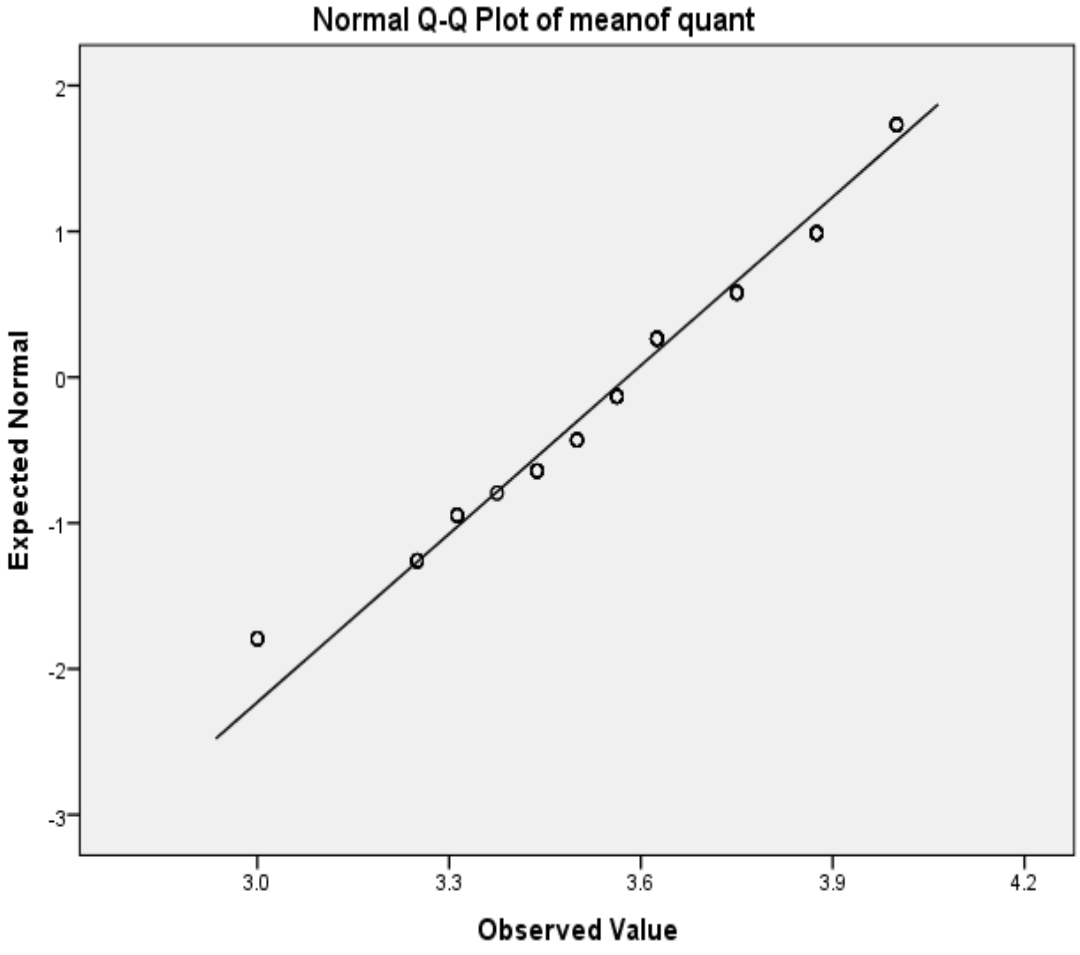
Variables	Kolmogorov-Smirnova		
Pharmaceutical supply chain practice	**Statistics**	**Df.**	**Sig.**
	0.53	15	.00
Warehousing	0.35	13	.00
Inventory management	0.41	8	.00
Distribution	0.41	8	.00
Quantification and procurement	0.41	8	.00

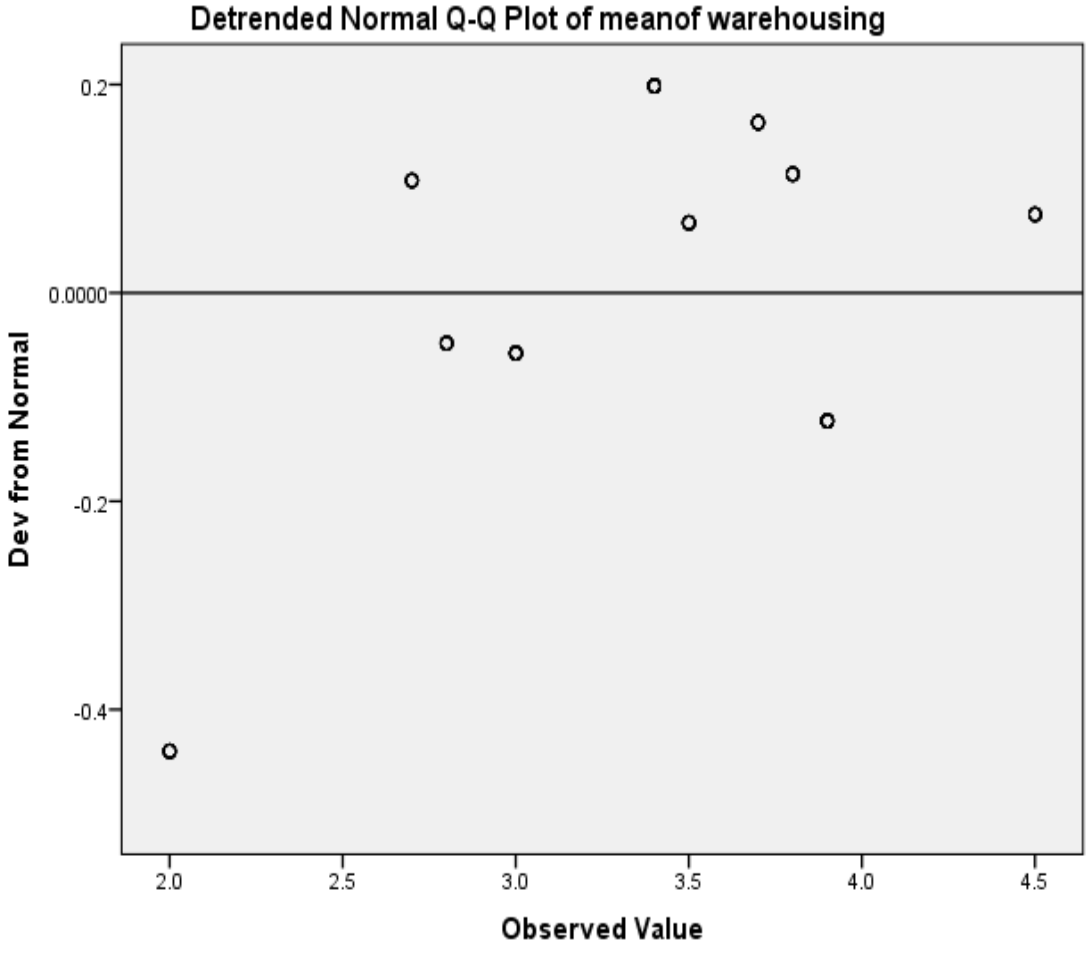
As the table showed as the result of skewness regarding the measurement of pharmaceutical supply chain practice against factors of the independent variables was in acceptable range **(-1 to 1).** The Kolmogorov-Smirnov normality test for the standardized residuals is significant with a significance of 0.00 which is less than 0.05. This implies that the residuals follow a normal distribution as required for a linear regression.

4.5.3 Linearity

Linearity of the relationships between dependent and the independent variables. As showed in the below graph most of the variables are linear with the line showing that there is linear relationship between challenges of pharmaceutical supply chain and the overall supply chain practice.


Histogram
Mean = 3.58
Std. Dev. = .515
N = 95
Frequency
30
20
10
0
2.50
3.00
3.50
4.00
4.50
mean of distribution


Normal Q-Q Plot of meanof quant
Expected Normal
Observed Value
2
1
0
-1
-2
-3
3.0
3.3
3.6
3.9
4.2


Detrended Normal Q-Q Plot of meanof warehousing
Dev from Normal
0.2
0.0000
-0.2
-0.4
2.0
2.5
3.0
3.5
4.0
4.5
Observed Value

4.5.4 Multicollinearity Test

Multicollinearity refers to the situation in which the independent or predictor variables are highly correlated. When independent variables are multicollinear, there is "overlap" or sharing of the predictive power. This may lead to the paradoxical effect, whereby the regression model fits the data well, but none of the predictor variables has a significant impact in predicting the dependent variable but may not individually contribute significantly to the model. Existence of the multicollinearity can be checked using "Tolerance" and "Variance Inflation Factor -VIF" values for each predictor variables. As can be indicated Tolerance value is less than 0.10 and VIF is greater than 10 indicating existence of multicollinearity. Multicollinearity is therefore not a problem for this study.

4.5.5 Multiple Regression

Multiple regression model analysis for testing of challenges ofs pharmaceutical supply chain practices.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.774[a]	.600	.582	.04327

a. Predictors: (Constant), mean of distribution, mean of quant, mean of inventory management, mean of warehousing
b. Dependent Variable: practice SC

The multiple correlation coefficient, R indicates existence of strong correlation 0.774 between the overall pharmaceutical supply chain practices and the independent variables. Adjusted R2 amounted to 0.582 revealed that 58.2% of the relationship or the variation on supply chain practice is explained by the variation independent variables (quantification and procurement challenges, warehousing challenges, inventory management challenges and distribution challenges). The remaining 40% is explained by different other challenges not studied in this research.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.253	4	.063	33.723	.000[b]
	Residual	.169	90	.002		
	Total	.421	94			

a. Dependent Variable: Supply ChainPractice

b. Predictors: (Constant), mean of distribution, meanof quant, meanof inventory management, meanof warehousing

The study used ANOVA to establish the significance of the regression model. In testing the significance level, the statistical significance was considered significant if the p-value was less or equal to 0.05. The significance of the regression model in the above table is with P-value of 0.00 which is less than 0.05. This indicates that the regression model is statistically significant in predicting challenges pharmaceutical of supply chain practice in EPSS. The overall ANOVA results indicates that the model was significant at F = 33.72, p = 0.000.

4.5.6 Coefficients

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	3.538	.071		49.814	.000		
	Quantification challenges	.096	.020	.373	4.716	.000	.711	1.406
	Warehouse challenges	.054	.011	.512	4.887	.000	.404	2.473
	inventory management	.065	.009	.652	6.958	.000	.506	1.977
	Distribution challenges	.019	.014	.149	1.365	.176	.373	2.683

a. Dependent Variable: **supply chain practice**

As can be seen in above table, the p value of the t statics for the independent variables' quantification and procurement (t=4.71, p=0.00), warehousing (t=-4.88, p=0.00), inventory management (t=6.95, p=0.00), distribution (t=1.36, p=0.00) are less than 0.05 which implies the coefficient of the independent variable is significant.

Therefore, independent variables such as Quantification and procurement, warehousing factors, inventory management factors, distribution factors showed impact on pharmaceutical supply chain practice in the multiple regression analysis.

Standardized Coefficients

The coefficients that can explain the relative importance of factors in terms of how they affect the dependent variable are the standardized coefficients. As a result, after standardizing each explanatory variable, the regression analysis' coefficients were determined. The standardized coefficient of inventory management is the largest value and then warehousing, and procurement as shown in the table below. The larger the standard coefficient, the higher is the relative effect of the challenges to the supply chain practice.

The significance tests of the four variables indicate that three of the explanatory variables (quantification & procurement, warehousing and inventory management) are significant with p-value ($p<0.05$) for impacting supply chain practice. Distribution challenge has a p-value greater than 0.05, thus the factor is not statistically significant to impact supply chain practice.

Based on the study results, the three variables of supply chain challenge have stronger effect on the pharmaceutical supply practice. With standard Beta Coefficient of 65.2% of the total variation of supply chain practice is explained by inventory management challenges.

Based on the study results shown above next to inventory management challenges, warehousing challenges have stronger effect on the pharmaceutical supply chain practice with standard Beta Coefficient of 51.2% of the total variation of supply chain practice. According to the standard beta coefficient findings the next higher significant contributor for supply chain practice is the challenges of quantification and procurement with standard Beta Coefficient of 37.3%.

Chapter Five

Summary, Conclusion and Recommendation

5.1 Summary of the findings

Pharmaceutical supply chain practices help to ensure availability of medicines in adequate quantity and improves the quality of service provided to the public. The main purpose of the study was to assess challenges of the supply chain practices in Ethiopian Pharmaceutical Supply Service (EPSS). The study was conducted through descriptive design with a census target population of 100 respondents in EPSS who directly or indirectly involved in the overall operation process. The supply chain practice of the organization is influenced by quantification and procurement challenges with mean and standard deviation of 3.58 and 0.72 respectively, by warehousing challenges with mean and standard deviation of 3.34 and 0.935 respectively, by inventory management challenges with mean and standard deviation of 3.31 and 0.94 and by distribution challenges with mean value of 3.58 and 0.87 standard deviation respectively.

The Cronbach alpha coefficient for the above variables was found to be greater than 0.70 showing that the questionnaire is reliable and internally consistent. The multiple correlation coefficient, R indicates existence of strong correlation 0.774 between challenges of pharmaceutical supply chain and the independent variables. Adjusted R2 amounted to 0.582 revealed that the model accounts for 58.2% which means that 58.2% of the relationship or the variation on supply chain practice is explained by the variation independent variables (quantification and procurement factors, ware housing factors, inventory management factors and distribution factors. The study used ANOVA to establish the significance of the regression model. In testing the significance level, the statistical significance was considered significant if the p-value was less or equal to 0.05. The significance of the regression model in the above table is with P-value of 0.00 which is less than 0.05. This indicates that the regression model is statistically significant in predicting challenges pharmaceutical of supply chain practice in EPSS. Coefficients of beta, the significance tests of the four variables indicate that the three of the explanatory variables (quantification & procurement, ware housing and inventory management) are significant with p-value ($p<0.05$) for impacting supply chain practice. The

rest one factor (distribution) has a p-value greater than 0.05, thus this factor is not statistically significant to impact supply chain practice.

5.2 Implication of the study

The findings of this study have an impact on FMOH, EPSS, and medical facilities that use the organization's service. According to the analysis, the agency's supply chain practices were influenced by all four of the variables. Therefore, managers at various levels must focus on these aspects to lessen their impact and ultimately enhance organizational performance. To address the issues and assist the underserved population, a team effort is needed since the concerns include numerous multisectoral parties.

5.2 Conclusion

The challenges of pharmaceutical supply chain practices in EPSS are summarized in the following conclusion based on the overall findings of the study.

Both the qualitative and quantitative data showed that majority of respondents agree with the effect of the challenges of the procurement, warehousing, inventory management and distribution affect the overall supply chain practice of EPSS. Additionally, based on the model summary of the multiple regressions it is concluded that the stated four independent variables have impact in explaining the variance in the dependent variable. Quantification& procurement challenges ($r = 0.583$, $p < 0.01$), warehouse challenges ($r = 0.866$, $p < 0.01$), inventory management ($r = 0.841$, $p < 0.01$), and distribution ($r = 0.834$, $p < 0.01$). The relationship between these independent variables and dependent variable is positive relation.

It was assessed that from the many challenges described by the respondents, the majority identified lack of consumption date from health facilities that supports the quantification process, limited supplier of essential medicines, long and tedious international tender process and contract management, lengthy customs clearance procedure, scattered location of warehouse which poses difficulty to collect products timely, inadequate warehouse capacity, lack of established guidelines for minimum and maximum stock level at which optimum quantity products should be maintained, lack of adequate type and number of vehicles to

meet desired distribution schedules and lack of proper distribution planning of vehicles were majorly identified.

Of all the challenges identified lack of adherence to standard operating procedure, limited use of information technology and lack of coordination and integration between the core operational functions is observed in all the departments.

From the findings it can be concluded that EPSS faces many muti faceted challenges arising from the different core functions that affects it supply chain practices resulting in unavailability of pharmaceuticals at the right time to the health facilities.

5.4 Recommendation

From the findings of the research, there are several challenges that EPSS should address in order to accomplish an efficient supply chain practice by reducing stock out and overstock of pharmaceuticals and provide sufficient service to health facilities in the country.

- EPSS needs to establish volume estimation system for its vehicles based on the inventory handling unit. This will standardize the process and avoids delays in loading cargo and document preparation time and most importantly supports the planning process.
- EPSS needs to strengthen its capacity to use its own trucks rather than relying on commercial transporters to distribute pharmaceuticals to branch offices and health facilities. This will support more flexibility and strengthens the monitoring process.
- For the warehouse activities standard operating procedures need to be enforced to allow smooth workflow process and to optimize warehouse space usage. In addition, expired and damaged pharmaceuticals need to be disposed as per the required operating procedure to create more space for usable stock. EPSS also needs to monitor record keeping activities of the warehouse to strengthen accountability of stocks.
- For annual quantification of pharmaceuticals, EPSS needs to provide training and increase the capacity of health facilities to provide accurate consumption data. In addition, EPSS needs to employ

reliable and traceable methods of compiling and estimating quantities of pharmaceuticals for procurement process.

- EPSS needs to create a system whereby it measures the performance of suppliers to establish long term agreement with best performers for sustainable and timely supply of pharmaceuticals. In addition, it is recommended that the agency need to streamline and improve the lengthy tender approval and decision-making process.
- The Federal Ministry of Health together with other relevant stakeholders need to develop the capacity of local manufacturers to produce essential and vital medications which can easily be sourced by EPSS.
- In contemporary supply chain, communication plays crucial role, so EPSS needs to strengthen communication and integration with external stakeholders; national bank, customs office, international suppliers, health facilities and local manufacturers to have a transparent and accountable process and to trace gap areas for effective and efficient delivery of service.
- EPSS needs to develop and update its standard operating procedures for core processes and strengthen on the internal communication among the different departments for smooth flow of information.
- EPSS should fully implement effective computerized logistics system in all the core processes to increase data visibility and support in informed decision making.
- Training gaps in the different departments need to be identified and the agency need to work in building the capacity of staff to increase their competency. In addition, staff need to be exposed to other country experiences especially in procurement practices, warehousing and inventory management activities through job shadowing and other mechanisms to learn from best experiences.

5.5 Suggestion for further research

The findings of this research have contributed to provide the overall view of the challenges of pharmaceutical supply chain practices. It can be used as reference for all stakeholders to improve the gaps in EPSS as the research provides an insight on the overall challenges of the agency and which areas to focus on for the improvement. The research has limitations as it is focused on challenges within the internal workflow of the organization and data was collected only from staff in EPSS. Thus, the researcher advises

other interested parties to conduct thorough research by excluding the limitations of this particular study to find more broader understanding of the challenges faced in the country in regard to supply of adequate medicines.

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Appendix I

Frequency of Quantification and Procurement Challenges

Variables	SD	D	N	A	SA	Mean	Standard deviation
Lack of reliable data from facilitates	0	0	6(6.3%)	67(70.5%)	22(23.2 %)	4.17	0.52
Requested quantities for procurement are not reliable	8(8.4%)	22(23.2)	22(23.2%)	43(45.3%)	0	3.05	1.01
Long and tedious tender process	0	6(6.3%)	8(8.4%)	67(70.5%)	14(14.7 %)	3.94	0.7
Limited supplier for essential medicines	0	0	15(15.8%)	72(75.8%)	8(8.4%)	3.93	0.49
Supplier's delivery delay	0	22(23.2%)	7(7.4%)	51(53.7%)	15(15.8 %)	3.62	1.01
Lack of prompt payment mechanism	0	8(8.4%)	36(37.9%)	43(45.3%)	8(8.4%)	3.54	0.77
Lack of follow up with performance indicators	0	21(22.1%)	43(45.3%)	31(32.6%)	0	3.11	0.74
Lack of market research before procurement planning	0	0	42(44.2%)	45(47.4%)	8(8.4%)	3.64	0.63
Lack of establishment of long-term relationship with suppliers	0	7(7.4%)	34(35.8%)	54(56.8%)	0	3.49	0.63
Lack of regular communication between the agency and suppliers	0	15(15.8%)	20(21.1%)	60(63.2%)	0	3.47	0.76
Lack of supplier qualification	0	22(23.2%)	22(23.2%)	43(45.3%)	8(8.4%)	3.29	0.84
Lack of the involvement of stockholders in developing specification	0	37(38.9%)	7(7.4%)	51(53.7%)	0	3.39	0.94

Lack of sufficient budget for purchasing pharmaceuticals	0	37(38.9%)	7(7.4%)	51(53.7%)	0	3.15	0.96
Limited information technology system	6(6.3%)	15(15.8%)	7(7.4%)	67(70.5%)	0	3.42	0.97
Lack of foreign currency and delay in getting approval	0	0	0	95(100%)	0	4.03	0.18
Lengthy government customs clearance procedure	0	0	6(6.3%)	81(85.3%)	0	4.02	0.39
Overall mean						**3.58**	**0.72**

Source: Own survey, 2023 *F = frequency*

Frequency of Warehousing Challenges

Variables	**SD**	**D**	**N**	**A**	**SA**	**Mean**	**Standard deviation**
Inadequate warehouse capacity	0	8(8.4%)	15(15.8%)	72(75.8%)	0	3.67	0.62
Inadequate human power to load and offload	0	30(31.6%)	21(22.1%)	44(46.3%)	0	3.14	0.87
Inadequate equipment to load and offload	0	15(15.8%)	15(15.8%)	65(68.4%)	0	3.52	0.755
Lack of adherence to Warehouse SOP	0	23(24.2%)	30(31.6%)	19(20%)	23(24.2%)	3.44	1.10
Poor organization of product location and delay in picking of products for loading	0	30(31.6%)	14(14.7%)	51(53.7%)	0	3.22	0.90
Poor record keeping and application of Information Technology (IT)	0	32(33.7%)	21(22.1%)	42(44.2%)	0	3.10	0.88
Lack of coordination between warehouse staff	0	36(37.9%)	28(29.5%)	16(16.8%)	15(15.8%)	3.10	1.08
Lack of warehouse monitoring and evaluation system	0	36(37.9%)	14(14.7%)	24(25.3%)	21(22.1%)	3.31	1.19
Lack of disposing damaged and expiry products	0	28(29.5%)	22(23.2%)	38(40%)	7(7.4%)	3.25	0.96

Poor and scattered location of warehouses	0	22(23.2%)	0	58(61.1%)	15(15.8%)	3.69	1.00
Overall mean						**3.34**	**0.935**

Source: Own survey, 2023

Frequency of Inventory Management Challenges

Variables	SD	D	N	A	SA	Mean	Standard deviation
Lack of inventory management practice in line with SOPs	6(6.3%)	23(24.2%)	15(15.8%)	51(53.7%)	0	3.16	1.00
Lack of established guidelines for maximum and minimum stock levels	0	29(30.5%)	30(31.6%)	28(29.5%)	8(8.4%)	3.15	0.96
Lack of transparent and efficient inventory procedure	6(6.3%)	16(16.8%)	22(23.2%)	51(53.7%)	0	3.24	0.95
Lack of coordination with procurement and inventory management team	0	6(6.3%)	16(16.8%)	73(76.8%)	0	3.70	0.58
Lack of enforcement of standard operating procedures	6(6.3%)	7(7.4%)	23(24.2%)	59(62.1%)	0	3.42	0.88
Lack of available information technology system	6(6.3%)	22(23.2%)	8(8.4%)	53(55.8%)	6(6.3%)	3.32	1.09
Inadequate data visibility with all relevant	0	22(23.2%)	0	58(61.1%)	15(15.8%)	3.73	0.9
Inadequate staff knowledge and skill	0	14(14.7%)	12(12.6%)	54(56.8%)	15(15.8%)	2.93	0.95
Lack of regular monitoring of stock	6(6.3%)	31(32.6%)	8(8.4%)	42(44.2%)	8(8.4%)	3.15	1.16
Overall mean						**3.31**	**0.94**

Source: own survey, 2023

Frequency of Distribution Challenges

Variables	SD	D	N	A	SA	Mean	Standard deviation
Lack of adequate type and number of vehicles to meet desired distribution schedules	0	16(16.8%)	8(8.4%)	55(57.9%)	16(16.8%)	3.74	0.93
Proper distribution planning of vehicles	0	23(24.2%)	0	72(75.8%)	0	3.51	0.86
Lack of ability to manage the flow of information for a reliable and secure delivery	0	16(16.8%)	21(22.1%)	51(53.7%)	7(7.4%)	3.51	0.86
Lack of adequate management information system used to control vehicles	0	15(15.8%)	14(14.7%)	52(54.7%)	14(14.7%)	3.68	0.91
Lack of preparing delivery documents timely	0	28(29.5%)	15(15.8%)	52(54.7%)	0	3.25	0.88
Poor communication between distribution officers and warehouse managers	6(6.3%)	16(16.8%)	13(13.7%)	52(54.7%)	8(8.4%)	3.42	1.06
Delay in loading of vehicles after receiving of delivery document	0	8(8.4%)	36(37.9%)	28(29.5%)	23(24.2%)	3.69	0.93
Resistance of drivers to carry full vehicle capacity	0	8(8.4%)	12(12.6%)	37(38.9%)	38(40%)	4.10	0.92
Lack of documented distribution schedule	8(8.4%)	22(23.2)	22(23.2%)	43(45.3%)	0	3.08	1.01
Lack of adequate vehicle volume capacity	0	8(8.4%)	14(14.7%)	65(68.4%)	8(8.4%)	3.76	0.72
Lack of flexibility and adherence to guidelines from commercial transporters	0	0	35(36.8%)	60(63.2%)	0	3.63	0.48
Overall mean						**3.58**	**0.87**

Source: Own survey, 2023

Appendix II

ADDIS ABABA UNIVERSITY

SCHOOL OF COMMERCE

DEPARTMENT OF LOGISTICS AND SUPPLY CHAIN MANAGEMENT

Questionnaire to be filled by Respondents

Dear Respondents.

The questionnaire is prepared by Masters of **Logistics and Supply Chain Management** graduate student for the purpose of writing thesis on **'Factors Influencing the Pharmaceutical Supply Chain Practices in the case of Ethiopian Pharmaceutical Supply Service (EPSS)'.** Your genuine and timely response is essential for the success of my study. I want to assure you that your privacy for responding to this questionnaire is completely kept confidential. I know that your time is valuable, and I hope that you will take the time to complete the questionnaire. Please attempt to answer all the questions and click one in appropriate box that best suits your perspective for each statement.

General Instruction

- There is no need of writing your name
- In all case where answers options are available, please make mark **(√)** in the appropriate place.

Thank you in advance for your cooperation.

Sincerely,

. Mahlet Sisay

Part I: Demographic characteristics

1. Gender
   - Male
   - Female
2. Education level
   - College/University Diploma level
   - Bachelor's Degree
   - Master's Degree
   - PhD (Doctor of Philosophy)
   - Others
3. How many years have you worked in EPSS?
   - Less than a year
   - 1 – 5 years
   - 6 – 10 years
   - 11 – 15 years
   - Over 15 years
4. Please indicate your current Directorate
   - Warehouse and Inventory Management
   - Distribution and Fleet Management
   - Quantification and Market Shaping
   - Procurement and Contract Management
   - Tender Management
   - Quality Control and Assurance
   - Other…….
5. Position in the Directorate
   - Director
   - Team Leader
   - Officer III

- Officer II
- Officer I
- Clerk
- Other…….

Part II: ASSESSMENT OF CHALLENGES OF PHARMACEUTICAL SUPPLY CHAIN PRACTICES IN ETHIOPIAN PHARMACEUTICAL SUPPLY SERVICE (EPSS).

Please rate your level of agreement for each given statement by tick (√) against corresponding lines.

Note: Strongly disagree **(1),** Disagree **(2),** Neutral **(3),** Agree **(4)** and strongly agree **(5).**

A. Quantification and Procurement Challenges

S/No	**Quantification and procurement challenges**	**Scale**				
		1	**2**	**3**	**4**	**5**
1	Lack of reliable data from facilitates for estimation of annual pharmaceutical need					
2	Requested quantities for procurement are based on reliable estimate of actual need					
3	Long and tedious international tender process and contract management					
4	Lack of supplier for some essential medicines					
5	Suppliers delay delivery of pharmaceuticals as per awarded quantity					
6	Lack of prompt and reliable payment mechanism for suppliers					
7	Lack of follow up with key procurement performance indicators					
8	Lack of market research before procurement planning					

9	Lack of establishment of long-term relationship with suppliers					
10	Lack of regular communication and transparency between the agency and suppliers					
11	Lack of supplier qualification based on product quality, service reliability, and financial viability					
12	Lack of the involvement of different experts, stockholders and suppliers in developing specification for each item to be procured					
13	There is lack of sufficient budget for purchasing pharmaceutical products required to meet the demand					
14	There is limited information technology system for exchange of procurement related documents and transactions with suppliers					
15	Lack of foreign currency and delay in getting approval					
16	Lengthy government customs clearance procedure					

B. Warehousing Challenges

S/No	**Warehousing challenges**	**Scale**				
		1	**2**	**3**	**4**	**5**
1	Inadequate warehouse capacity to store pharmaceuticals					
2	Inaequate human power to load and offload pharmaceuticals					
3	Inadequate equipment to load and offload pharmaceuticals					
4	Lack of adherence to Warehouse Standard Operating Procedures (SOPs)					
5	Poor organization of product location and delay in picking of products for loading					

6	Poor record keeping and application of Information Technology (IT) for warehouse activities					
7	Lack of coordination between warehouse activities and warehouse staff					
8	Lack of warehouse monitoring and evaluation system					
9	Lack of disposing damaged and expiry products on time					
10	Poor and scattered location of warehouses					

C. Inventory Management Challenges

S/No	**Inventory Management challenges**	**Scale**				
		1	**2**	**3**	**4**	**5**
1	Lack of inventory management practice that is in line with standard inventory management procedures					
2	Lack of established policies for maximum and minimum stock levels at which full supply products should be maintained					
3	Lack of transparent and efficient inventory procedure					
4	Lack of coordination with procurement and inventory management team					
5	Lack of enforcement of standard operating procedures for implementation of effective inventory management					
6	Lack of available information technology system which supports implementation of inventory management					
7	Inadequate data visibility with relevant directorate and stakeholder for decision making					
8	Inadequate staff knowledge to perform effective and efficient implementation of inventory management					
9	Lack of regular monitoring of stock out and overstocked items					

D. Distribution Challenges

S/No	Distribution challenges	Scale				
		1	2	3	4	5
1	Lack of adequate type and number of vehicles to meet desired distribution schedules					
2	Proper distribution planning of vehicles					
3	Lack of ability to manage the flow of information for a reliable and secure delivery					
4	Lack of adequate management information system used to control vehicles					
5	Lack of preparing delivery documents timely					
6	Poor communication between distribution officers and warehouse managers					
7	Delay in loading of vehicles after receiving of delivery document					
8	Resistance of drivers to carry full vehicle capacity					
9	Lack of documented distribution schedule					
10	Lack of adequate vehicle volume capacity					
11	Lack of flexibility and adherence to guidelines from commercial transporters					

S/No	Supply chain practice	Scale				
		1	2	3	4	5
1	Supply chain practice of the organization is influenced by quantification and procurement challenges					
2	Supply chain practice of the organization is influenced by warehousing challenges					

3	Supply chain practice of the organization is influenced by inventory management challenges					
4	Supply chain practice of the organization is influenced by distribution challenges					

Interview guiding questions

1. In your opinion, what are procurement challenges affect supply chain practices in EPSS? Which are the most relevant challenges you think is crucial to the delivery of right product to patients in need?
2. What are the warehousing challenges that affect supply chain practices in EPSS? What do you think is the possible solution for Good Storage practice in the organization?
3. What are the inventory management challenges that affect supply chain practices in EPSS? What do you think are the possible interventions to resolve these challenges?
4. What are the distribution challenges that affect supply chain practices in EPSS? Do you believe that there is delay in distribution of pharmaceuticals to health facilities? If yes, why this happens? And what efforts the agency need to do to?
1. In your opinion, how can EPSS solve the issue of shortage of essential medicines in the country?
2. What other additional factors affect the supply chain practices in EPSS? If you have additional information, please elaborate clearly?

Thank you in advance for your cooperation!!!