**ADDIS ABABA UNIVERSITY**

**COLLEGE OF BUSINESS AND ECONOMICS**

**SCHOOL OF COMMERCE**

# Challenges of Supply Chain Management of Laboratory Commodities: in the Case of Ethiopian Pharmaceutical Supply Agency, Addis Ababa

By: Hilina Tesfaye

Advisor: Tariku Jebena (Ph.D.)

Thesis Submitted to Addis Ababa University School of Commerce in partial fulfillment of the requirements for the Degree of Master of Art in Logistics and Supply Chain Management.

Addis Ababa, Ethiopia

June 2021

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**Approved by examiners committee:**

**Internal Examiner**: _____ , Signature _____,

Date _____

**External Examiner**: _____ , Signature _____,

Date _____

**Advisor**: Tariku Jebena (PhD), Signature _____, Date_____

# Declaration

I declare that the work in this thesis entitled “Assessment of the challenges of Supply Chain Management of Laboratory Commodities: in the Case of Ethiopian Pharmaceutical Supply Agency, Addis Ababa” has been carried out by me in the department of Logistics and Supply Chain Management. References are also duly acknowledged in the list of reference provided.

No part of this work was previously presented for a degree by any other person in partial fulfillment of the requirements for the Degree of Masters of Art in Logistics and Supply Chain Management in Addis Ababa University.

Name: Hilina Tesfaye

Signature: _____

Date: _____

# Statement of Certification

This is to certify that the thesis carried out by Hilina Tesfaye Teklu on the topic entitled "Assessment of the Challenges of Supply Chain Management of Laboratory Commodities: in the Case of Ethiopian Pharmaceutical Supply Agency, Addis Ababa" is her original work under my direct supervision and guidance. This research project has been submitted to Addis Ababa University, School of Commerce, Department of Logistics and Supply Chain Management for examination with my approval as a university advisor and is appropriate for submission for the award of Masters of Art Degree in Logistics and Supply Chain Management.

Name: Tariku Jebena (PhD),

Signature: _____

Date: _____

# Table of Content

## Contents

# Acknowledgment

First, I would like to thank almighty God, for helping me and giving me the strength and courage to go through all the way.

My truthful appreciation goes to my advisor Dr. Tariku Jebena for offering me his goodwill and support me during this study. I would also like to thank all respondent who are working in Ethiopian Pharmaceutical Supply Agency (EPSA) who were kind and willing to provide me essential information by sacrificing their golden time.

I would also like to extend my appreciation to Ato Damtew Negash and W/ro Muluemebet Tesfaye for their strong support and assistances during the data collection process.

Finally, I would like to thank my family and friends for their full time support and cooperation.

## List of Acronyms/Abbreviations

SCM: Supply Chain Management

EPSA: Ethiopian Pharmaceuticals Supply Agency

QMSD: Quantification and Market Shaping Directorate

TMD: Tender Management Directorate

CMD: Contract Management Directorate

WIM: Warehouse and Inventory Management

FMOH: Federal Ministry of Health

SPSS: Statistical Package for the Social Sciences

LMIS: Logistics Management Information System

EPHI: Ethiopian Public Health Institute

FEFO: First Expiring First Out

SDP: Service Delivery Points

EPHI: Ethiopian Public Health Institute

SOP: Standard Operating Procedure

FWA: Frame Work of Agreement

HCMIS: Health Management and Information system

EFDA: Ethiopian Food and Drug Authority

COVID: Corona Virus Disease

NGO: Non-Governmental Organization

## List of Tables



## List of Figures

# Abstract

*Laboratory services play a significant role in a country's health system and in the delivery of quality health services. For laboratories to function effectively, they must have the commodities needed for the testing services offered. Considering wide range of commodities needed at the various levels of the laboratory network, ensuring the availability of commodities is mandatory. This study targets to assess challenges of supply chain management of laboratory Commodities in the Case of Ethiopian Pharmaceutical Supply Agency. A descriptive, cross-sectional study design with mixed research approaches, qualitative, and quantitative were employed in data collection and analysis. Three interviews, thirty-one questionnaires were responded. The finding indicates that the cause of frequent stock out in EPSA is quantification error (improper quantification). Professionals who had limited skills and knowledge quantify laboratory commodities. More than half, (61.3%) believed that the agency has no continues follow up on stock status of lab commodities, (51.6%) confirmed that EPSA had no enough hard currency to procure and avail all lab commodities, (58.1%) procurement process cannot be finished with in the specified lead-time. 80% of the respondents believed that there were a gap about distribution of full package laboratory kits to the health facilities. The major challenges found were no sufficient warehouse to accommodate room temperature required laboratory commodities, shortage of lab professional in the agency, high expiry of controls and calibrators. Therefore, the agency needs to work closely with the respective internal departments and related technical and professional experts from stakeholders for the efficiency and effectiveness of Laboratory commodities management in the health system.*



Keywords: Laboratory Commodities, Quantification error, controls and calibrators, warehouse, .

# CHAPTER ONE

# INTRODUCTION

This chapter mainly includes the background of the study, statement of the problem, research question, its objectives, significance and scope of the study, definition of terms and organization of the study.

## 1.1. Background of the Study

Supply chain management (SCM) incorporates management of all activities involved in sourcing and procurement, conversion, and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers, and customers (CRS Guideline, 2011). Therefore, Laboratory commodities should be produced and reach to the end users at the right quantities to the right place and at the right time, in order to lower system wide costs to the end users.

SCM by itself is the process that encompasses the whole logistics activities to manage quantification, procurement or sourcing activities, transportation, warehousing and various activities in which concerned with a harmonized movement of products from suppliers to the end users.

Pharmaceutical supply chain management shares the same goal with that of the broader SCM with specific objective of moving pharmaceuticals from the manufacturer to the end user in organized and efficient or optimized ways (Rui T. Sousa et.al, 2011).

Laboratory services play a significant role in a country's public health system and in the delivery of quality health services. Hence, strong and reliable laboratory services can be achieved by having strong supply chain management practice especially on laboratory commodities management.

In contrary, supply chain management of laboratory commodities is a challenge, especially in developing countries (USAID, 2008).

According to USAID|DELIVER (2009), the commonly faced challenges in developing countries is that in order to perform a test in a laboratory it requires a collection of commodities to address the desired test result. On the other hand, laboratory commodities often come in a variety of preparations-including solid and liquid reagents. The packaging of laboratory commodities is also

another issue that should be mentioned as the packages are in kits, whereas the dry laboratory chemicals and consumable liquids are often packed in bulk. In addition to this, Some laboratory commodities have either short shelf lives or need special storage condition.

The other major challenges of laboratory service are frequent stock outs of reagents that can cause delays in testing, longer hospitalization, and missed opportunities for outpatient testing. Moreover, many different kinds of customers with varying needs for commodities, testing, and information can add another complexity to the system. In addition, lack of standardization of the laboratory platforms in the country can cause this frequent stock out of lab commodities in the health facilities.

EPSA is an agency with a prime responsibility of managing the pharmaceutical logistics system of the country. It was established by the name PFSA in 2007 by Proclamation No. 553/2007 to supply quality assured pharmaceuticals at affordable prices in a sustainable manner to all public health institutions in the country. The provision of complete health care necessitates the availability of safe, effective and affordable drugs and related supplies of the required quality, in adequate quantity at all times. Despite this fact, in the past, the pharmaceutical supply chain management system of the country had several problems including non-availability, un-affordability, poor storage and stock management and irrational use (PFSA SOP, 2015).

This study is therefore, carried out to assess the challenges of supply chain management of laboratory commodities in EPSA.

## 1.2. Statement of the Problem

According to USAID (2008), laboratory services play a significant role in a country's health system and in the delivery of quality health services.

For laboratories to function effectively, they must have the commodities needed for the testing services offered. Given the wide range of commodities needed at the various levels of the laboratory network, the task of ensuring that commodities are available when and where they are needed can be formidable. Effective supply management practices help ensure commodity availability (USAID, 2008).

However, not all public health facilities are providing these services mainly due to unavailability of laboratory supplies (USAID 2009). As a result, health care delivery was hampered (Boadu et al, 2016). In Ethiopia, government has taken a number of measures to enhance laboratory commodities supply to all public health facilities. EPSA is the sole responsible agent in quantifying and procuring program and budget based health commodities, including laboratory commodities (PFSA, 2018). The agency is responsible for managing the pharmaceutical logistics system of the country. As the provision of complete health care necessitates the availability of safe, effective and affordable drugs and related supplies of the required quality, in adequate quantity at all times, having a well-organized and systematic supply chain management and logistics service is mandatory. Despite this fact, in the past, laboratory commodities supply chain management system of the country had several problems including non-availability, un-affordability, poor storage and stock management and irrational use (PFSA, 2015)

In addition to that, from the previous researches done at the study area, a number of challenges had been encountered and hinder the agency from delivering the expected level of service and availing all the necessary commodities at all time in the required quantity. Accordingly, this study was designed to scientifically assess the causes and the challenges of Supply Chain Management of Laboratory Commodities in EPSA and provide the possible recommendations.

## 1.3. Research Questions

The study has addressed the following Research Questions:

i. What are the challenges faced on quantification practice of Laboratory Commodities?
ii. What are the problems faced on procurement process of Laboratory Commodities?
iii. What are the challenges on inventory management practices of Laboratory commodities?
iv. What are the gaps identified related to storage and distribution of laboratory commodities?

## 1.4. Research Objectives

### 1.4.1. General Objective

The overall objective of this study is to assess the challenges of Supply Chain Management of Laboratory Commodities in the Case of Ethiopian Pharmaceutical Supply Agency, Addis Ababa.

### 1.4.2. Specific Objectives

This research has the following specific objectives:

i. To identify challenges faced on quantification practice of laboratory commodities
ii. To assess problems faced on procurement process of laboratory commodities
iii. To assess the challenges of Inventory Management practice of Laboratory commodities.
iv. To identify the gaps related to storage and distribution of laboratory commodities.

## 1.5. Significance of the Study

The findings of this research greatly benefit EPSA to emphasize on the commonly faced challenges of Laboratory commodities management and its corrective measure in which that can improve laboratory commodities management practice. Improving laboratory commodities management practice in EPSA will in turn have a significant impact on optimizing the supply chain and these results in improving access to essential lab commodities to the facility.

In addition, the findings of this study allows managers and other decision makers to make decisions that enhances availability of laboratory commodities in EPSA. The study can have a great importance for managers and operational directors in EPSA as the study findings can provide a guiding framework for the implementation of Laboratory commodities management practice. Furthermore, this can help the agency for efficient and effective utilization of scarce public resources. The health facilities, community, suppliers and the service provider (EPSA) will benefit from this research outcome.

## 1.6. Scope of the Study

This study emphasis on the assessment of challenges of Supply Chain Management of Laboratory Commodities in the case of EPSA, Addis Ababa Head Office. It also identifies challenges related to Quantification, Procurement activities and assess Inventory Management Practice on Laboratory Commodities. The data for this study was collected from technical experts in Quantification and Market Shaping Directorate (QMSD), Tender Management Directorate (TMD), Contract Management Directorate (CMD) and Warehouse and Inventory Management (WIM) in EPSA Head Office from May 21, 2021 to May 28, 2021. In addition, because EPSA is a public procuring agent of Pharmaceuticals for the country, this paper can't able to address the production and manufacturing subdivision of Laboratory commodities.

## 1.7. Limitation of the Study

This study faced absence of similar secondary date done on Laboratory commodities management especially in Ethiopia in which this made the comparison of findings a bit difficult with other researches. In addition, due to its scope limitedness, this study could not address all possible challenges of supply chain management in lab commodity stream. Moreover, there were a shortage of ample budget and time constraint to dig out further problems related to laboratory commodity management.

## 1.8. Definition of Terms

- **Laboratory commodities**: are products used to collect, prepare, test, analyze, store, and dispose of biological/clinical specimens (USAID, 2008).
- **Health Facilities**: are hospitals and health centers who receive pharmaceuticals from EPSA.
- **Pharmaceuticals:** means any substance or mixture of substances used in the diagnosis, treatment, mitigation or prevention of a disease, and include medical instruments and medical supplies (Proclamation No 553/2007).
- **Public Health Institutions**: these are health facilities owned by the government of Ethiopia and managed under FMOH or regional health bureaus.
- **Challenge:** is something new and difficult which requires great effort and determination.
- **Supply Chain Management:** is managing supply and demand sourcing raw materials and parts, manufacturing and assembly, warehousing and inventory tracking, order entry and order management, distribution across all channels, and delivery to the customer.(Council of Supply Chain)

## 1.9. Organization of the Study

The organization of this research paper was divided in to five chapters: The first chapter contains the introduction that covers the background of the study, the statement of the problem, the research questions, the research objectives, significance of the study, the scope of the study, the limitations of the study, the definitions of terms and organization of the study. The second chapter contains the literature review that includes on the theoretical literature review, Overview of Supply Chain Management of Laboratory Commodities, empirical literature review, Identified Gaps and conceptual framework. The third chapter contains research methodology which focuses on the description of the study area, the research approach, the research design, the populations and samples, the data sources and types, the data collection procedures, ethical considerations and data analysis. The fourth chapter contains Result and discussion that includes the data presentation and discussion. The fifth chapter contains the basic summary, conclusion, recommendation.

# CHAPTER TWO
# LITERATURE REVIEW

This chapter presents a critical review of relevant literature on logistics practice of health commodities particular focus on laboratory commodities. The section has four sub-chapters such as Theoretical, and Empirical reviews, Identified Literature Gaps and Conceptual Framework.

## 2.1. Theoretical Review

### 2.1.1. Overview of Supply chain management of Laboratory commodities

Supply Chain Management (SCM) can be defined as, "the planning and management of all activities involved in sourcing and procurement and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third party service providers, and customers. In essence, supply chain management integrates supply and demand management within and across the companies" (USAID DELIVER PROJECT, 2011)

According to Logistics Handbook for Supply chain management of health commodities, Effective supply chain not only helps to ensure commodity security, it also helps to determine the success or failure of any public health program. (David S et al., 2000)

When supply chain activities of the healthcare system functions well, the public society will gain so many advantages such as: enhance quality of care given to the society and make the system cost effective and efficient. In order to give efficient and effective laboratory service to the society, proper management of laboratory commodities is the most critical.

Supply chain management (SCM) is a set of approaches utilized to efficiently integrate suppliers, manufacturers, warehouses, and stores:- so that merchandise is produced and distributed at the right quantities to the right locations and at the right time, in order to minimize system wide costs while satisfying service level requirements (David S et al., 2000).

Pharmaceutical supply chain management shares the same goal with that of the broader SCM with specific objective of moving pharmaceuticals from the manufacturer to the end user in organized and efficient or optimized ways (Rui T et al, 2011).

The study conducted by Fasil B. (2019) shows that, in health sector logistics, healthcare supplies delivery on time to fulfill the needs of healthcare providers to save a life. Similarly, in the case of laboratory, many tests require the simultaneous availability of multiple commodities. Depending

on the levels of the logistics system, laboratory services will need between 350 and 3,000 different commodities to perform testing services.

Ethiopia developed the pharmaceutical supply management cycle in which includes five basic functions.

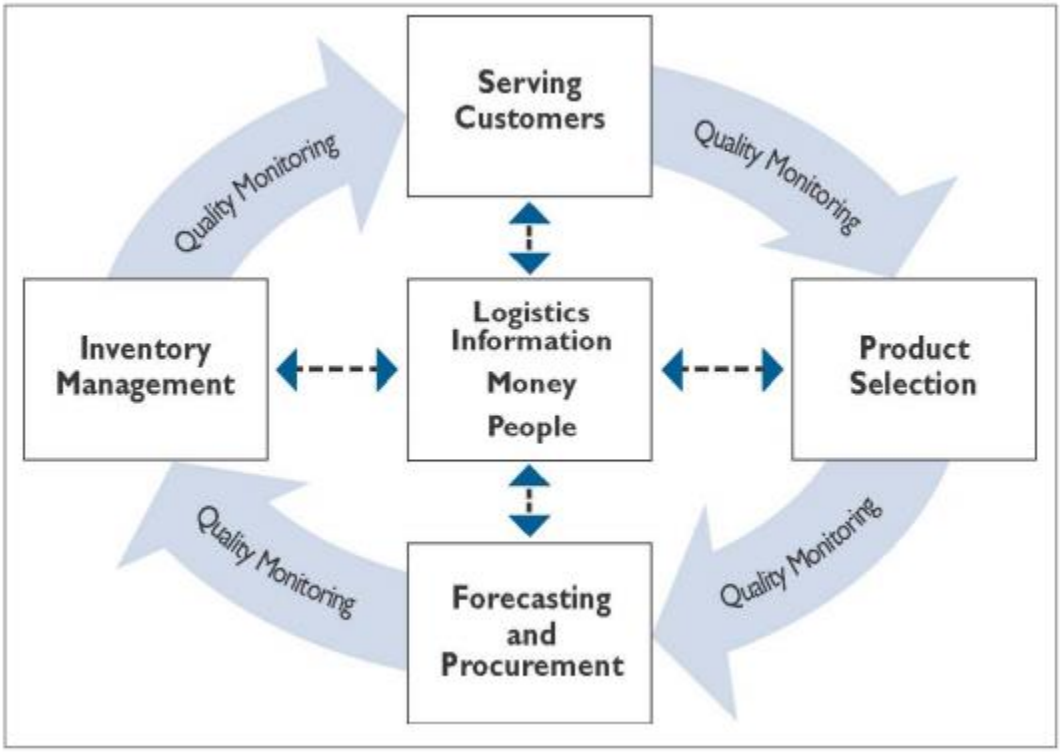


Figure-2.1. Pharmaceutical Supply Management Cycle

**Product Selection**

The basic goal of product selection is to select the most effective and cost-efficient commodities to meet the goals of the program. When commodities are selected, a number of factors need to be taken into consideration. This includes Inclusion of the commodity in protocols and standards, Storage requirements, such as cold chain, and capacity to maintain the commodities, Ease of use of the commodity, Packaging of the commodities to facilitate distribution, Shelf life and Compatibility with existing instrumentation (durables) (Logistic handbook, 2009)

The other most important consideration that needs to be taken in the selection of Laboratory Equipment is whether the instrument is part of a closed or open system. Closed systems are laboratory instruments that require specific brands of reagents, while open systems do not. Closed

systems may create a dependence on a single source of supply, but they often ensure a higher level of reagent quality. (Logistic handbook, 2009) In Ethiopia, all health facilities expected to develop their facility specific laboratory commodity list (PFSA, 2016).

**Quantification**

After products have been selected, the required quantity and cost of each product must be determined. Quantification is the process of estimating the quantity and cost of the products required for a specific health program (or service), and, to ensure an uninterrupted supply for the program, determining when the products should be procured and distributed (JSI, 2011).

Quantification is the forecasting future demand for laboratory commodities and calculating the quantities to procure while taking into account service capacity, supply chain capacity, and resources available are important parts of ensuring the availability of laboratory commodities. (Logistic handbook, 2009)

**Procurement**

After a supply plan has been developed as part of the quantification process, quantities of products must be procured. Health systems or programs can procure from international, regional, or local sources of supply; or they can use a procurement agent for this logistics activity. Moreover, following a set of specific procedures that ensure an open and transparent process that can support six rights is mandatory for procurement process. (JSI, 2011) Program laboratory commodities procured by EPSA centrally and distribute for facilities based on their needs. Health facilities should procure budget drugs preferentially through EPSA, products that are not found at EPSA can be procured from private suppliers using stock out certificate.

**Inventory Management**

The continuous supply of laboratory commodities can be guaranteed only through the selection, design, and proper implementation of an appropriate inventory control system. A number of strategies or inventory control systems can be adopted to manage commodities of any kind. If sufficient commodity supplies are ensured, a max-min inventory control system is recommended. (Logistic handbook, 2009)

The decision to hold inventory provides organizations with a means to balance supply and demand. The purpose of an inventory control system is to inform personnel when and how much of laboratory commodities to order and to maintain an appropriate stock level to meet the needs of patients.

**Storage and Distribution**

The purpose of a storage and distribution system is to ensure the physical integrity and safety of commodities and their packaging as they move from the central storage facility to peripheral laboratories. A sound storage and distribution system will help ensure that commodities reach the laboratory in usable condition. Having proper storage procedures in storage facilities can help to ensure issuance of only high quality commodities and this can helps for little or no loss caused by damaged or expired products. (Logistic handbook, 2009)

Although the major focus in storage and distribution is on the commodities being moved, the packaging of the commodities should be considered as well. The packaging provides the primary protection to the commodity during storage and transportation, so the quality of the packaging should be specified during procurement. In Ethiopia, EPSA is mandated to delivery program and budget laboratory commodities to health facilities based on their requisites.

**Logistics Management Information System (LMIS)**

An LMIS collects data about the supply and demand for commodities and these are most often used for routine operations, such as ordering and replenishing supplies for health facilities. The purpose of a Logistics Management Information System (LMIS) is to collect, organize, and report information to other levels in the system in order to make decisions that govern the logistics system and ensure that all six rights. A well-designed logistics management information system will include records and forms that collect and report the three essential data items (stock on hand, consumption and loss/adjustment) as they relate to store in inventory, moved between facilities, and used to provide health services to patients (PFSA, 2013).

## 2.2. Empirical Review

**Product Selection**: A study done in Kenya showed, the significance of national standardization that can reduce the total Laboratory Commodities in the system. For instance according to the study conducted the total number of laboratory commodities reduced from over 3,000 varieties to fewer than 300 without compromising the quality of care given in the health facilities. (Peter et al., 2009) whereas most countries like Lesotho (Pharasi, 2007) and Angola ( Kagoma, C. and W. Goredema, 2011) are suffering from non-standardized laboratory commodities list in their laboratory.

Similarly, Ethiopia has not yet a standardized list of analyzers, test menu, and test technique nationally. The selection of laboratory commodities and analyzers is the mandate of EPSA and Ethiopian Public Health Institute (EPHI), respectively. As part of its transformation and improving product availability at the health facility level, EPSA has predefined 178 essential Laboratory Commodities nationally (PFSA, 2018).

**Quantification**: According to PSTP II final report quantification in EPSA is often based on ordinary non-database tools (Excel spreadsheets) and standalone PCs that carry a high risk of data loss. An assessment on the quantification process conducted by consultants from SmartChain revealed that the annual quantification exercise by EPSA is a labor intensive, expensive, and bottom-up process that takes more than 6 months to generate a forecast. (PSTP II, 2020)

The assumptions to quantify program laboratory commodities based on guidelines and strategic plan are morbidity, laboratory analyzers throughput capacity, analyzer functionality rate, wastage rate and training, and number of working days in the year (Federal Ministry of Health, Pharmaceuticals Fund and Supply Agency, HIV/AIDS Prevention and Control office, Ethiopian Public Health Institute, 2017).

Similarly an assessment in Angola show that there is no system yet to quantify laboratory supplies based on what consumed in the country, which contributes to recurrent stock-outs of critical reagents and other supplies. The process of quantification and procurement didn't involve laboratory personnel which have skills to effectively manage laboratory commodities that can lead to not quantifying current and future laboratory needs to adequately support the country's health care needs. (Kagoma, C. and W. Goredema, 2011)

**Procurement**: The procurement process begins with selection, forecasting and quantification of product requirements. It includes the development of exacting product specifications, identification of financing, and a budget process to secure funding. (USAID|Deliver, 2006).

A study done by Seifu. (2020) at EPSA found that, Ethiopia have done a country wide assessment of the pharmaceuticals supply management system to document the challenges faced in the procurement, storage and distribution of pharmaceuticals and health commodities. The assessment revealed that long procurement lead times, inadequate storage infrastructure, and unsystematic distribution practices were major constraints to pharmaceuticals supply management system in the country.

In Ethiopia, EPSA is a sole agent in quantifying and procuring program and budget based health commodities including Laboratory Commodities annually (PFSA, 2018). Most recently, in 2018, a three years contract agreement is done with suppliers for providing closed system hematology and clinical chemistry reagents with service maintenance for quantified commodities.

**Inventory Management:** A study done in Ghana, only 25% of inventory managers update their stock weekly, while 43.75% quarterly. 47.64% of inventory managers use economic order quantity to keep optimal level of inventory (Annor, 2012).

Other cross-sectional study conducted in Amhara Region, Ethiopia, in 2014 show that thirty-three (40.2%) health centers were under-stocked for at least one of the critical items for tuberculosis diagnosis at the time of visit.

The reviewed literatures show that efficient Laboratory commodities inventory management is important for health facilities to achieve their establishment objectives that are provision of health services to the large community.

**Storage and Distribution**: In Lesotho, due to storage space is inadequate and poorly ventilated (Pharasi, 2007), reagents are not stored according to the First Expiring First Out (FEFO) practice; also there were no cupboards for flammable reagents.

The distribution includes storage, inventory management, transport, and reordering. These functions are essential in getting the health commodities down to the service delivery points (SDPs) and ultimately to the consumers (Raja and Mohammad, 2004).

**Logistics Management Information System (LMIS):** Laboratory commodities logistics is a severe problem in developing countries.

A study done in Uganda for health facility survey for laboratory logistics system showed that, many staff members were not trained for LMIS and no standardized LMIS forms in the health facility. (Ifeanyi and Abum, 2018)

In 2007, a Logistics Management Information System (LMIS) was introduced by the Ethiopian Federal Ministry of Health to manage the distribution and stock control of laboratory reagents and consumables in the country (Alemayehu Nigatu, Hany Abdallah, Francis Aboagye-Nyame, Tsehaynesh Messele, Tsegaye KidaneMariam, Gonfa Ayana, 2009).

## 2.3. Identified Gaps

Most of the papers done on supply chain management of laboratory commodities focused on specified program such as Human Immuno-deficiency Virus (HIV), Tuberculosis (TB) or Malaria program (Azeb, 2017; Taddesse, 2015) but this study was tried to identify major challenges in the supply chain managements of laboratory commodities in to consideration of current logistics practices of laboratory commodity management in EPSA.

## 2.4. Conceptual Frameworks

As indicated on the logistics cycle, it provides a clear guideline on the functions needed to manage health commodities like that of laboratory commodities.

This study was organized to investigate logistics related problems faced in EPSA particularly focusing on the laboratory commodities.

In each logistics cycle failure to follow the steps can cause service interruption in the overall health system and leads to frequent stock out.

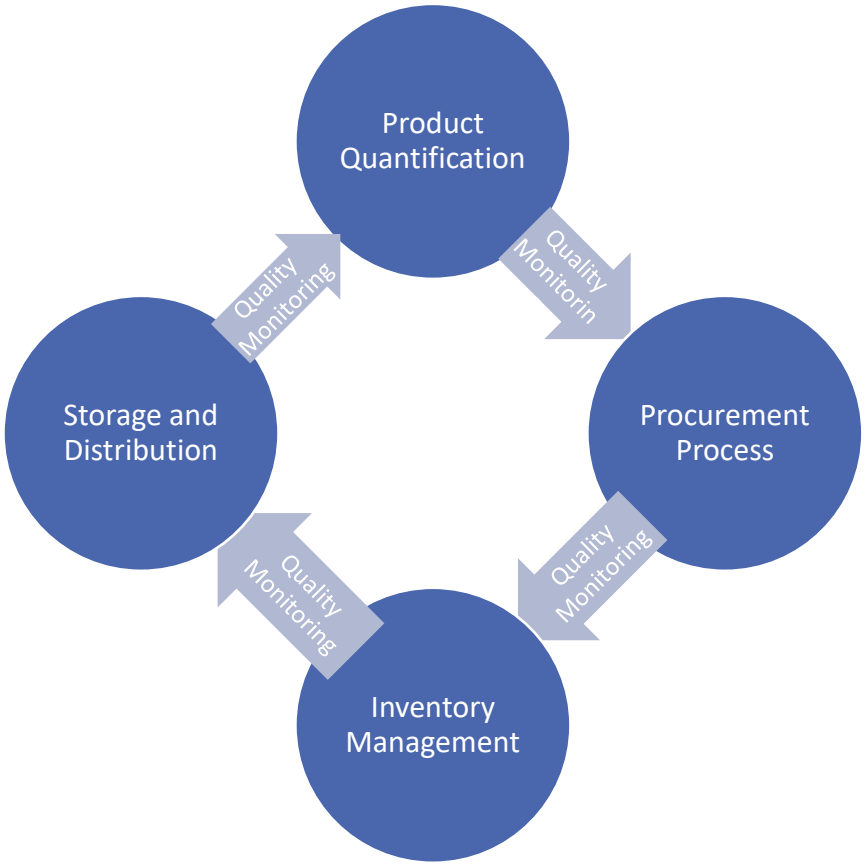


Figure 2.2. Conceptual framework

# CHAPTER THREE
# RESEARCH METHODOLOGY

In this chapter, the researcher was describing the methodology. It describes the study area, research approach, research design, population and sampling technique, data collection procedure, data analysis and its interpretation.

## 3.1. Description of the Study Area

The study was conducted at Ethiopian Pharmaceutical Supply Agency (EPSA) Head Office.

It was formerly known as Pharmaceuticals Fund and Supply Agency (PFSA), is a governmental pharmaceuticals procurement and supply agency established by proclamation number 553/2007. It is located in Addis Ababa that found in Addis Ketema Sub city Arbegnoch Street in front of St Paulo's Hospital. It is established to supply quality assured pharmaceuticals and Laboratory Commodities at affordable prices in a sustainable manner to all public health institutions in the country.

Its mission is to supply quality assured pharmaceuticals to public health facilities at an affordable price in a sustainable manner. The Agency is responsible for the public sector's healthcare supply chain and all its key functions, including forecasting, procurement, warehousing, and distribution of medicines, medical supplies, diagnostic chemicals and reagents and medical equipment. Today, its activities constitute an annual turnover of almost USD 1 billion.(PSTP II, 2020).

## 3.2. Research Approach

Mixed research approach, qualitative and quantitative approach were used. The main objective of this approach was to provide a better understanding of research questions in which it can address challenges of supply chain management of Laboratory commodities in EPSA.

The reason why mixed type of approach was implemented due to the fact that, quantitative approach may cause bias in reliability of findings because of the nature of research problem, non-representativeness of sample or the nature of questionnaires that predicts clue.

On the other hand, Qualitative techniques can increase a research's depth of understanding of the phenomenon under investigation in which it is exploratory and flexible in nature to identify problems that are affected by human behaviour.

The core assumption of this approach (mixed type) was to provide a complete understanding of research problem i.e. assessing challenges of supply chain managements of laboratory commodities, than either approach alone (Samuel, 2017).

Therefore, this study employed mixed research approach to complement one another and gather reliable information to draw representative outcome and conclusion.

## 3.3. Research Design

A descriptive, cross sectional research design was used to address the raised research objectives and to answer the research questions. This research design is important to have a proper understanding of what a research problem is about before investigating why it exists in the first place. Accordingly, the researcher chosen this research design to describe the nature, condition and the present situation of supply chain practices of Laboratory commodities management.

## 3.4. Unit of Analysis

The unit of analysis on this study was Ethiopian Pharmaceuticals Supply Agency (EPSA), in which specifically concerned with the operational departments of TMD, CMD, QMSD & WIM found in EPSA.

## 3.5. Population and Sample

The sample size for this study was determined by using a purposive sampling method. The reason for using Purposive-sampling method was, it could allow focusing on experts who have more experience and know about, or have insights into the research area. In such sampling method, a researcher tries to create a representative sample by considering all populations as a study population like census.

The study population of this study established from all employees who works on supply chain management of laboratory commodities at QMSD, TMD, CMD and WIM departments of the Agency. The employees who are working on supply chain managements of Laboratory commodities were mainly found in the aforementioned directorates. All the target population was included in sample size for getting reliable information about the challenges of supply chain managements of Laboratory commodities. Based on this assumption, there are 35 professionals in these departments. Of these, all the professionals (35) were included in the study due to the smallness of the study population.

Accordingly, a total of 35 questionnaires were distributed to the selected respondents who are laboratory professionals and pharmacists, who have insights into the challenges of laboratory commodities management through out EPSA's operational activities. These respondents are experts who have been managing Laboratory commodities at different departments of EPSA

namely in TMD, CMD, QMSD & WIM.

Out of these 31 of them were filled and returned. Four of them not returned due to the absence of the staffs for fieldwork. In addition, qualitative data was collected from three participants (one director and two team leaders/ experts) by using semi structured interview guideline.

## 3.6. Data Sources and Types

Both primary and secondary data types were used in this study. The primary data can be gathered from the respondents by using questionnaires and interview questions as key instruments designed and administered to the respondents.

The secondary data were collected from the related literatures and journals written on the subject matter and from the related researches conducted previously which are useful to collect essential data to enrich the study.

## 3.7. Data Collection Procedures

Primary data were collected using interview schedules and questionnaires as the key instruments designed and administered to the respondents. Interviewing some selected experts (including Directors and coordinators of different departments) from the selected sample members were included. The reason for the choice of personal interview is that it is flexible and adaptable in controlling the response situation of the respondent. Interviews can probe deeply into respondents inner experiences by following up with questions to obtain more information and clarify vague responses.

On the other hand, questionnaire were administered to the sampled groups. The questionnaire was made up of both closed-ended questions that present the respondents with a fixed set of options, and open-ended questions, which encourage them to share as much information as possible.

## 3.8. Validity and Reliability of the study

**Validity** is concerned with the accuracy and truthfulness of scientific findings. A valid study should demonstrate what actually exists and a valid instrument or measure should actually measure what it is supposed to measure (Brink, 1993). To achieve the validity of the study, the instrument applied (questionnaires) is derived from related subject matter literatures, USAID Deliver projects, the previously studied researches from Azeb, 2017; Fasil, 2019.

**Reliability** is concerned with the consistency, stability and repeatability of the informant's accounts as well as the investigators' ability to collect and record information accurately. It refers

to the ability of a research method to yield consistently the same results over repeated testing periods. It requires that a researcher using the same or comparable methods obtained the same or comparable results every time he uses the methods on the same or comparable subjects (Brink, 1993). To test the reliability of the questions in the questionnaire, three pre-test questionnaires were distributed and data collected. Accordingly, redundant, unnecessary and outlier questions were removed and reversed.

## 3.9. Ethical Consideration

Prior to launching the study, permission were asked from EPSA management and other department directorates who were included in the study. During data collection, interviewers or respondents would be communicated the purpose, scope, and expected outcome of the study. Any respondent not interested in participating in the survey can decline; during the interview, if the respondent does not want to answer specific questions or discontinue the interview, they can. All data would be anonymous; no individual/respondent were not identified in any reports or any publication based on this study.

## 3.10. Data Analysis

The collected data were checked initially to detect for any errors to ensure consistency and completeness. After the data checked, it was coded, entered and analyzed by the use of IBM Statistical Package for the Social Sciences (SPSS) version 20. Study results were also presented by using descriptive statics (mean, standard deviation, proportion, percentage, and frequency), and tables.

The data gathered for qualitative study were organized and analyzed on the word. Later, thematic analysis were also implemented to identify the recurrent credible challenges related with laboratory commodity management in EPSA.

# CHAPTER FOUR
# RESULT AND DISCUSSION

## 4.1 Introduction

This chapter presented the data presentation, analysis, and interpretation of key findings and discussing against other literature obtained information.

The analysis was performed in relation to the objectives for this study; however, other relevant details were also added for better presentation of findings. A total of 35 employees were selected to acquire their response. Among these, 31 were collected and analyzed on SPSS 20. Thus, the response rate was 88.57%.

Accordingly, respondents were asked to rate their opinion about challenges faced related to Laboratory Commodities Management practices of the agency. Under each section, respondents were asked a group of questions to indicate their level of agreement by using Likert scale ranging from l (strongly agree) to 5 (strongly disagree). Moreover, open-ended questions were delivered to the respondents to get their most prevalent challenges related to challenges of laboratory commodities management in the agency. Hence, respondents indicated their level of agreement for each corresponding statement by using a 5-point Likert scale where 1, 2, 3, 4, and 5 represented strongly agree(SA), agree(A), neutral(N), disagree(DA), and strongly disagree(SD) respectively. Accordingly, the responses were presented in form of frequencies, percentage, mean and standard deviation.

Qualitative date was also collected from the respondents to deeply understand problems faced in the agency and relate with the findings gathered from quantitative information. Interview questions were used to collect data regarding the assessment of challenges of Supply Chain Management of Laboratory Commodities in EPSA. In this section of the questionnaires, the researcher wants to briefly look at the insight of department managers and expertise to explicitly address the challenges faced related to Laboratory commodities management.

The results of this study organized as follows:

## 4.2 Socio demographic information of the respondents

This part of the questionnaire contains of the general socio demographic information of respondents related to the personal and professional data of the respondents and summarized in the below Table 4.1. These variables from the respondents includes: Sex, educational qualification, current department working in and years of experience in EPSA.

Table 4.1. Summary of socio demographic information

| Variables | Category | Frequency | Percent |
|---|---|---|---|
| Sex | Male | 22 | 71 |
| | Female | 9 | 29 |
| | Total | 31 | 100 |
| Educational qualification | Bachelor degree | 22 | 71 |
| | Masters degree | 9 | 29 |
| | Total | 31 | 100 |
| Work experience in EPSA | Less than two years | 1 | 3.2 |
| | 2- 5years | 17 | 54.8 |
| | 5-10 years | 12 | 38.7 |
| | more than 10 years | 1 | 3.2 |
| | Total | 31 | 100 |
| Current department working in | QMSD | 5 | 16.1 |
| | TMD | 14 | 45.2 |
| | CMD | 4 | 12.9 |
| | WIM | 6 | 19.4 |
| | Others | 2 | 6.5 |
| | Total | 31 | 100 |

Source: own survey, 2021

As shown on the above table 4.1, the majority of the respondents (71%) were male and the remaining 29 % were female. With respect to the educational qualification, the majority of the respondents of EPSA were bachelor (first-degree) holders, accounting 71% of the staffs. On the other hand, 29% were master's degree holders. This implied that majority of EPSA staffs working

on the technical areas are first degree or master's degree holders that may in turn has a positive effect on Laboratory commodity management if they are properly trained and motivated.

The study also investigated that 54.8% of respondents had a work experience of 2-5 years, and the second majority had the experience of 5-10 years of service in the agency, the rest 3.2 % of the respondent had the experience of less than two years and more than ten years respectively.

Concerning the Current department working in, 45.2% of the respondents had worked in TMD, 19.4% were working in WIM, 16.1% of the respondents had worked in QMSD, 12.9% were working in CMD and the remaining 6.5% of the respondents are from the supportive staffs who are seconded staffs to EPSA.

## 4.3. The challenges of Quantification activities of EPSA

As it were noted from table 4.2. Below, 64.5% respondents agreed on the quantification process that the focus of EPSA is on vital and essential laboratory items. 25.8% of the respondents also rated strongly agreed on the statement.

Table 4.2. Challenges of Quantification activities

| SN | Problems faced on Quantification activities | SA (F/%) | A (F/%) | N (F/%) | DA (F/%) | SD (F/%) | Mean | SD |
|---|---|---|---|---|---|---|---|---|
| 1 | Quantification process in EPSA mainly focuses on vital and essential lab items. | 8(25.8) | 20(64.5) | 1(3.2) | 1(3.2) | 1(3.2) | 1.94 | 0.854 |
| 2 | EPSA quantify lab commodities regularly | 11(35.5) | 12(38.7) | 6(19.4) | 2(6.5) | 0(0) | 1.97 | 0.912 |
| 3 | During the quantification process, there is a participation of lab staffs. | 10(32.3) | 17(54.8) | 3(9.7) | 1(3.2) | 0(0) | 1.84 | 0.735 |
| 4 | Quantification error (improper quantification) is the cause for frequent stock out in EPSA | 13(41.9) | 13(41.9) | 2(6.5) | 2(6.5) | 1(3.2) | 1.87 | 1.024 |
| 5 | Laboratory commodities are quantified by professionals who has limited skills and knowledge | 2(6.5) | 11(35.5) | 8(25.8) | 8(25.8) | 2(6.5) | 2.9 | 1.076 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 6 | EPSA has a continues follow up on stock status of lab commodities | 3(9.7) | 1(3.2) | 8(25.8) | 7(22.6) | 12(38.7) | 2.71 | 1.039 |
| **Grand Mean =** | | | | | | | **2.205** | |

Source: own survey, 2021

Most of the respondents (41.9%) were strongly agreed and again (41.9%) were agreed on the point that the cause of frequent stock out in EPSA is quantification error (improper quantification). Only one respondent (3.2%) disagreed on the stated point. This indicated that the agency faced frequent stock out due to quantification error.

35.5% of the respondents confirmed that professionals who has limited skills and knowledge quantify laboratory commodities. This may cause improper quantification and lead to frequent stock out.

From the above table 4.2, out of the total number of the respondents, 38.7% strongly disagreed and 22.6% of them disagreed on the sixth questions. Nevertheless, 25.8% of respondents were neutral on the same point. This showed that most of the respondents did not agree on the point that the agency had continues follow up on stock status of lab commodities**.**

As per the response of the interviewee, Poor data visibility that found in health facility as well in the agency were the major problem faced in the agency related with quantification. In addition, the interviewee explicitly elucidated that lack of participating concerned stockholders whether internal or external were the major factor for the existence of frequent quantification error in the agency. Because it were quantified in wrong way by using poor data, it will result on the expiry of the remaining laboratory commodities of package items.

Gaps related with the technical skill of the professionals were another challenge discussed with the interviewee in which had a potential to cause stock out or over stock of laboratory commodities. For instance, a rapid spread of the current pandemic COVID were one of the reason for the occurrence of stock outs of vital and essential laboratory commodities in the agency.

The participants also emphasized on problems related with data visibility were the other main issue that they encountered in their day-to-day activities. Thus, this can cause a major problem especially on short shelf life laboratory commodities. Moreover, there is a gap on usage of package system

for some selected laboratory commodities. i.e in order to perform one test in a laboratory, there were a requirement to bring all items in the package. However, the respondents explained that there were a gap regarding package starting from quantification in Health facility to the agency procurement process, then after to the distribution of procured items.

In addition, participants reflected that there were a knowledge gap on complete proportion of the reagents that to perform one test.

## 4.4. Problems faced on Procurement activities of EPSA

Table 4.3. Problems faced on Procurement activities

| SN | Problems faced on Procurement activities | SA (F/%) | A (F/%) | N (F/%) | DA (F/%) | SD (F/%) | Mean | SD |
|---|---|---|---|---|---|---|---|---|
| 1 | EPSA has enough hard currency to procure and avail all lab commodities. | 1(3.2) | 4(12.9) | 5(16.1) | 16(51.6) | 5(16.1) | 3.65 | 1.018 |
| 2 | EPSA has established a frame work agreement for a selected lab commodities. | 8(25.8) | 19(61.3) | 4(12.9) | 0(0) | 0(0) | 1.87 | 0.619 |
| 3 | Does EPSA benefited from Framework procurement | 10(32.3) | 11(35.5) | 8(25.8) | 2(6.5) | 0(0) | 2.06 | 0.929 |
| 4 | EPSA Procurement list for lab commodities cover all critical items | 2(6.5) | 11(35.5) | 11(35.5) | 6(19.4) | 1(3.2) | 2.77 | 0.956 |
| 5 | The procurement process finished with in the specified lead time period./ products delivered as per the required delivery schedule | 2(6.5) | 4(12.9) | 3(9.7) | 18(58.1) | 4(12.9) | 3.58 | 1.089 |
| 6 | Most of the laboratory reagents are procured from Single source (they are closed system). | 8(25.8) | 11(35.5) | 8(25.8) | 4(12.9) | 0(0) | 2.26 | 0.999 |
| 7 | EPSA procures full package(all consumables to do the test) of lab commodities | 2(6.5) | 6(19.4) | 0(0) | 13(41.9) | 10(32.3) | 2.65 | 0.877 |
| **Grand Mean =** | | | | | | | **2.69** | |

Source: own survey, 2021

Majority of respondents (51.6%) believed that EPSA had no enough hard currency to procure and avail all lab commodities. In contrary, (61.3%) of the respondents were agreed on the establishment of framework agreement for a selected lab commodities. In addition, most of the respondents (35.5%) believed that Procurement list for lab commodities cover all critical items.

From the total number of participants, (58.1%) of them disagreed on point that the procurement process cannot be finished with in the specified lead-time and this resulted a delay on delivery of products as per the required delivery schedule. The remaining respondents said strongly disagree and neutral with rate of 12.9% and 9.7% respectively.

Regarding the closed system procured laboratory commodities, most of the respondents (35.5%) were agreed and (25.8%) of the respondents strongly agreed on most of the laboratory reagents are procured from Single source. This indicated that the agency would face frequent stock out due to dependency of single source suppliers for closed system laboratory commodities.

On the full package of Laboratory Commodities procurement, most of them (41.9%) disagreed and (32.3%) of the respondents were strongly disagreed that the agency did not procure full package list of products to run a test.

According to the respondents, although Framework agreement and Placement project solved the problems towards frequent occurrence of stock outs, still the agency is facing challenges like: refusal of suppliers in framework agreement to supply the items on time, occurrence of unexpected Pandemics like COVID, shortage of Hard currency.

The participants also reflected strongly about frequent market price fluctuation in which suppliers in the framework agreement were not interested to supply with fixed price. The agency were also planning to perform price adjustment but there were no approved price index for budgetary Laboratory commodities.in addition, there is no legal ground that can permit a price change once it were fixed price.

As per interviewees' information, shortage of hard currency were one of the major problem related with procurement process of Laboratory commodities. This will result on prioritizing of vital items and can cause a shortage of products on the unselected commodities.

The other big issues addressed by the interviewee's were long lead time taken to finalize procurement process in line with the participation of external stockholders like Ethiopian Food and Drug Authority (EFDA) for purchase order approval for international procurements.

According to the respondents regarding Laboratory commodities management especially for those closed system reagents, there were supplier limitedness. Hence, the supplier had the upper hand and usually they were not responsive concerning fulfillment of shipping documents in customs process.

In addition, the respondents explained about supplier's side challenges that they were not responsive regarding submission of clear documents as per requirement. Incorrect shipping document and having so many partial shipment were other problems of the agency that can hinder the supply chain activities. The collective effect of these challenges made Laboratory commodities management of the agency very difficult and can cause frequent stock outs of lab commodities.

## 4.5. Inventory Management Challenges

From the table 4.4 below, Most of the respondent (48.4%) perceived that there is a standard guideline (SOP) on how to handle laboratory commodities in the warehouse. whereas 48.4% of the respondents were disagreed on management of short shelf life products effectively.

On the other hand, about (45.2%) respondents were disagreed that the agency can supply all consumables of lab commodities with full package. Above half of the respondents believe that the agency can manage properly freeze items. This indicates that the existence of cold chain rooms recently.

About 29% of the respondents were disagreed on the point that the agency can monitor short shelf life lab commodities with a system.

Related to inventory management of vital and essential laboratory commodities according to their stock value, (54.8%) of respondents were agreed and (16.1%) were disagreed ones.

Equal number of respondents (25.8%) were agreed and disagreed on the proper identification and segregation of expired, damaged and obsolete inventories. Similarly, the study conducted in Ghana showed that expired products were segregated from the functional laboratory commodities and related supplies but were not removed and disposed on time. Therefore, this may cause inventory cost to the agency (Addo et al., 2006)

Table 4.4. Inventory Management Challenges

| SN | Inventory Management Challenges | SA (F/%) | A (F/%) | N (F/%) | DA (F/%) | SD (F/%) | Mean | SD |
|---|---|---|---|---|---|---|---|---|
| 1 | There is a standard guideline (SOP) on how to handle laboratory commodities in the warehouse. | 3(9.7) | 15(48.4) | 6(19.4) | 6(19.4) | 1(3.2) | 2.58 | 1.025 |
| 2 | EPSA can manage short shelf life products effectively. | 1(3.2) | 5(16.1) | 6(19.4) | 15(48.4) | 4(12.9) | 3.52 | 1.029 |
| 3 | EPSA can supply all consumables of lab commodities with full package. | 9(29.0) | 6(19.4) | 0(0) | 14(45.2) | 2(6.5) | 3.29 | 0.973 |
| 4 | EPSA can manage properly freeze items. | 2(6.5) | 17(54.8) | 8(25.8) | 4(12.9) | 0(0) | 2.45 | 0.81 |
| 5 | Accurate records provide the management with an information which is used to ensure accountability at EPSA | 5(16.1) | 13(41.9) | 10(32.3) | 3(9.7) | 0(0) | 2.35 | 0.877 |
| 6 | Accuracy of inventory records is necessary to provide satisfied customer service at EPSA. | 11(35.5) | 14(45.2) | 4(12.9) | 2(6.5) | 0(0) | 1.9 | 0.87 |
| 7 | EPSA has a system to monitor short shelf life lab commodities. | 2(6.5) | 8(25.8) | 8(25.8) | 9(29.0) | 4(12.9) | 3.16 | 1.157 |
| 8 | EPSA gives priority for inventory management of vital and essential laboratory commodities according to their stock value. | 6(19.4) | 17(54.8) | 3(9.7) | 5(16.1) | 0(0) | 2.23 | 0.956 |
| 9 | In EPSA expired, damaged and obsolete inventories are properly identified and segregated. | 2(6.5) | 8(25.8) | 12(38.7) | 8(25.8) | 1(3.2) | 2.94 | 0.964 |
| **Grand Mean =** | | | | | | | **2.71** | |

Source: own survey, 2021

According to the respondents, there were no separate warehouse for laboratory commodities management. Thus, in line for to short shelf life nature of some reagents like controls and calibrators, there may be a missing of some items during distribution process because of failures to manage lab commodities in separate warehouse.

The interviewee also said that, Knowledge gaps on personnel's who manage lab commodities were the other problem faced in inventory management. Related to HCMIS connection problems and failure to regularly registering on system were the other challenges addressed by the respondents.

On the other hand, as per the respondents replied as strengths the agency were on process of separating warehouse only for laboratory commodities but still the problem persists during bulk shipments.

Usually from contract management side, immediate action were taken for lab commodities especially for Viral load reagents and controls to clear from ports as soon as possible. Unfortunately, there may be a delay due to so many problems and can cause expiry of products.

Moreover, the main problem faced were on end-to-end supply chain management. There is a gap on participation of Laboratory professionals in different departments of the agency. In adding to that, there were a coordination problem on information sharing among the departments in the agency.

## 4.6. Storage and distribution Practice

Table 4.5. Storage and distribution Practice

| SN | Storage and distribution Practice | SA (F/%) | A (F/%) | N (F/%) | DA (F/%) | SD (F/%) | Mean | SD |
|---|---|---|---|---|---|---|---|---|
| 1 | EPSA has effective storage and distribution practice. | 3(9.7) | 17(54.8) | 4(12.9) | 6(19.4) | 1(3.2) | 2.52 | 1.029 |
| 2 | EPSA has SOP for Laboratory commodities storage and management | 4(12.9) | 13(41.9) | 0(0) | 3(9.7) | 11(35.5) | 2.42 | 0.848 |
| 3 | EPSA has sufficient warehouse to accommodate room temperature required laboratory commodities | 5(16.1) | 1(3.2) | 7(22.6) | 8(25.8) | 10(32.3) | 2.68 | 1.137 |
| 4 | EPSA has adequate cold chain (2-80C) warehouses for laboratory commodities. | 5(16.1) | 15(48.4) | 7(22.6) | 4(12.9) | 0(0) | 2.32 | 0.909 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 5 | I have received a complaint from health facilities due to improper storage of laboratory commodities in EPSA. | 9(29.0) | 15(48.4) | 2(6.5) | 5(16.1) | 0(0) | 2.55 | 0.85 |
| 6 | The stores in EPSA are suitable for laboratory commodity management. | 3(9.7) | 1(3.2) | 10(32.3) | 8(25.8) | 9(29.0) | 2.84 | 1.036 |
| 7 | EPSA follow FEFO (First Expiry First Out) practice during distribution. | 8(25.8) | 18(58.1) | 2(6.5) | 3(9.7) | 0(0) | 2 | 0.856 |
| 8 | EPSA always distribute full package kits to health facilities | 3(9.7) | 4(12.9) | 6(19.4) | 10(32.3) | 8(25.8) | 3.13 | 1.231 |
| **Grand Mean =** | | | | | | | **2.55** | |

From the above table 4.5, (54.8%) of the respondents were agreed on effective storage and distribution practice of the laboratory commodities in EPSA. Whereas, (19.4%) of the respondent disagreed on the same point.

Although EPSA had SOP for Laboratory commodities storage and management, (35.5%) of them were responded strongly disagree about its accessibility. Whereas (41.9%) of the respondents were agreed with the existence of the SOP. This implies that the existence of SOP by itself could not make a difference for storage and management practice in the agency. There should be a real repetition of the activities on ground according to the SOP directions.

25.8% of the respondents were disagreed and 32.3% were strongly disagreed on the third question that the agency has sufficient warehouse to accommodate room temperature required laboratory commodities.

On the fifth question, more than half of the respondents (48.4% agreed and 29% strongly agreed) confirmed that they receive a complaint from health facilities due to improper storage of laboratory commodities in EPSA.

A great number of respondent, which is (25.8% and 29%) were disagreed and strongly disagreed respectively, that the agency's stores are suitable for laboratory commodities management. While 32.3% of the respondents were not sure that, the stores are suitable for laboratory commodities.

About distribution of full package laboratory kits to the health facilities, 32.3% of the respondents said disagree, 25.8% said strongly disagree. Whereas 19.4% of the respondents were not aware of full package distribution practice in the agency.

As per the respondent's comments on storage of laboratory commodities, although there were an improved way of storage of cold items in cold chain as compared to the last two years, they still confirmed that there is a shortage of cold chain for Laboratory commodities. Furthermore, there were a shortage of space for ambient temperature commodities and the temperature of the warehouse were not monitored regularly.

Separation of crude chemicals in the warehouse is mandatory as Corrosive, flammable, explosive, whereas there were a gap faced as per the respondent's confirmation to identify/ assign separate zone from the other items.

According to the respondent's confirmation, the other main challenge of storage and distribution were the existence of scattered warehouse. Thus, laboratory reagents by its very nature they require to be stored and distributed as a kit (not individually). Accordingly, this can cause expiry of short shelf life items from the remaining ambient temperature ones. In addition, the interviewee also confirmed that some cold chain items were transported by vaccine carrier/cold chain in which it is against the standard and may cause a damage of reagents before it reached to the health facilities. The collective effect of these challenges made the laboratory commodities management difficult, this eventually fail to avail the required products at the right time and place to the health facilities.

Moreover, respondents explained that the expiry on one reagent/laboratory supplies could cause a damage in the next shipped laboratory regent because they were consumed simultaneously.

Regarding the management process interviewees said that, there were awareness problem that caused due to poor data management in which can cause expiry of those short shelf life supplies.

## 4.7. Most frequently prevalent challenges of supply chain management of Laboratory commodities.

Most of the respondents replied to the challenges faced regarding supply chain management of laboratory commodities seeking to ensure efficient laboratory commodities management in the

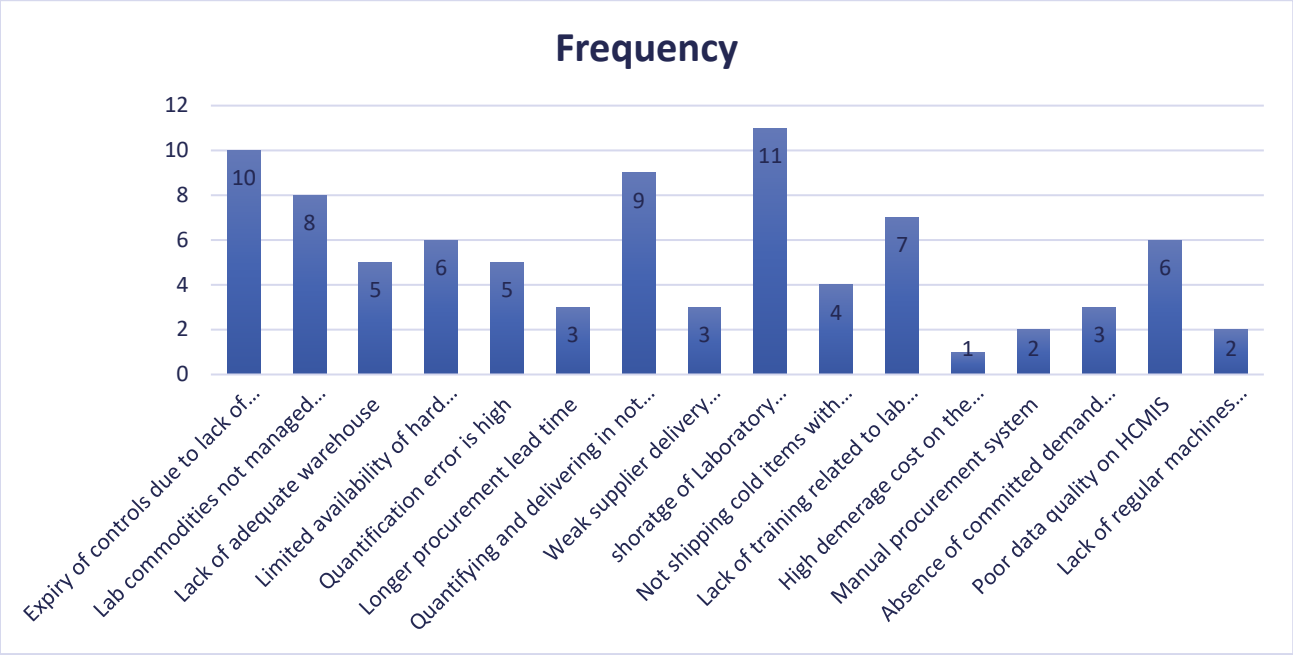


Figure 4.1. Challenges faced on laboratory commodities management

From the figure 4.1 above, the respondents said that the 11(40.74%) were the most frequently mentioned challenge in which shortage of lab professional in the agency. The second highest number of the respondents 10(37.04%) replied that there is high expiry of controls due to lack of well-organized procurement and supply plan.

9(33.33%) of the total respondents' responded quantifying and delivering in not full package of lab commodities as one of the most prevalent challenges of the agency. The fourth highest number of respondents 8(29.63%) confirmed that Lab commodities not managed by professionals at all level in the agency was one of the most prevailing lab commodity management challenges. Lack of training related to lab items management was responded by 7(25.93%) of the respondents as one of the most lab commodity management challenges in the agency. Lastly, only one respondent that accounts (3.7%) said that High demurrage cost on the agency was one of the challenges of the agency.

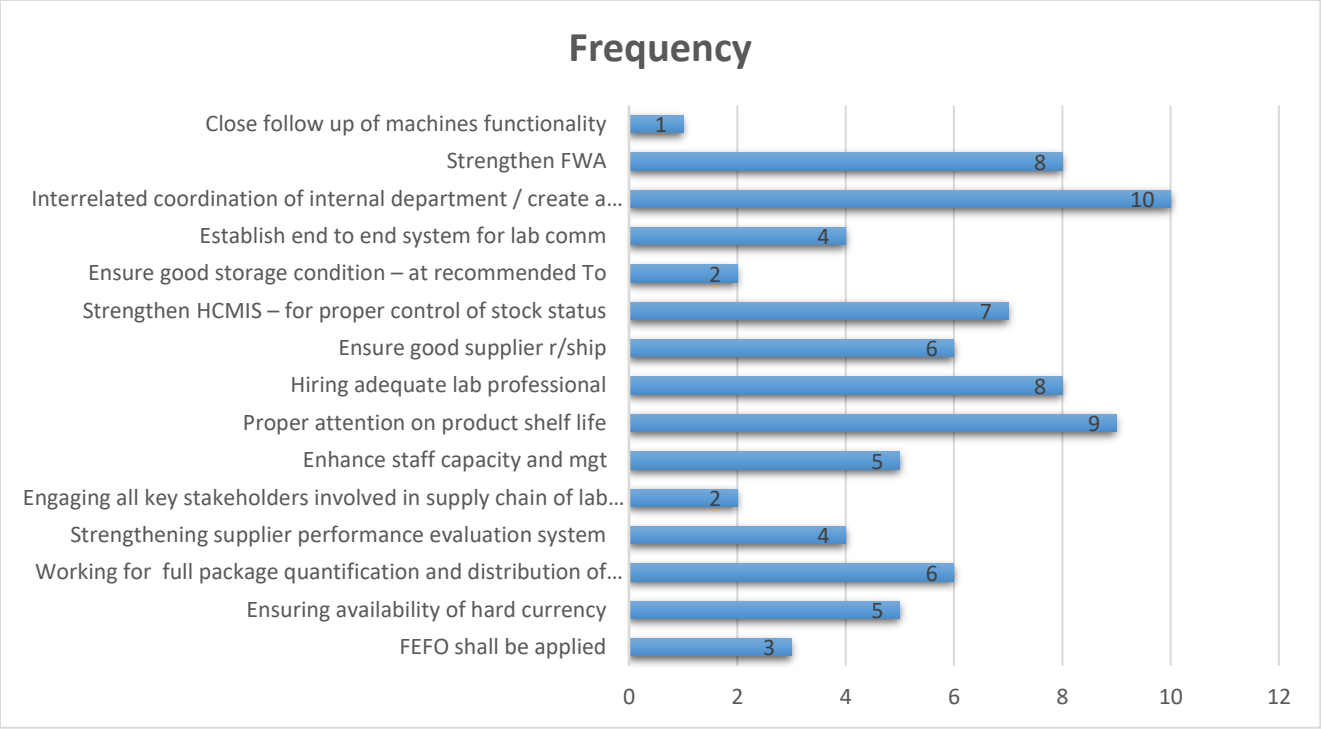


Figure 4.2. Intervention modalities suggested ensuring availability of laboratory commodities

From the figure 4.2 above, the respondents pointed out their mandatory intervention points in which 10(37.04%) were the most frequently mentioned remedial action suggested by the respondents that the importance of creating Interrelated coordination between internal departments of the agency. The second highest number of the respondents 9(33.33%) recommended that giving Proper attention on product shelf can help the agency a lot and helps to utilize scarce resource of the country.

8(29.63%) of the total respondents' suggested for Strengthening Framework of Agreement (FWA) and Hiring adequate number of lab professionals in all departments can help to address the commonly faced challenges of the agency. The fourth highest number of respondents 7(25.93%) mentioned about Strengthening HCMIS system for proper control of stock status that aids the agency to properly manage laboratory commodities.

Working for full package quantification and distribution of lab commodities in line with ensuring good supplier relationship were the other most recommended points by the respondents, which is 6 (22.22%). Lastly, only one respondent that accounts (3.7%) stressed the importance of close follow up of machines functionality at the facility level that can support the whole supply chain process of laboratory commodities in the agency.

## 4.5. Discussion of the results

As per the information gathered from this study, respondents stressed standardizing the use of data and updating the data found by using the existing information technology, on time data sharing and strong collaboration with the internal departments. The respondents also stressed that use of visible and real time data for quantification and decision-making purpose were influential for minimalizing frequent stock out and wastage due to overstocks of lab commodities.

According to PSTP II, 2020, during quantification process there is lack of data to determine their consumption (Average Monthly Consumption and Months of Stock) leading to high rates of quantification error, stock-outs, and wastage across the supply chain. Although the agency has achieved its target of reducing forecasting error below 25%, which is 17%, the forecasting error for budgetary items is still above the target set.(PSTP II, 2020)

Thus, having on time consumption data can support a lot in minimizing quantification errors. Whereas, it was not practical and easy of getting accurate data during quantification exercise.

Besides, most believed that there were a limited access of laboratory professionals for performing quantification and supply plan. Furthermore, there were a gap identified in quantifying full package items.

According to the study conducted by (Waqtola C, et al, 2019), Medical laboratory require suitable laboratory commodities in order to fully provide the required standard services at any time to patients. Whereas, this study shows that different challenges have been encountered to supply full necessary commodities at all time in the required quantity. Moreover, the study revealed that laboratory commodities are very sensitive regarding their short shelf life. Therefore, hiring experienced experts were crucial suggested by the respondents to utilize the scarce resource that the country have. Likewise, the study showed that the importance of enhancing the capacity of lab professionals by continuously providing refresher trainings on the supply chain management of laboratory commodities.

Regarding the procurement process, the study findings stressed that long procurement lead time, shortage of hard currency to procure and avail all lab commodities and difficulties faced on

implementation of framework agreements were the main challenges of supply chain management of laboratory commodities. Whereas by strengthening the management of framework of agreements, the agency can achieve the planned availability of the products on time. In addition, it has the ability to reduce extra burden of the agency and helps to boost functionality of the laboratories in the country. According to the agency's PSTP II (2020), the Agency has implemented Framework Agreement procurements to reduce year-round repetitive tendering and procurement. Currently, products for HIV/AIDS, family planning, malaria and RDF vital pharmaceuticals, medical supplies and chemical reagents are procured by framework agreement.

Likewise, the agency has implemented placement project as country basis, working strongly on it has a crucial impact on the availability of commonly consumed laboratory commodities. Similarly the study conducted by Fasil B. 2019 showed that for closed hematology and clinical chemistry with hormonal testing analyzers, EPSA has launching 2- 3 years framework agreement. Hence, most respondents of this study were also attracted by this project.

The other point addressed by the respondents were, having continuous discussion with the health facility/ end users to identify the commonly faced problems related with the supply of laboratory reagents and take remedial actions to improve the functionality of the machines in the country who are placed by the placement modality.

Concerning the challenges of inventory management practices of laboratory commodities, management of lab commodities with incompetent professionals, management of short shelf life products, supply of consumables of laboratory commodities in full package, proper identification and segregation of expired damaged and obsolete inventories were the commonly identified challenges of inventory management practices of this study.

According to Kanda & Iravo (2015), staff competency is crucial for inventory management practices to achieve the desired supply chain management of laboratory commodities. If the professionals involved on supply chain management of laboratory commodities are competent and qualified, there will be effectiveness of the managements of lab commodities.

According to the study done by Welelaw N. (2017), lack of strong support by senior management has a negative impact towards modernizing the overall inventory management system at all levels of the supply chain. In addition, the study also showed that standard

inventory practices such as Lean and JIT are not properly practiced in EPSA. The presence of scattered warehouses and lack of stringent application of FEFO principles were major limitation that hindered efficiency of the inventory management practice of laboratory commodities.

Regarding gaps identified on storage and distribution of laboratory commodities, receiving of complaint from health facilities due to improper storage of laboratory commodities in EPSA, having not suitable stores for laboratory commodities management and distribution of not full package laboratory kits to health facilities were the main gaps faced in the agency.

Likewise according to the assessment done in KEMSA by Aronovich et al (2001), there were expiry of short shelf life of reagents and often expire soon after they are received in laboratories. In addition, the assessment observed that expired stocks are rarely removed from inventory and discarded in which this cause high inventory cost to whole supply chain management system. Besides, due to scarce and irregular supplies of these reagents few laboratory visited during their assessments continue the use of expired products due to lack of alternative reagents. Similarly the study done in KEMSA showed that products are arrived at health facilities piled and crushed due to improper arrangement and also arrived unexpectedly in large quantities which makes it difficult to track the number of kits received and unable to be monitored according to FEFO by staffs at the health facilities.

Concerning the availability of the laboratory commodities this study confirmed that because EPSA alone cannot afford to avail all the required products to the country, a strong support from the NGO's who are working with the federal ministry of health. Those NGO's can support the agency on the areas where the agency faced major challenges on the overall supply chain processes.

# CHAPTER FIVE:
# SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

## 5.1. Introduction

This chapter includes summary of the major findings, conclusions as well as recommendation and area of further study included.

## 5.2 Summary

The study under this section was intended to present summary findings of Problems faced on Quantification process, Procurement process, Inventory Management Practice, Storage and distribution Practice and the challenges and intervention priorities in Laboratory commodities management.

**Quantification process:** this study investigated that majority of respondents (41.9%) agreed and (41.9%) again strongly agreed that the cause of frequent stock out in EPSA is quantification error (improper quantification). About 35.5% of the respondents believed that professionals who has limited skills and knowledge quantify laboratory commodities. This may cause improper quantification and lead to frequent stock out. The study also further investigated that more than half of the respondents (38.7%) strongly disagreed and (22.6%) disagreed that EPSA has continues follow up on stock status of lab commodities.

**Procurement process:** the majority of the respondents, 51.6%, confirmed that EPSA had no enough hard currency to procure and avail all lab commodities. Whereas, (61.3%) of the respondents were agreed on the establishment of framework agreement for a selected lab commodities. Moreover (35.5%) of the respondents believed that Procurement list for lab commodities cover all critical items.

Most of the participant in the study, 58.1%, 41.9% showed their disagreement on procurement process cannot be finished with in the specified lead-time and the agency procure full package list of products to run a test respectively. The higher number of the respondents, 35.5% and 25.8%, again agreed on most of the laboratory reagents are procured from Single source. This indicated that the agency would face frequent stock out due to dependency of single source suppliers for closed system laboratory commodities.

**Inventory Management Practice:** 25.8% of the respondent believe that the agency had no proper identification and segregation of expired, damaged and obsolete inventories. Although most of them believe there is a standard guideline (SOP) on how to handle laboratory commodities in the warehouse, (45.2%) respondents were disagreed that the agency can supply all consumables of lab commodities with full package.

Besides, about 29% of the respondents were disagreed on the point that the agency can monitor short shelf life lab commodities with a system.

**Storage and distribution Practice:** From the respondents, who addressed the challenges, majority of them replied that the agency has no sufficient warehouse to accommodate room temperature required laboratory commodities; and there were a complaint from health facilities due to improper storage of laboratory commodities in EPSA. In addition, more than half of the respondents (32.2% + 25.8%), who addressed the challenges, replied that there were a gap about distribution of full package laboratory kits to the health facilities.

According to a cross sectional study done by Waqtola C, et.al, 2019, laboratory commodities often come in a variety of preparations-including solid and liquid reagents, laboratory commodities can also be packaged in kits, dry laboratory chemicals and consumable liquids are often packaged in bulk, and some laboratory commodities have either short shelf lives or need special storage condition. Thus, these all nature of lab products makes its management difficult and complex to deliver packaged kits to the health facilities on time.

From the total participants, 40.74% of them said that the most prevalent challenge of the agency were shortage of lab professional in the agency. The next highest number of the respondents 37.04% replied that there is high expiry of controls due to lack of well-organized procurement and supply plan. 33.33% of the total respondents' responded that quantifying and delivering in not full package of lab commodities as one of the most prevalent challenges of the agency.

On the other hand, on intervention modalities, (37.04%) were the most frequently mentioned remedial action suggested by the respondents that the importance of creating Interrelated coordination between internal departments of the agency. The next highest number of the respondents 33.33% recommended that giving Proper attention on product shelf can help the agency a lot and helps to utilize scarce resource of the country. 29.63 % of the total respondents' suggested for Strengthening Framework of Agreement (FWA) and hiring adequate number of

lab professionals in all departments can help to address the commonly faced challenges of the agency

## 5.3. Conclusions

Based on summary of finding of the result and discussion of this study, the following conclusion is drawn:

EPSA has been managing laboratory commodities for a long period of time though frequent stock out in EPSA due to quantification error, professionals with limited skill and knowledge, lack of continuous follow up on stock status of laboratory commodities are the major problems faced in quantification process.

Regarding procurement process, shortage of hard currency to avail all laboratory commodities, prolonged lead-time of procurement process & lack of procuring full package of kits to run a test are the major problems faced from the study findings. Whereas as the study findings showed that importance of framework agreement for selected laboratory commodities were essential to continuously avail vital/selected laboratory commodities to health facilities.

The establishment of long-term Framework agreements with selected suppliers is one of the way of having strategic alliance. This helps to establish agile and responsive supply chain system in the agency. It is also one way to avail vital and essential lab commodities with minimum price. It is also important to obtain the required products on time and deliver the required service to the health facilities. Having a strategic buyer supplier relationship would have helped the agency to secure high level of commitment that helps to create long-term partnership to be responsive to the health sector needs.

The most prevalent challenge that this study found out were not delivering full packaged Laboratory kits to the health facility. The reason for this challenge were the requirement of different commodities to perform one/each test in the laboratory.

The majorities of challenges of the agency this study find out are no sufficient warehouse to accommodate room temperature required laboratory commodities, shortage of lab professional in the agency, high expiry of controls and calibrators.

## 5.4 Recommendations

Based on the major findings and conclusion of this study the following recommendations are forwarded:

- ✓ EPSA should develop automated quantification process in order to reduce quantification error and work strongly on data visibility by involving relevant stakeholders and experienced professionals.
- ✓ The agency should also work strongly on hiring experienced Laboratory professionals and managing the items with knowledge to reduce wastage rate of the agency as well to avail the products on time.
- ✓ EPSA should also strengthen Long-term framework agreements with suppliers, which is undeniable to be responsive to the requirements of health system.
- ✓ The agency should develop a special system to deliver short shelf of controls and calibrators according to the supplier schedule. Furthermore, the agency should work closely with relevant stakeholder like EPHI (Ethiopian Public Health Institute) and Regional Laboratories to prepare controls in house in laboratories from known samples that has a potential to reduce the expense of hard currency.
- ✓ The performance of the supplier should be also monitored regularly and proceed with the best performers. There should be also a rewarding mechanism to the best performers to strengthen their relationship with the agency.
- ✓ EPSA should work strongly on increasing the number of suppliers who can provide Laboratory commodities since most of the machines are closed system in the country. This can be achieved by closely work with other responsible stakeholder like EPHI to increase the number of platforms in the country which can be used as a backup if the machines on the long-term agreement doesn't work properly.
- ✓ The agency should also think about increasing warehouse capacity for managing all pharmaceuticals including lab commodities efficiently without any space problem. Besides, continuing on separation of warehouse only for lab commodity management since started the last two to three years ago.
- ✓ EPSA should arrange regular assessments on health facilities to monitor machines functionality, which helps to reduce quantification error. In addition arranging regular

meeting with relevant stakeholders and supplies will enhance mutual benefits of all stakeholders and helps to improve product availability in the agency.

## 5.5. Suggestion for Future Studies

This study focused on the Assessment of the challenges of Supply Chain Management of Laboratory Commodities: in the Case of Ethiopian Pharmaceutical Supply Agency and will give a hint for further studies especially in EPSA. To address some points in detail on Supply Chain Management of Laboratory Commodities in EPSA more studies need to be researched in the future. These are: on factors affecting supply chain management of laboratory commodities, the efficiency and effectiveness of laboratory commodities supply chain management, the impact of efficient laboratory commodities management on the overall health system are suggested in the future studies.

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# Appendix I

**ADDIS ABABA UNIVERSITY**

**SCHOOL OF COMMERCE**

**LOGISITCS AND SUPPLY CHAIN MANAGEMENT**

***QUESTIONNAIRE***

Greetings; my name is Hilina Tesfaye. I am a graduate student of Logistics and Supply Chain Management. Currently, I am conducting my thesis on Assessment of challenges of Supply Chain Management of Laboratory Commodities: in the Case of Ethiopian Pharmaceutical Supply Agency, Addis Ababa. The main purpose of this questionnaire is to collect necessary data for the study on laboratory commodity management practice in EPSA. It is purely for academic purpose and your response will be kept confidential. The objective of the study is to assess challenges of supply chain management of laboratory commodities in EPSA.

Your genuine response to the questions raised on this questioner will help me to clearly find out the problems and give possible recommendations to the problems.

Therefore, I kindly would like to request you to take 15-20 minutes and fill the questionnaire as per the instruction. Thank you in advance for giving your valuable time & information to this end.

For any unclear information, you can contact me through email – hilinatesfaye81@gmail.com and/or cellphone - +251 910 06 80 92.

Hilina Tesfaye

**PART I: Background information of the respondent**

| Kindly respond to the question by circling the code numbers most appropriate to your response | | |
|---|---|---|
| **SN** | **Questions and Filters** | **Coding Categories** |
| 1 | Sex | Male …….....1<br>Female …….2 |
| 2 | The highest academic qualification you achieved | Diploma……..1<br>Bachelor degree …….2<br>Master's degree …….3<br>Others: specify_____ |
| 3 | For how long have you worked in EPSA? | Less than two years…….……1<br>2- 5years……2<br>5-10 years ……3<br>more than 10 years……..…….4 |
| 4 | Please indicate your current department/Directorate that you are working with | Quantification and Market Shaping Directorate(QMSD)……..…….....1<br>Tender Management Directorate(TMD)…….……....……...2<br>Contract Management Directorate (CMD)…….……..……3<br>Warehouse and Inventory Management(WIM) ……...……...….4 |

**Part II: Challenges faced related to Laboratory Commodities management.**

Based on the current practice in EPSA you know, please indicate your level of agreement by placing a **tick** with the following statements about Challenges faced related to Laboratory Commodities management at EPSA.

(Key =1-Strongly Agree 2- Agree, 3-Netrual, 4-Disagree, 5- Strongly Disagree)

### A. Problems faced on quantification process of Laboratory Commodities:

| SN | Problems faced on Quantification process | Strongly Agree [1] | Agree [2] | Neutral [3] | Disagree [4] | Strongly Disagree [5] |
|---|---|---|---|---|---|---|
| 5 | Quantification process in EPSA mainly focuses on vital and essential lab items. | | | | | |
| 6 | EPSA quantify lab commodities regularly | | | | | |
| 7 | During the quantification process, there is a participation of lab staffs. | | | | | |
| 8 | Quantification error (improper quantification) is the cause for frequent stock out in EPSA | | | | | |
| 9 | Laboratory commodities are quantified by professionals who has limited skills and knowledge | | | | | |
| 10 | EPSA has a continues follow up on stock status of lab commodities | | | | | |

### B. Problems faced on Procurement process of Laboratory Commodities:

| SN | Problems faced on Procurement process | Strongly Agree [1] | Agree [2] | Neutral [3] | Disagree [4] | Strongly Disagree [5] |
|---|---|---|---|---|---|---|
| 11 | EPSA has enough hard currency to procure and avail all lab commodities. | | | | | |
| 12 | EPSA has established a frame work agreement for a selected lab commodities. | | | | | |
| 13 | Does EPSA benefited from Framework procurement | | | | | |
| 14 | EPSA Procurement list for lab commodities cover all critical items | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 15 | The procurement process finished with in the specified lead time period./ products delivered as per the required delivery schedule | | | | | |
| 16 | Most of the laboratory reagents are procured from Single source (they are closed system). | | | | | |
| 17 | EPSA procures full package(all consumables to do the test) of lab commodities | | | | | |

### C. Assessment of Inventory Management practice of Laboratory commodities in EPSA:

| SN | Inventory Management Practice | Strongly Agree [1] | Agree [2] | Neutral[ 3] | Disagre e [4] | Strongly Disagre e [5] |
|---|---|---|---|---|---|---|
| 18 | There is a standard guideline (SOP) on how to handle laboratory commodities in the warehouse. | | | | | |
| 19 | EPSA can manage short shelf life products effectively. | | | | | |
| 20 | EPSA can supply all consumables of lab commodities with full package. | | | | | |
| 21 | EPSA can manage properly freeze items. | | | | | |
| 22 | Accurate records provide the management with an information which is used to ensure accountability at EPSA | | | | | |
| 23 | Accuracy of inventory records is necessary to provide satisfied customer service at EPSA. | | | | | |
| 24 | EPSA has a system to monitor short shelf life lab commodities. | | | | | |
| 25 | EPSA gives priority for inventory management of vital and essential laboratory commodities according to their stock value. | | | | | |
| 26 | In EPSA expired, damaged and obsolete inventories are properly identified and segregated. | | | | | |

**d. Problems related to storage and distribution of laboratory commodities:**

| SN | Storage and distribution Practice | Strongly Agree [1] | Agree [2] | Neutral[ 3] | Disagree [4] | Strongly Disagree [5] |
|---|---|---|---|---|---|---|
| 27 | EPSA has effective storage and distribution practice. | | | | | |
| 28 | EPSA has SOP for Laboratory commodities storage and management | | | | | |
| 29 | EPSA has sufficient warehouse to accommodate room temperature required laboratory commodities | | | | | |
| 30 | EPSA has adequate cold chain (2-80C) warehouses for laboratory commodities. | | | | | |
| 31 | I have received a complaint from health facilities due to improper storage of laboratory commodities in EPSA. | | | | | |
| 32 | The stores in EPSA are suitable for laboratory commodity management. | | | | | |
| 33 | EPSA follow FEFO(First Expiry First Out) practice during distribution. | | | | | |
| 34 | EPSA always distribute full package kits to health facilities | | | | | |

**Part III. Kindly answer the following questions based on your understanding**

35. In your opinion, what are the challenges faced by EPSA regarding management of Laboratory commodities?

_____

_____

_____

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36. What priority interventions can be put in place to ensure efficient Laboratory commodities management at EPSA?

_____

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_____

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_____

Thank you very much again!

# Appendix II

## Interview Questionnaires

**An interview guide to collect information from QMSD, TMD, CMD and WIM Director's**

**Dear Interviewee!!**

The purpose of this interview is to collect data about Assessment of challenges of Supply Chain Management of Laboratory Commodities: in the Case of Ethiopian Pharmaceutical Supply Agency, Addis Ababa, to carrying out my thesis. The type of the information that you will provide determine the quality of this research. In addition, please be sure that the information that you will forward will be used only for the aforementioned thesis. You are, therefore kindly requested to be genuine and honest in providing the appropriate information in the course of the interview. I assure you that your answer will be kept anonymous throughout the research report.

Let us begin now,

i. What are the main challenges faced in relation to laboratory commodities management in EPSA?
ii. What are the problems faced on quantification and procurement processes of laboratory commodities?
iii. How do you see inventory management practices of laboratory commodities in EPSA?
iv. What are the gaps identified in relation to storage and distribution of laboratory commodities?
v. What would be the intervention modality to ensure efficient and effective Laboratory commodities management at EPSA?

Thank you very much again!