



**ADDIS ABABA UNIVERSITY COLLEGE OF HEALTH
SCIENCES SCHOOL OF PHARMACY**

**ASSESSMENT OF WAREHOUSE PERFORMANCE: THE
CASE OF ETHIOPIAN PHARMACEUTICAL SUPPLY
SERVICE HEAD OFFICE**

**BY
DAGIM AYALEW KINDE**

**A Thesis Submitted to Addis Ababa University School of Pharmacy,
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BY

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Addis Ababa, Ethiopia

Declaration

I, Dagim Ayalew, hereby declare that the thesis entitled "Warehouse Performance Assessment: The Case of Ethiopian Pharmaceutical Supply Service Head Office" is the result of my original research work. This thesis has not been previously submitted to any other university for any diploma or degree. Furthermore, I confirm that all the resources utilized during the course of this research have been duly acknowledged and referenced.

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ABBREVIATIONS AND ACRONYMS

CMD	Contract Management Directorate
DN	Delivery Note
EPSA	Ethiopian pharmaceutical Supply Agency
EPSS	Ethiopian Pharmaceutical Supply Service
EPHARMECOR	Ethiopian Pharmaceutical and Supplies Corporation
ETB	Ethiopian Birr
GRNF	Goods Receiving Notification Form
GRV	Goods Receiving Voucher
PHARMED	Pharmaceutical and Medical supplies importer and wholesaleDistributor
PFSA	Pharmaceutical Fund and Supply Agency
QA	Quality Assurance
QC	Quality Control
RDF	Revolving Drug Fund
SCM	Supply chain management
STV	Stock Transfer Voucher
SPSS	Statistical Package for Social Science
SOP	Standard Operating Procedure
TMD	Tender management Directorate
WIM	Warehouse and Inventory Management

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ABSTRACT

Introduction: Warehouse plays an essential part in the supply chain management, as it is an important hub for receiving and holding stocks until they distributed to the end consumers. In today's competitive landscape, the success of organizations depends on the productivity and effectiveness of their warehouse. Understanding warehouse efficiency is crucial for organizations to identify where inefficiency is and to improving warehouse performance. Therefore, assessing warehouse performance provides a valuable measure of how well these expectations being met and to help the decision maker to identify where the inefficiency is exist to set the policy to improve the warehouse performance.

Objective: This study aims to evaluate the warehouse performance of the Ethiopian Pharmaceutical Supply Service head office with frequently used warehouse key performance indicator, which proposed by Frazzle (2002), namely quality, response time, productivity and cost/financial indicators.

Methods: A descriptive cross-sectional study design employed and followed by quantitative data collection approaches. Primary data collected through a questionnaire adapted from prior literature and employing a five-point Likert scale. Since the total population less the researcher took all population using census method and the collected data analyzed descriptively.

Results: The mean average score value of quality 3.1, response time 3.2, productivity 3.0 and cost indicator was 2.9, all indicators rated under the moderate performance level. The lower rating received for the Cost/Financial indicator, as reported by the respondents and EPSS should focus on this aspect to enhance warehouse performance. The overall mean average score value of the EPSS central warehouse performance of Head office measured across the four KPIs on a five-point Likert scale found to be 3.1, the level indicating an average level of agreement, which categorized under Moderate. This includes implementing cost-saving measures, reducing the overall cost of warehouse operations, and optimizing financial resources.

Conclusions: The findings concluded that warehouse performance of Ethiopian Pharmaceutical Supply Service head office is at a moderate level. Further efforts should make to enhance the quality, response time, productivity, and cost efficiency to optimize warehouse performance and meet customer expectations effectively. Special attention should have given to the cost indicator since it rated least among the four KPIs.

Keywords: Warehouse performance, Performance management, Supply Chain management

1. INTRODUCTION

1.1 Background of the study

Health care system success can be highly dependent on the availability of adequate health commodities. Several factors are involved in ensuring their availability, such as effective warehouse and inventory management, includes proper planning, recording, controlling and monitoring of the inventory (UNHCR, 2013). To achieve consistent and rational supply of health commodities, health care workers at all levels of healthcare system and supply chain managers need to be equipped with the necessary knowledge and skills that will help to meet the present challenges and requirements.

In the supply chain, Warehouse is vital where products received from suppliers and stored up to eventually distribute to the final users, it is especially true in resource is very scares environments (Bartholdi and Hackman, 2011). It becomes essentially important to have a programmatic and systemic approach for strengthening warehousing (UNHCR, 2013). Well-managed warehouse and properly stocked inventory has used as absorbers against the interruptions in the flow of health commodity.

Warehouses play a significant role in logistics management and significantly influence the supply chain's speed and cost. In warehouse a number of activities are takes place, like holding for a while, moving, sorting, transferring, regulating quality, & taking training to store staffs and warehouse operation technical administrations (Donald, 2002; Bartholdi and Hackman, 2011, Dawit, 2021, UNHCR, 2013).

Those Processes, which occur in a warehouse, have large importance for the circulation of goods throughout the supply chain. Warehousing itself can be defined, “taking care, transportation, loading, unloading, packing and processing of goods between the production and consumption area” (Johnson, 2011). Good pharmaceutical warehousing guarantees the quality and safety of products including their packaging materials over numerous storage sites until they distributed for end users (John Snow, 2017, Elisa *et al.*, 2018). In the opposite hand, the poor a typical expertise of warehouse efficiency and the related causal elements could restricts the organization’s ability to discover promising opportunities to increasing warehouse performance (Johnson, 2011).

Ineffective inventory management could result incorrect quantities released, incorrect data

recorded, poor decisions, excessive inventory levels, inefficient use of funds, damage and losses (UNHCR, 2013).

In today's harsh and competitive environment, success measured by how well or poorly the operation of a warehouse is efficient and successful enough towards meet consumers' expectations. Therefore, Conducting a warehouse overall performance assessment is used to suggest wherein the inefficiency is passed off and this inefficiency have to be stepped forward accordingly (Ahferom and Michael 2018; Aronovich *et al.*, 2010).

Furthermore, by lowering transportation costs and raising both internal and external customer service standards, warehouse performance management gives businesses a competitive edge (Emmett, 2005). Best-in-class organizations achieve competitive customer service levels while attaining logistical cost benefits of 20 to 30 percent over their straggler rivals, according to another author who also supports this viewpoint (Jeroen and Berg, 2012).

Warehousing has tremendous advantages like reducing costs, raising productivity, and improving client's service but it has expenses. The cost is ranging from 17% -30% of total logistics activity cost (Indrawiti *et al.*, 2018, Emmett, 2005). Companies who give more attentions to their Warehouse and invest on it are financially more successful (Jeroen and Berg, 2012). They are able to guarantee, accuracy, quality, timeliness, and cost-effectiveness with in the process. By doing this, Organizations support high-performance operations, which in turn support customer retention and happiness (Richards, 2011).

1.2 Statement of the Problem

Warehouse management is an important part of the pharmaceutical supply chain. If the warehouse not handled efficiently, the entire supply chain will suffer. According to Nigatu (2018), poor warehouse and supply chain performance will have an impact on the quality of health care service offering. Furthermore, poor warehousing performance leads to a scarcity of important medications and a loss of millions of dollars owing to expired stock in the warehouse (SIAPS, 2014).

Warehouse management is a critical component of supply chain management, and system failure leads to overall supply chain management failure, unless we analyze our performance against our clients' expectations and continue to fight to advance it. We are not only at risk of losing consumers, but we will also suffer additional costs (Richards, 2011).

Pharmaceuticals represent huge portions of the cost in the healthcare provision. They accounts about 20-60% of health spending in developing countries (Cameron et al., 2009). As pharmaceuticals are an essential and indispensable resource in health facilities, they should have to managed, efficiently to prevent a shortage, theft and wastage due to expiration.

It is a human right to have access to safe, efficacies, affordable pharmaceuticals with required quality and quantity. However, in Ethiopia, the pharmaceutical supply chain system has a number of problems, non-affordability issue, unavailability; poor warehouse and inventory management are among the problems (PFSA, 2015, Admasu, 2017).

Therefore, if Warehouse management plays an important role in supply chain management specially in preventing shortage, wastage due to overage and pilferage it has to be managed properly. When properly stocked the inventory and appropriately managed the warehouse, it will able to provide a consistently supply of pharmaceuticals as they are needed (USAID | DELIVER, 2014).

Assessment of the Warehouse's operation performance significantly overlooked in research literature (Johnson, 2011) and has received less attention from researchers and practitioners while it holds tremendous potential to achieve the goals of sustainable development (Indrawiti et al., 2018).

Effective warehouse performance evaluation might possibly influence the organization's total supply chain operations and directly contribute to the company's overall productivity (Tewdros, 2016).

The topic of SCM particularly contemporary management of the warehouse is comparatively new to Ethiopia; there appear to be a lack of written evidences that adequately characterize the process of analyzing warehouse performance (Tigist, 2011). When there is such a scarcity, it is quite difficult to obtain suitable references to examine the warehouse's performance. Despite these restrictions, existing research indicates that analyzing warehouse performance is critical for a firm to increase warehouse efficiency and overall productivity in the Ethiopian setting (Getahun and Bruck, 2020; Biniam, 2006). However, warehouse performance is included in those above titles but still little is, known about warehouse performance. That is why Tigist (2011) said in her study that the most often applied method of warehouse management in the case of Ethiopians, as well as in the majority of other countries, is conventional methods of management.

This research is differed from previous work by focusing on warehouse performance of large volume, ranging from 5000m² to 10,000m². This study will fill the gap by presenting a technique to assess the storage facility based on empirical data and integrating several statistical methods, as well as discovering several opportunities for additional research and serving as a baseline assessment for those interested in conducting research on warehouse performance measurement.

As a result, the purpose of this research is to evaluate warehouse performance management in Ethiopian Pharmaceutical Supply Service (EPSS) using four commonly used warehouse key performance indicators. They proposed by Donald, (2002), Frazzle, (2002), Aronovich et al., (2010), EPSS, and (2021). Quality, response time, total warehousing cost, and productivity are all important considerations for Ethiopian Pharmaceutical Supply Service (EPSS). Furthermore, it will identify some of the reasons that contribute to poor warehouse performance.

1.3 OBJECTIVES

1.3.1 General Objectives

- The general objective of this study is to assess the level of warehouse performance Ethiopian Pharmaceuticals supply Service Head Office.

1.3.2 Specific Objectives

- To assess level of warehouse performance regarding the quality indicator in Ethiopian Pharmaceutical supply service, Head office
- To assess level of warehouse performance regarding the response Time indicator in Ethiopian Pharmaceutical supply service, Head office
- To assess the level of warehouse performance regarding cost or financial indicator in Ethiopian pharmaceutical supply service, Head office
- To assess the level of productivity indicator in Ethiopian Pharmaceuticals supply Service, Head office and
- To identify the key performance indicator that can mostly affect the warehouse performance of Ethiopian Pharmaceuticals supply Service, Head office

1.4 Significance of the study

Warehouse has been, in the past, constantly referred to as cost centers and rarely adding value. Warehouses considered a critical gear in today's supply chain. However, managers are under pressure to improve productivity accuracy, reduce costs and inventory while improving customer service. This study will help the Agency to have a clear picture of how current processes and activities are carried out in the warehouse. This research also shed light on the need for the Agency management to enhance their decision making to improve the warehouse performance management. It will also become a reference point for future research in the field of supply chain management especially on the warehouse performance management and customer Satisfaction.

2 RELATED LITERATURE REVIEW

2.1. Theoretical Literature Review

Warehouses have been, in the past constantly referred to as cost centers and rarely adding value. Warehouses are now, seen as an essential component of today's supply chain (Richards, 2011).

Improving warehouse performance in global operations is a demanding task, particularly within an environment of increasing competition, customer satisfaction and reduces uncertainty in demand and supply, in large supply chain networks. Performance measurement had an incredible influence in management over the last decades (Axelsson and Frankel, 2014; Water, 2010). Performance measurement is a process of quantifying the efficiency and effectiveness of an action or activity (Elisa et al., 2018). The key reason why performance assessment is crucial to a warehouse is to, maintain customer happiness, ensure continual development within the operation, and detect possible issues before they become big problems, train workers in the proper areas (Richards, 2011). According to Lord Kelvins', (1824-1907) says, "If you cannot measure it, you cannot improve it".

A warehouse's performance can assess in two ways: one is to compare a warehouse with an ideal expressed as a mathematical model and the other is to compare not an ideal but an actual warehouse to determine the standards of performance, which proved and achievable (Bartholdi and Hackman, 2011). A good or bad performance could increase profits, time to deliver and the quality of customer service through better management of warehouse performance.

2.2. Functions in the Warehouse

Functions in the warehouse could be different according to product specification, customer requirement and service level offered. Even though differences may exist among warehouse activities, they are defining as follows.

Receiving Goods- is the act of categorizing, visually inspecting, counting and capturing the receipt of all incoming materials. Pharmaceutical has received from different commercial suppliers, upstream distribution centers or from customers (e.g. returns) (Rushton et al., 2014). Some of the documents used during receiving in a warehouses are

Stock transfer voucher (STV), Delivery Notes (DN), Air Way bill, Packing list, Good receiving notification Form (GRNF), Good receiving voucher (GRV), Bin card/stock card, Credit Invoice form, break down of local supplier (UNHCR, 2013).

After arrival, actual receipt activities must be completed, and the receiving process requires preparation (PFSA, 2015). Depending on the delivery status, a precise delivery date has been fixed especially in cases with a high number of deliveries and a low goods reception capacity. Such time schedules should help to avoid or reduce waiting times for trucks and, on the transporter side, help to coordinate system loads and to avoid load peaks (Michael & Thorsten, 2007).

Codification

Codification is a process of representing each item by a number, alphabet or combination of the two, in a way that the group, sub-group, & the type. Pharmaceutical Coding Systems is a system of assigning a unique identifier for a product. A code is used to represent a product using letters, numbers or their combinations (PFSA, 2015, Emmett, 2005).

Put away

The act of putting away a pharmaceutical involves taking it from the receiving area and putting it in the best possible final storage location; it is also known as stocking. After products released for storage, this process entails moving them from the unloading dock, or receiving area, and allocating them to their storage areas (rack, shelf, floor, etc.) (Axelsson & Frankel, 2014). Every product that is placed on or removed from a rack, shelf, or other storage area must accurately be recorded on the stock keeping records (PFSA, 2015). Because Stock Keeping units must transport over long distances to their storage location, the put-away process may be labor-intensive and makes up about 15% of warehouse operating expenses (Habazin et al., 2017). There are four types of Put away; Direct put away, Directed put away, Batch put away and Continuous put away (Perform both put away (stocking) with retrievals (picking). After completing put away, the picker directed to pull product to fill an order to re-warehouse) (PFSA, 2015)

Picking: The process of retrieving items from the storage locations and transporting either to a sorting area or to directly shipping, the process will take around 55% of total

warehousing cost (Axelsson & Frankel, 2014).

Types of Warehouse

The nature of warehouses within supply chains may vary tremendously, and there are many different types of classification:

By geographic area: a global warehouse may serve the whole world, a regional warehouse may serve a number of countries, a national warehouse may serve just one country, or a local warehouse may serve a specific region of a country (Rushton et al., 2014).

By ownership: owned by the manufacturer or retailer or by a third-party logistics company (Rushton et al., 2014).

Private Warehouse: - Run and owned by re-sellers and channel suppliers. A large retail chain, for instance, might operate several regional warehouses to supply its stores, or a wholesaler might run a warehouse where it receives and distributes goods (Rushton et al., 2014).

Public Warehouse

In essence, the public warehouse is space that was rented to address immediate distribution demands. Retailers who run their own private warehouses could periodically look for more storage space if existing facilities are full or if they are making a significant, one-time goods purchase. For instance, businesses may buy additional inventory to preparation for in-store sales or a huge quantity of a product that is being given by a supplier at a cheap promotional price (PFSA, 2015), (Richards, 2011).

Automated Warehouse: - these types of warehouse are advances in computer and robotics technology:- The level of automation ranges from a fully automated facility where only a small number of workers are required to perform storage tasks for thousands of pounds or kilograms of goods, to a small conveyor belt transporting items in a limited area. In reality, practically all-physical distribution handled by machines in many warehouses (Turn, 2014).

Climate Controlled Warehouse:

Many different items are stored in warehouses, including some that require particular handling circumstances, such as those that require to be handled inside freezers for frozen products, humidity controlled for fragile products, and clean surroundings for extremely sensitive products (Rushton et al., 2014).

2.3. Warehouse Management Systems (WMS)

The warehouse management system, as defined by Adzimah et al., (2015), made up of cutting-edge technology and operational procedures that maximize all warehousing operations. This includes all inventory movements and information flows among these activities.

Therefore, the main goal of a warehouse management system is to regulate the flow and storage of items inside a warehouse as well as the processes involved in transactions like shipping, receiving, putting away, picking, managing FEFO automatically, balancing, and many other tasks (David et al., 2008, Bartholdi and Hackman, 2011).

Furthermore, registering the reception of goods into the warehouse and registering its shipments out of the warehouse are among a warehouse management system's most important function.

The study conducted at EPSS indicated that there is little use of information technology. Despite the fact that technology cannot completely stop product theft and product leakage, the information technology tool that is being used to run the primary warehouse activities (such as inventory accuracy, picking accuracy, put-away accuracy, receiving time, order processing time, and warehouse space utilization) is helping to enhance performance (Nigatu, 2018).

According to the same study, which conducted at EPSS showed that, the EPSS employees perceived that the warehousing and storages had moderate performance. However, technological inventory control system was not fully implemented in the warehouses and the existence of material handling equipment is very low (Admasu, 2017).

2.4. Empirical Literature Review

Many researchers have done studies on the various aspects of warehouse earlier. These works are differ from one another with respect to the objectives (long /short term decisions), the way to measure these objectives (Key performance indicators), the type of warehouse systems (distribution center, cross dock), the focus area inside the warehouse (storage, picking, receiving etc.) and the tools used for measurement (statistical tools, mathematical programming,) (Francielly, 2014).

According to A Case Study on Warehouse Performance Measurement research done in Romania, Companies could gain cost advantages by effectively managing their logistics area of the business (Ilies et al., 2009).

A viable source of cost reductions from logistics that companies may leverage in the current economic downturn is warehouse management. According to Global Fund, (2017) report showed that, EPSS has owned and rented warehouses to store expired medicines and all health facilities visited have accumulated over five years expired product. In addition, the report concludes that, at the time of the audit, the central warehouse of the EPSS had a 65% space utilization rate. The ability to utilize the available racks in nine out of the ten regional warehouses visited had substantial floor damage, which restricted their usage of those warehouses' available racks. The main weakness of the Agency's pharmaceutical storage practice, according to the research done at EPSS, is incorrect pharmaceutical layout, uncomfortable warehouse floor for movement of products, inadequate and inaccessible fire safety equipment, and a lack of security controlling system in the warehouse (Gulilat, 2018).

2.5. Conceptual Framework

Numerous kinds of indicators have been created to assess supply chains management and warehousing operations. It may be discouraging to choose the sort of indicators to measure, and it might be risky to take consideration only to one area. For instance, concentrating just to finance savings may enhance some part of the without affecting supply chain's total performance. Due to this, the researcher modified a more comprehensive model created by Edward Frazzle (2001) that uses four different sorts of indicators: quality, time, money, and productivity. All indicator kinds must be taken into account in order for the analysis to be

finished and they must cooperate.

2.6. Warehouse Performance Indicator

Quality Indicator

Quality related performance indicator dimension is linked with customer satisfaction (external) and operational quality (internal).

A. Inventory Accuracy Rate

This indicator measures the proportion of warehouse or storage locations that had no inventory discrepancies when stock cards compared to a physical inventory count (Frazelle, 2002). The proportion of months or quarters with no inventory contradictions in relation to the total number of months or quarters in the review period (for example, annually) can also be used to generate this indicator for a single site. The accuracy of inventory is critical for managers because it allows them to maintain track of inventory levels and determine when new orders must be placed to refill inventories. This discrepancy analysis assists managers in identifying warehouse sites with inventory management issues, as well as chances for improvement (Franciely, 2014) (Hedler, 2015).

B. Storage accuracy (Put away accuracy)

It indicator measures the percentage of products that are placed in the correct location or bin inside a warehouse or storage space. It assesses a facility's capacity to stock products in the appropriate areas, allowing them to be located quickly and simply (Franciely, 2014). This helps you to demonstrate whether your employees are following effective inventory management policies and procedures. It measures on-site or through regular inspections of facilities throughout time.

C. Pick Accuracy Rate

It defined as percentages of Pharmaceuticals (correct item and quantity) correctly picked from the warehouse and placed in the correct container based on an inquiry or packing list. It measures how goods correctly selected from storage and placed in containers for shipment according the facilities request (Hedler, 2015) (Frazelle, 2002). This demonstrates the facility's ability correctly pick requests for quantities and items. Errors can result in out-of-stock or over-stock orders in your order setup.

D. Warehouse accident rate

The metric evaluates the number of accidents occurred in a warehouse or other storage facility during defined period. It may also give insight the management and practices of a warehouse to improve if there are untrained staffs, unclear safety policies, defective equipment, or poor conditions. Identifying the root cause of accidents due to human error or other causes, helps identify areas for improvement. Interventions should reduce the incidence of accidents (PFSA, 2015; Franciely, 2014 and Frazzle, 2002).

E. Security measures

These metric assesses whether policies or SOPs are in place to provide instructions to prevent theft or leakage at specific storage locations. Proper security measures in storage facilities help prevent product theft or leakage, save costs, and increase product availability. The program should define detailed instructions that the facility must follow to ensure facility safety and product protection. The evaluator should also assess the quality or thoroughness of these guidelines or his SOPs and the level of adherence by the facility (PFSA, 2015).

Response time

A. Inventory order-processing time

These metric assesses the average length of time (minutes, hours, days, weeks, etc.) that passes between when an order arrives at the warehouse and when it is dispatched to the client. Order processing time for a certain shipping facility can be determined as an average of all orders or as an average of orders for a specific client or product. It allows you to keep track of your shipping facility's order processing performance and efficiency. It also aids in identifying areas where staff performance in order management and facility response times may be improved.

B. Customs Cycle (customs clearance cycle)

It counts the time (minutes, hours, days, weeks, etc.) from the time the shipment arrives at the port or airport, clears customs, arrives at the warehouse, and is available for storage. Other issues, such as a shortage of warehouse equipment, have an impact on the transit of cargo from the port to the warehouse Hedler (2015).

The indicator can assist in identifying customs clearance delays and, with further

investigation, the factors involved, such as incomplete paperwork, inadequate material description, missed certificate of origin, and so on. Based on it, opportunities for improvement identified and efforts made to reduce the time necessary for products to clear customs and become available at warehouses.

C. Storage time (Put away time)

These metric evaluates the time it takes from the product is offloaded from a truck and arrives at a storage or a warehouse, until it is stored and picked and for distribution. It can be calculated per product, per shipment, or as an average over all products or shipments within a given time period (Hedler, 2015). Evaluating storage time helps improve productivity by allowing you to monitor the storage process and the efficiency of the worker accountable for that operation. This helps higher officials to identify working conditions and processes that need improvement and employee training needs.

Cost/finance

A. Total storage cost

Total storage costs include all costs associated with warehousing; labor costs and warehouse rent costs, consumables and other materials used for warehousing. It usually measured annually and calculated as total inventory cost per product dividing the total inventory cost by the number of storage volume of stored items per storage area (m²) in cubic meters (m³).

These metrics allows administrators to monitor the costs of various components within a Store and compare costs between different stores. This helps identify the most cost-effective bearings and leads to best practice analysis (Franciely, 2014) (Frazelle, 2002).

B. Amount of damaged products in the store:

These metric also used to calculates the value of products damaged in the warehouse during a defined period usually in annual based against percentage of the value of all products shipped during that period. Improper storage conditions and product handling can lead to inventory damage (Bartholdi & Hackman, 2011). Therefore, to determine the value of damaged products in the warehouse and helps to identify the cause as well as to take a necessary action that used to prevent such damage, like infrastructure improvements and providing necessary employee training.

Productivity

A. Space usage: space utilization shows the percentage of total space currently in use out of total available space. Managers can use this indicator to monitor warehouse storage capacity and utilization. By assessing storage space usage, managers are looking for ways to improve storage capacity e.g. Disposing expired products, reorganizing, and maximizing storage space utilization or request a re-evaluation of the layout, such as material flow and shelf arrangement (PFSA, 2015).

B. Movement units per effort (units moved per person hour): These metric measures the number of units (boxes, pallets, etc.) or weight per person-hour moved during a defined period for each person, both receipt and shipment of goods are considered. It helps to evaluate measure material handling productivity over a defined period (hours, days, or months). It also benefits comparing productivity levels across different work shifts and different warehouse locations. It uses as a source of information for identifying training needs and measuring their effectiveness (Hedler, 2015).

C. Percentage of storage space dedicated to product handling

These metric evaluates the percentage of total warehouse space dedicated to product handling (receiving, unloading, packing, loading and shipping) (PFSA, 2015). Handling space required depends on the amount of product moved within the storage area and the equipments required to moving the product. This particular area is critical to the efficient operation of the storage facility (Hedler, 2015).

Conceptual Model

Based on the above point of view relating to the demanded factors of warehouse performance, and with reference to the suggestions of the present literature, this study brought out the following conceptual framework that would pursue in the course of the preceding parts. The conceptual framework modified from the conceptual frameworks that developed by prior studies (Aronovich et al., 2010).

This is Conceptual model adopted from (Aronovich et al., 2010, Frazelle, 2002, Hedler, 2015 and EPSS, 2022).

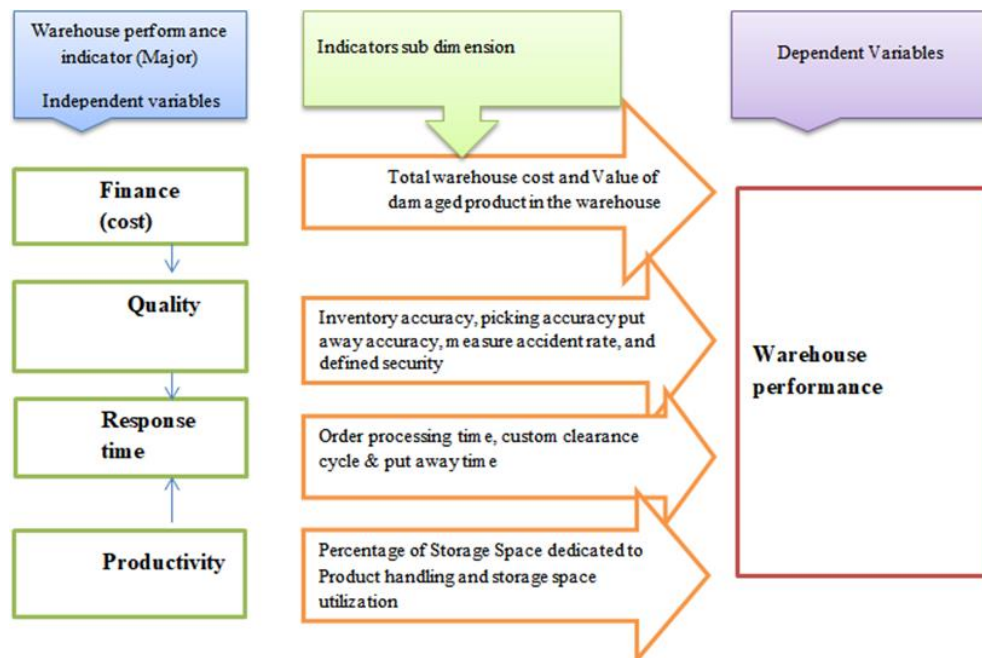


Figure1 Conceptual model

3 METHODS AND MATERIALS

A research methodology is a method of scientifically solving a research problem. We will consider various procedures that researchers commonly use when investigating research problems and the logic behind them. This involves more than just knowing how to, design a particular test, how to calculate the mean, mode, median or standard deviation, chi-square, and how to use a particular research method (Henock, 2019).

3.1 General Information about Ethiopian Pharmaceuticals Supply Service (EPSS)

The current Pharmaceuticals Supply Service has first established in 1947 with a capital of 80 million birr under the name “The main Pharmacy.” The military regime then restructured “The main Pharmacy” in 1976.

PHARMED has re-established with reformed vision, mission and goals in 2007 under proclamation no.553/2007 Negarit Gazeta, (2007) bearing the name “Pharmaceutical Fund and Supply Agency (PFSA). PFSA has once again changed its name at the beginning of the 2019 to “Ethiopian Pharmaceuticals Supply Agency (EPSA) which was lately changed to Ethiopian Pharmaceutical Service (EPSS) in the same year. Regardless of the numerous changes in nomenclature throughout the years, supplying pharmaceuticals has always been their core activity.

Currently the EPSS is under ministry of health, which stands for forecasting, procurement, warehousing and distribution of pharmaceuticals throughout the country. It has 19 branches, which found in all regions of Ethiopia. The agency has 2535 permanent and 314 contract employees that makes it a total of 2849 employees, 409 pharmacist, 220 bachelor degree or above while 189 are diploma holders.

There are 26 lab technicians, 25 of them have BSc degree and above. The 14 biomedical Eng. totally, there are 620 administrative staffs, of which, 304 have bachelor degree and above and the rest 316 have diploma. The number of contract employees fluctuates from time to time (Racmint System, 2016-2020). The Ethiopian Pharmaceutical Supply Service (EPSS) has structured by General Director, three deputy director generals and around twenty directorates, who are responsible of running the Organization.

3.2 Study design

Kothary (1990) in Nigatu (2018) and John AH et al., (2007), Tewodros (2016) said that research design is a master plan or blueprint that guides how research conducted. There are two approaches to the research question, quantitative and qualitative methods. There are also mixed-approach methods that include both qualitative and quantitative methods. In this particular study, quantitative research approaches used. The EPSS warehouse was the unit of analysis and both primary and secondary data sources used to conduct this research.

For questionnaires and some items suitable for characterizing variables, a 5-point Likert scale (5 = strongly agree, 4 = agree, 3 = disagree, 2 = disagree, 1 = strongly disagree) was used (Tewodros Bogale, 2016). The data collected from various sources and analyzed using descriptive statistical techniques and cross-sectional design used in this study in the sense that all-important data collected at a single time point.

According to Ruane (2006) in Tewodros (2016), obtaining information from population a cross-sectional design is a rational and consistent strategy for conducting many descriptive investigations. Quantitative data collection approach were followed to determine the performance of the warehouse in Ethiopian Pharmaceutical supply Service of head office, Addis Ababa, Ethiopia from November 07/2022 to December 03/2022

3.3 Sample size determination

The population size of the study area is too narrow to draw sample from the population. Therefore, it is feasible to take the entire population using the census method in order to conduct the research on the study population.

The source of population were all warehouse managers, Distribution and Fleet management officers, Contract Management officers, Tender Management officers, Quantification, and Market shaping Directorate staffs that have direct contact with warehouse and Inventory in Ethiopian Pharmaceutical Supply Service (EPSS) head quarter. The sample population for this study was 119 individuals. These defined as 44 Warehouse and Inventory Management officers, 6 distribution and Fleet Managers, 36 Quantification and Market shaping officers, 22 Contract Managers and 11 Tender Managers.

As far as the unit of analysis is concerned for this particular study, the EPSS warehouses was taken to be the unit of analysis

Variables: This particular study included four key performance indicators to measure warehouse performance: quality, response time, total warehouse cost, and productivity. A review of the relevant literature for the title identified 5 items for measuring quality, 3 items for response time, 2 items for total inventory cost, and 3 items for measuring productivity.

Table 1 Variables and Measurement Item

No	Factors	Measurement Items	Adopted From
1	Quality Indicators	Inventory accuracy, Put away accuracy, Picking accuracy, Accident rate and Defined security measures	(Aronovich et al., 2010)
2	Response Time Indicator	Order processing time, custom clearance cycle and put away time	(Aronovich et al., 2010)
3	Financial Indicator	Total warehouse cost and value of damaged product in the warehouse	(Frazelle, 2002)
4	Productivity Indicator	Storage space Utilization, Unit moved per person hour and percent of storage space dedicated for product handling	(Frazelle, 2002)

Quality: These metrics are usually the easiest to implement and measure. It usually tells you how well you are doing a particular activity. Common logistics metrics in this classification are accuracy such as order accuracy, inventory accuracy, picking accuracy, storage accuracy, warehouse accident rate, and defined safety measures.

Response time: These metrics focus on how long it takes to complete a particular activity. These show that time savings in specific activities can improve overall supply chain performance.

Cost/Finance: Using these metrics, managers can identify supply chain cost drivers and chart a path to a more efficiently managed supply chain.

Productivity: These indicators check how well resources being used. For example, shipping a

vehicle full instead of half-full can reduce costs and increase efficiency.

3.4 Data collection

Data collection for this study involved obtaining support letters from the Addis Ababa University School of Pharmacy Department of Research and Ethics Committee, which provided to WIM, Distribution and Fleet Management, Contract Management, and Tender Management officers. These support letters ensured ethical considerations met.

Upon receiving consent from the participants to partake in the study and questionnaires administered. The researcher personally distributed the questionnaires to the potential respondents at their respective locations and collected them physically.

3.5 Data collection tool

The data for this study were, collected using a well-designed questionnaire and administered to the study population EPSS Head Office.

The questionnaire consisted of two parts; the first part focused on gathering socio-demographic information, including educational qualifications and years of service in the current position. The second part consisted of multi-item scales designed to capture the factors of the theoretical constructs: quality, response time, total warehouse cost, and productivity, which has adopted from previous study. Each item of questionnaires measured on a five-point Likert scale, ranging from strongly disagrees to strongly agree; to ensure an effective data collection procedure, initial contact made with the respondents to explain the purpose and objectives of the study. It has done in order to achieve the desired response rate and encourage active participation from the respondents.

Validity

The degree to which the test captures the desired outcome referred to as validity (Cronbach, 1951) (Bhattacharjee, 2012). To evaluate the research's validity Pretest study done. The findings of a pretest study carefully reviewed before the real data-collecting tool sent to the respondents, and they excluded from the final research analysis. The goal of the pretest research is to find potential errors, such as unclear instructions and a short window of time to complete the questionnaire, and it improves the clarity of the questions. The researcher compiles concerns expressed by respondents for example, the initial distributed questionnaires was in Amharic version and the pretest respondent was suggests if it would be in English version for the ease of understandability; accordingly the researcher made appropriate corrections and revised questionnaires then given out.

Reliability

It is the degree to which measure of construct is constant or trustworthy; the dependability of the items forming the data-gathering aspects verified by utilizing Cronbach's Alpha (Cronbach, 1951, Bhattacharjee, 2012). The table below presents the items' Cronbach's alpha values consequently. According to table 3.2 below, the Cronbach's alpha value for every measurement construct used in this work is more than 0.7, which is much over the recommended cutoff value of 0.7 (Cronbach, 1951). The values suggest that the research tool is trustworthy and consistent as a result.

Table 2 Reliability Statistics of the data

Reliability Statistics		
Indicators	Cronbach's Alpha Based on Standardized Items	N of Items
QI	0.736	5
RTI	0.751	3
CI	0.783	2
PI	0.70	3
Total	0.872	13

Source: Own Survey Result, 2022

3.6 Data management and analysis

The collected data through questionnaires reviewed carefully to ensure completeness and readiness for analysis. Descriptive data analysis performed to present the demographic and general information of the respondents, which expressed in terms of frequencies, mean and percentages. For conducting this analysis, Statistical Package for the Social Sciences (SPSS) version 25.0 employed as the tool.

Finally, the outcomes of the statistical analysis interpreted and discussed aims to providing insights and implications based on the findings of the study. The scoring system is as follows: a score of 0.5-1.5 indicates "very low" performance, 1.6-2.5 indicates "low" performance,

2.6-3.75 indicates "moderate" performance, 3.76-4.5 indicates "high" performance, and above 4.6 indicates "very high" performance (Bezuayehu, 2018). This scoring system helps in interpreting the performance level for each indicator.

3.7 Ethical consideration

The study received ethical approval from the Research Ethics Committee of the School of Pharmacy, Addis Ababa University, with reference number ERB/SOP/481/14/2022, dated September 04, 2022. Additionally, the researcher obtained permission from EPSS to carry out the assessment on warehouse performance. All EPSS participants fully informed about the study's goals, the anticipated results, and the intended uses of the data prior to participation. Additionally, they made aware of their right, which include the freedom to decline or stop the questionnaire at any time and the choice to skip any questions they did not want to answer. Confidentiality, strictly maintained throughout the study, ensuring that all gathered information remained anonymous. No individuals will be, identified in any report or publication resulting from this study.

4 RESULTS AND DISCUSSIONS

Out of 119 questionnaires, distributed 109 filled and returned with the response rate of, 91.59%. Demographic characteristics of respondent include sex, age, educational qualification, work experience and position of work in the survey.

As indicated in the below table most of the study participant were male 88 (80.7%) and 21 (19.3%) of them were female, around two third of them are with the age group of 30-39, 75 (68.8%). Regarding their educational background, 66 (60.6%) of the respondent were first-degree holders, 7 (6.4%) of them were diploma holders and 36 (33%) of them were master's degree and above holders. Most the respondent which participated in this study were from WIM department 44(40.4%), 36 (33%) of them were from QMSD, 12 (11%) from CMD, 11(10.1%) from TMD and 6 (5.5%) from DFM. As far as the working experience is concerned, 65 (59.6%) of the respondents have working experience ranging from 1-10 years, 39 (35.9%) have 11-20, (Table 4).

Table 3 Socio demographic information of the respondents in EPSS, 2022

Socio Demographic Characteristics		Frequency	Percentage
Gender	Male	88	80.7%
	Female	21	19.3%
	Total	109	100%
Age	18-29	22	20.2%
	30-39	75	68.8%
	40-49	8	7.3%
	50 and above	4	3.7%
	Total	109	100%
	Diploma	7	6.4%
Educational Qualification	Degree	66	60.6%
	Master's Degree and above	36	33%
	Total	109	100%
	1-10 years	65	59.6%
Work experience	11-20years	39	35.8%
	21-30	3	2.8%
	30 and above	2	1.8%
	Total	109	100%
	Quantification and Market Shaping	36	33%
Department	Warehouse and inventory management	44	40.4%
	Tender management	11	10.1%
	Contract Management	12	11%
	Distributions and fleet Management	6	5.5%
	Total	109	100%

4.1 Descriptive Analysis

The collected data analyzed with respect to study's objectives, which aimed to assess the pharmaceutical warehouse performance in EPSS Head Office. Each key performance indicators weighted average performance scores calculated as part of the study and shown in the relevant tables.

4.2 Quality Indicators

Different researchers were measured the Warehouse performance previously. In this study four Indicators were adopted from literatures (Frazelle, 2002, Tewdros 2016), to assess the warehouse performance of the EPSS of head quarter. Among the four key performance indicators, quality indicator is one that intended to measure the warehouse performance, under quality indicator there are five items in which the respondents were ordered to rate their level of agreement with a 5-point likert scale from 1 (strongly disagree), 2(disagree), 3(neutral), 4(agree), to 5(strongly agree).

The respondents asked their level of agreement on the availability of Guidelines or SOP, in the warehouse. Accordingly about 56(51.4%) of the respondent Agree, 19(17.4) neutral, 18 (16.5%) Disagree, 10(9.2%) respondents strongly agree and about 6(5.5%) respondent strongly Disagree.

The presence of SOP in the warehouse will benefits the Organizations by ensuring the consistency and a decrease errors made and helps the organization to evaluate employee performance, save time and money and create a safer work environment.

This result shows an improvement compared to a previous study conducted in the same organization in 2019, where 43.5% of participants believed there was a lack of standard operating procedures for measuring pharmaceutical warehouse performance (Henock, 2019).

The other study conducted by Teshome in 2019 in governmental health facilities were revealed that a mean average value of the availability of SOP were 3.69 which is comparable with this study. However, the current result is slightly lower than this study. Despite the slight difference, this research indicates that the EPSS warehouses are performing well in terms of having guidelines and standard operating procedures in place to provide instruction.

SOP is recorded 2.79, which is less than the current study conducted in EPSS, therefore from this result we can conclude that the EPSS warehouse is performing well in regard of the availability of the SOP.

The next highest mean values from the quality indicators are 3.3 and 3.12, recorded for items three and four, respectively.

The participants were asked to show their level of agreement on how the product/item accurately picked from storage in item three and most of the respondent 61(56%) were agree, 30(27.5%) disagree, 7(6.4%), 7(6.4%) strongly agree and about 4(3.4%) of the respondent were kept neutral about the items. Item four was related to the occurrence of accidents in the warehouse and about 49(45%) were agree, 30(27.5%) disagree, 18(16.5%) neutral, and 5(4.6%) disagree. Both mean values correspond to a "moderate" level of response based on our criterion. This result is almost the same with study conducted by Tewodros, (2016) that reported the accuracy of product/item picking from storage and the occurrence of accidents in the warehouse were 3.01 and 2.9 respectively.

From this result, we confidently say that in EPSS warehouse most of the time items picked accurately, since the volume of the EPSS warehouse is very large and regarding the occurrence of the accident rate in the warehouse were relatively less.

The current results are also comparable with the previous study conducted in governmental health facilities by Teshome, (2019) which reported that the mean average scores value of 3.43 and 3.27 for these items, respectively. This suggests that still the EPSS warehouses are performing adequately in these aspects.

The fourth mean value 3.12 recorded for items location “in the warehouse, items are placed in the correct storage location or bin”. Putting the items in the correct location will benefit the Organizations in satisfying their customers by reducing the searching times.

According to Tewodros, 2016 study reported that the mean average values of 2.92 were recorded for the items “Most of the time in our warehouse, items are placed in the correct location or bin. As the result indicated us, the EPSS warehouse still in a position of performing well regarding putting the item in their correct storage location.

The less mean average value of putting the items in the correct locations or bin is leads to dissatisfy the customer since the warehouse personnel's waste their time in searching the items in the warehouse and increases the waiting time of the customers.

This result is almost the same with study conducted by Tewodros, (2016) that reported the accuracy of product/item picking from storage and the occurrence of accidents in the warehouse were 3.01 and 2.9 respectively.

From this result, we confidently say that in EPSS warehouse most of the time items were picked accurately and comparably since the volume of the EPSS warehouse is large the occurrence of the accident rate in the warehouse were very less.

The fourth highest average mean value recorded for item number two, which related to the correct products storage location or bin. The respondents asked their level of agreement if products stored at correct storage location or bin and about 45(41.3%) agreed, 36(33%) disagreed, 10(9.2%) strongly disagreed, 9(8.3%) neutral and about 9(8.3%) strongly agree.

According to Tewodros, (2016) study reported that the mean average values of 2.92 were recorded for the items "Most of the time in our warehouse, items are placed in the correct location or bin. As the result indicated us, the EPSS warehouse still in a position of performing well regarding putting the item in their correct storage location. The less mean average value of putting the items in the correct locations or bin is leads to dissatisfy the customer since the warehouse personnel's waste their time in searching the items in the warehouse and increases the waiting time of the customers. The smallest mean value recorded for item one: This pertains about the absence of inventory discrepancies in the warehouse when bin cards compared with stock cards and physical inventory count. 47(43.1%) disagree, 28(25.7%) agree, 17(15.6%) neutral, 11(10.1%) strongly disagree and 6(5.5%) strongly agree. The mean value for this item also corresponds to a "moderate" response rate. However, the percentage of average mean value indicates that a majority 47(43.1%) of respondents rated this item as "Disagree."

According to the study of Tewodros, (2016) results the respondents rated their level of agreement 2.93 on the item "most of the time our warehouse inventory has no discrepancies

when compared to the physical count or Bin card”. However, the current study almost comparable with the previous study of Tewodros, (2016) but the result highlights the need for warehouses to pay more attention to this issue in order to improve performance. In general, the overall average mean value of quality indicator is 3.1 (Table 4).

Table 4 Quality Indicator EPSS, 2022

Quality Indicator		Rating Scale					N	Mean
		SD	DA	N	A	SA		
1	There is no inventory discrepancies in the warehouse or storage locations when bin cards compared with stock cards or physical inventory count.	F 11 % 10.1 1	47 43. 1	17 15. 6	28 25. 7	6 5.5	109	2.7
2	Products are stored in the correct location or bin in our warehouse.	F 10 % 9.2	36 33	9 8.3	45 41. 3	9 8.3	109	3.10
3	Products are picked accurately in our warehouse (i.e., correct product and quantities) from storage based on a request,	F 7 % 6.4	30 27. 5	4 3.7	61 56	7 6.4	109	3.3
4	Physical accident are not occurs on daily laborers, warehouse personnel, and on equipment’s in warehouse.	F 7 % 6.6	30 27. 5	18 16. 5	49 45	5 4.6	109	3.12
5	There are guidelines or SOP in place that provide instructions to prevent theft, deterioration or leakage at a warehouse.	F 6 % 5.5	18 16. 5	19 17. 4	56 51. 4	10 9.2	109	3.4
							109	3.1
Overall Mean Score of Quality Indicator								

4.3 Response Time Indicator

The other key performance indicators of this research were response time indicator and under this indicator, there are three items categorized. The highest average mean value of 3.4 assigned to item one: "personnel’s serve our customers on a reasonable time in our

warehouse, i.e., from the moment an order is received at the store until the time order is shipped to the client."

Therefore, according to the respondents response, majority 57(52.3%) of them were agree, 31(28.45%) disagree, 10(9.2%) strongly agree, 9(8.3%) neutral and about 2(1.8%) of the respondent were strongly disagree. Although, both of the current and the previous study categorized under moderate level, the current study result is slightly different from the result of Tewodros, 2016 on this item, which reported that 3.67 mean average score value. In this regard, the EPSS warehouse is almost the same with the study conducted in the other organization.

The second highest average mean value recorded for item two: "our organization makes the product available for customers, i.e., from the moment the cargo arrives at the port or airport until it clears customs, arrives at the warehouse, and is ready for distribution."

According to the respondents response on this specific items about 53(48.6%) agreed, 26(23.9%) disagree, 16(14.7) neutral, 8(7.3) strongly agree and 6(5.5) strongly disagree. Both mean values correspond to a "Moderate" response range based on our criterion.

The percentage values for both items indicate that the majority of respondents rated these items as "Agree," with 57(52.3%) for item one and 53(48.6%) for item two. This suggests that warehouses are relatively performing well in terms of serving customers within a reasonable time and making products available, but there is room for improvement.

The lowest mean value of 2.8 reported for item number three regarding supporting the supplier in terms of timely offloading the upcoming shipment and make ready for distributions. In this regard the respondents response were majority 42(38.5%) of the respondents were disagreed, 39(35.8%) agreed, 15(13.8%) strongly disagreed; 10(9.2%) were neutral and 3(2.8%) were strongly agree.

This means the average mean value is still equivalent to "moderate" response rate. However, the majority of respondents 42(38%) evaluated this item as "Disagree." This indicates that warehouses' performance is poor in terms of ensuring a reasonable time gap between unloading and picking. The overall average mean value of the response time indicator were 3.2 (table 6).

Table 5 Response Time Indicator

RTI	Rating Scale							
		SD	DA	N	A	SA	N	Mean
1 It takes reasonable time from the moment an order received at the storage until the time the order will shipped to the client, offloading the upcoming shipment , and ready for picking or distribution.	F 2 % 1.8	31 28.4	9 8.3	57 52.3	10 9.2	109	3.4	
2 From the moment, the cargo arrives in the port or airport until the moment that it clears customs and arrives at the warehouse, then ready to distribution and available at final destination of the warehouse.	F 6 % 5.5	26 23.9	16 14.7	53 48.6	8 7.3	109	3.3	
3 Our warehouse personnel serve our supplier and makes product ready for shipment on the reasonable time i.e. the amount of time it takes from when a product(s) has been unloaded from a truck after arriving at a warehouse or other storage location to when it is stored in its designated place and is ready for picking.	F 15 % 13.8	42 38.5	10 9.2	39 35.8	3 2.8	109	2.8	
Overall Mean Score of Response Time Indicator						109	3.2	

4.4 Productivity Indicator

Based on the result on the below table all of the items used to evaluate productivity of warehouse performance are within the range of 3.0 to 3.1, which is equivalent with the mean average value range of “moderate” based on our criterion.

For more detail the first highest mean value is 3.1 recorded on item two (our daily laborer are not idle in our warehouse, i.e. the number of boxes, pallets or weight moved during a defined period of time, per person-hour, for each person during working period). It can be both receiving and shipping inventory considered.

The majority of respondents, which represent 35(32.1%) of total respondents, responded “Agree” for this item. It implies that most of the participant agreed those laborers are not idle in the warehouses. Average mean value of 3.0 recorded for both item number one and three respectively. For item number one respondents were asked to rate their level of agreement on the items which deals with the proper utilizations of warehouse space “our warehouse managers utilize the warehouse spaces properly” majority of the respondent 46(42.2%) were disagreed, 41(37.6%) agreed, 9(8.3%) strongly agreed and 5(4.6%) were strongly disagree.

For the third and the last items of the productivity, measures aimed to evaluate the ability of Warehouse managers on properly utilizations of warehouse space for product handling, the total storage space allocated to product handling e.g. for receiving, packing, and dispatching.

Therefore, the respondents were asked to rate their level of agreement on this specific items and most of the respondents 42(38.5%) were agreed, while 35(32.1%) disagreed, about 13(11.9%) were kept neutral, 12(11%) and 7(6.4%) were rated strongly disagree and strongly agree respectively. The overall average means score of the productivity indicator of EPPSS warehouse performance is moderate Table (7).

Table 6 Productivity Indicator EPSS, 2022

Productivity Indicator		Rating Scale					N	Mean	
		SD	DA	N	A	SA			
1.	Our warehouse managers utilize the warehouse spaces properly.	F	5	46	8	41	9	109	3.0
		%	4.6	42.2	7.3	37.6	8.3		
2	Mostly our daily loaders are not idle i.e. the number of boxes, pallets or weight moved during a defined period per person-hour during working period, either in offloading and loading time.	F	9	30	23	35	12	109	3.1
		%	8.3	27.5	21.1	32.1	11.1		
3	Warehouse managers utilize reasonable warehouse space for product handling, total storage space allocated to product handling, receiving, packing, and dispatching	F	12	35	13	42	7	109	3.0
		%	11	32.1	11.9	38.5	6.4		
Overall Mean Score of Productivity Indicator								3.0	

4.5 Cost indicators

The cost indicators are an important dimension used to evaluate warehouse performance in this study. The table below presents the results of the cost indicators, which consist of two items.

Among the cost indicators, item two which focuses on minimizing total product damage, ranked first with the highest mean average value of 3.0.

However, the majority 38(34.95) of the respondents rate this item disagree, this average mean value corresponds to a response rate of "moderate" according to our criterion. Then again, the respondent's response suggests that warehouse performance in terms of minimizing total product damage is not satisfactory. On the other hand, item one, which addresses minimizing total carrying/holding cost, has a mean average value of 2.7, indicating a "moderate" response rate. Additionally, as shown in the below table 47(43.1%) of the respondents disagreed with this statement, which suggesting that the warehouses have poor performance in terms of minimizing total carrying/holding cost.

The overall mean average score of cost/financial indicator's, is rated as moderate and the findings highlighted the need for improvement in both minimizing total carrying/holding cost and reducing total product damage in the warehouse (Table 7).

Table 7 Cost indicators EPSS, 2022

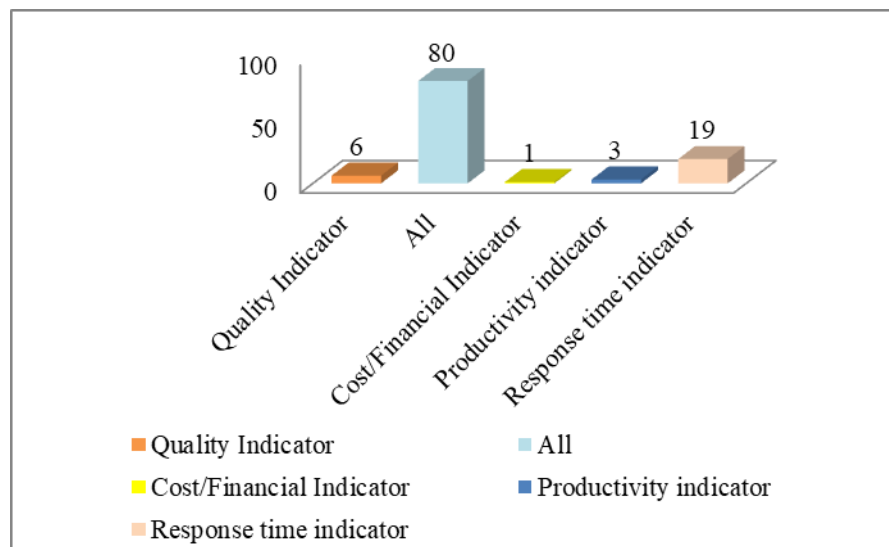
S.no	Cost indicators		Rating scale					N	Mean
			SD	DA	N	A	SA		
1	We are successful in minimizing total carrying/holding cost	F	12	47	17	29	4	109	2.7
		%	11	43.1	15.6	26.6	3.7		
2	We are successful in minimizing total product damage in the warehouse like product deterioration, breakage, leakage etc.	F	8	38	16	37	10	109	3.0
		%	7.3	34.9	14.7	33.9	9.2		
Over all mean Cost									2.9

4.6 KPIs that can potentially affect the warehouse performance

The other question that the respondents asked about their opinion was on the KPIs that significantly affect the overall EPSS warehouse performance. Accordingly, 80(73.39%) respondents of among those surveyed said all the indicators have an equally affect warehouse performance. Following this, the response time indicator received 6 (5.5%) responses, the quality indicator received 3 (2.8%) responses, and the productivity indicator received 1

(0.92%) response. Although, quality, response time, and cost indicators scored low regarding the potentially affecting the warehouse performance individually in terms of respondents' agreement, but in other hand they all considered as critical for warehouse performance under the options of all are potentially affect the warehouse performance (Figure 2).

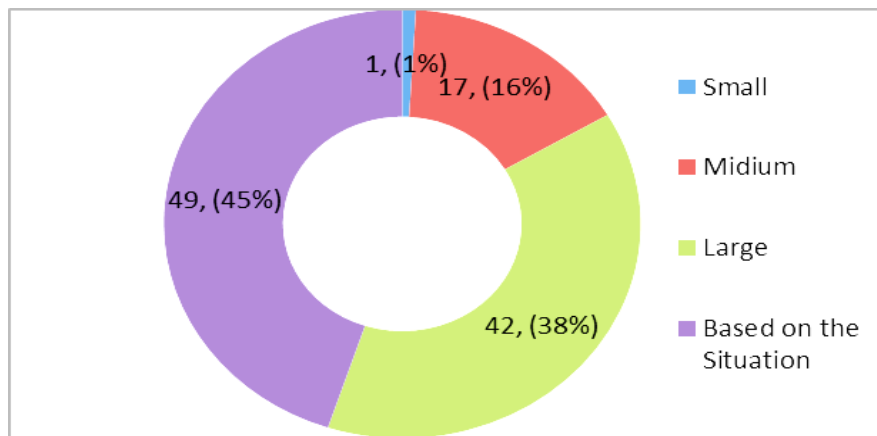
Figure 2 KPIs that can potentially affect the warehouse performance



4.7 What Warehouse Size is better enhancer of warehouse performance?

The respondents provided their opinions based on the available options, with the largest mean scale value of 49 (45%) indicating the influence of the situation on warehouse performance. The second largest mean value, 42 (38%), was associated with the belief that a large warehouse size is a better enhancer of warehouse performance. On the other hand, medium and small warehouse sizes received responses of 17 (16%) and 1 (1%) respectively. These findings suggest that respondents believe that based on situation and larger warehouse size play significant roles in enhancing warehouse performance, as indicated by this study (refer to Fig 3).

Figure 3 Warehouse Performance based on the Warehouse Size



4.8 Warehouse Performance enhancer based on the Warehouse types

The respondents asked to provide their opinions on various warehouse options and the automated warehouse received the highest average mean score value among the six options provided. Out of the total respondents, 64 (58.72%) believed that the automated warehouse is the better enhancer of warehouse performance.

The presence of SOP in the warehouse will benefits the Organizations by ensuring the consistency and a decrease for errors made and helps the organization to evaluate employee performance, save time and money and create a safer work environment. This result shows an improvement compared to a previous study conducted in the same organization in 2019, where 43.5% of participants believed there was a lack of standard operating procedures for measuring pharmaceutical warehouse performance (Henock, 2019).

The other study conducted by Teshome, (2019) in governmental health facilities were revealed that a mean average value of the availability of SOP were 3.69 which is comparable with this study. However, the current result is slightly lower than this study. Despite the slight difference, this research indicates that the EPSS warehouses are performing well in terms of having guidelines and standard operating procedures in place to provide instruction.

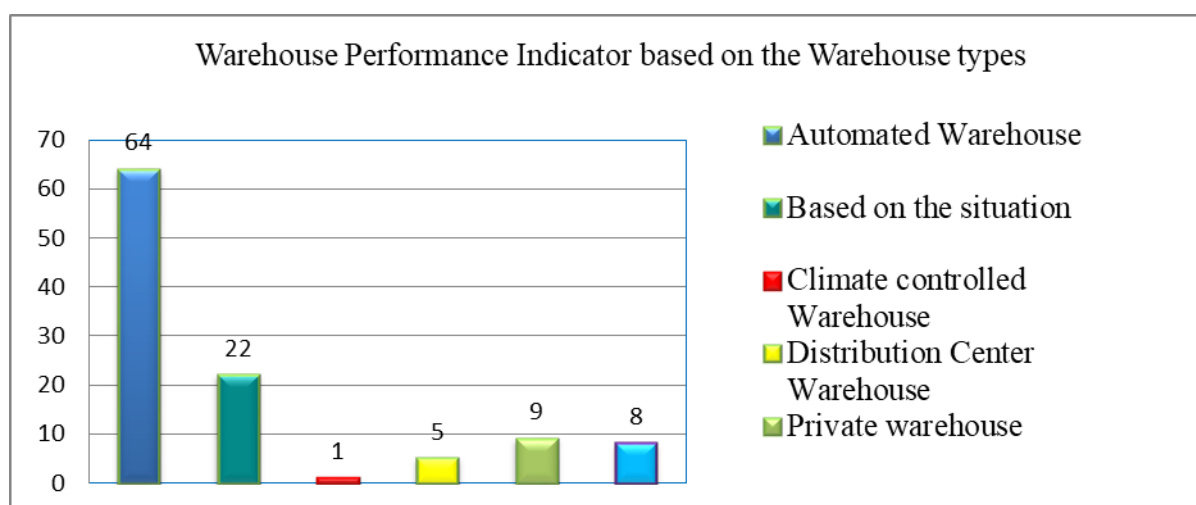
According to Tewdros, (2016) study the mean average score value of the availability of the SOP is recorded 2.79, which is less than the current study conducted in EPSS, therefore from

this result we can conclude that the EPSS warehouse is performing well in regard of the availability of the SOP.

The second highest average means score values registered for the option "Based on the situation," with 22 (20.18%) respondents selecting this choice. The remaining options, including Private, Public, Distribution center, and Climate controlled warehouses, had relatively similar scores 9(8.26%), 8 (7.34%), and 5 (4.59%) respectively.

Interestingly, the lowest score was registered for the Climate controlled warehouse, with only 1 (1%) respondent selecting this option (refer to Fig 4). Based on these findings, it can be concluded, that the majority of respondents perceive automated warehouses as the most effective enhancer of warehouse performance, followed by considerations based on the specific situation. The scores for the other warehouse options were relatively lower.

Figure 4 Warehouse Performance Indicator based on the Warehouse types



4.9 Overall Warehouse Performance on the KPI

The overall performance of the EPSS warehouse at the head office rated as moderate with the Grand mean average score value of . This finding aligns with the studies conducted by Nigatu (2018), Henock (2019), Habtamu, 2018 and Tewdros (2016), which also reported similar results. Specifically, this study ranked the four key performance indicators in order of their weighted average mean value from smallest to largest as follows: Cost/Financial Indicator, Productivity Indicator, Quality Indicator and Response Time Indicator.

5 SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Summary

The study aimed to assess the pharmaceutical Warehouse performance at Ethiopian Pharmaceuticals Supply Service under the Head office.

For EPSS 119 questionnaires were, distributed for the respondent and only 109 filled correctly and returned. Accordingly, the calculated response rate was 91.6%.

From the demographic distribution of the respondents, male respondents were 88(80.7%), and female respondents were 21(19.3%). Regarding their educational background 66(60.6%) of the respondent were first degree holder, 36(33%) of them were master's degree & above holders and about 7(6.4%) of the respondent were diploma holders. Respondents who were served the organization more than 1 year and above were 65(59.6%), which shows most of the respondent had better information on the Warehouse Performance.

The first specific objectives of this study were, to assess the level of warehouse performance of Ethiopian pharmaceutical Supply Service head office regarding quality indicator. The weighted average value of quality indicator was 3.1

The second specific objectives was, to assess the level of warehouse performance of Ethiopian Pharmaceutical Supply Service head office regarding responsiveness and the result was mean average score value of 3.2

The third specific research objectives were, to assess the warehouse performance of Ethiopian pharmaceutical supply service of head regarding Productivity indicator. The weighted average value for the productivity is 3.0

The fourth specific research objectives were to assess the performance of Ethiopian pharmaceutical service warehouse of head office regarding Cost/ financial indicator. The weighted average value of the cost/financial indicator was 2.9.

The fifth specific objectives of this research were, to identify the KPIs that can mostly affect the warehouse performance of the Ethiopian pharmaceutical supply service of head office. The result shows 80(73.39%) of the respondents believed that all indicators seems to be most valuable and high attention should be given for all of them.

The results revealed that the EPSS head office warehouse had moderate level of Performance, with an overall mean average score value of $M = 3.1$ on a five-point Likert scale. It recommended focusing on improving these indicators for further optimizations of the overall warehouse performance.

By taking measures to strengthen quality, reduce response time, enhance productivity, and manage costs effectively, the Ethiopian Pharmaceuticals Supply Service can elevate its warehouse performance and contribute to the smooth functioning of the pharmaceutical supply chain.

5.2 Limitation of the study

Cross-sectional studies, which gather data from a specific population at a single point in time, can provide valuable insights into various aspects of a particular phenomenon. However, when a cross-sectional study design includes only one facility, there are several limitations to consider. Findings from a single facility may not be representative of the broader population or other settings. The characteristics, practices, or outcomes observed in one facility may not be applicable to other facilities or regions. Therefore, generalizing the results of EPSS head office warehouse performance to that of the regional one may be challenging and not applicable.

Lack of variability: With only one facility, there may be limited variability in the data. This can restrict the ability to identify patterns, trends, or associations among variables. A more diverse sample from multiple facilities would provide a broader range of perspectives and allow for better generalization.

Potential bias: Single-facility studies are susceptible to selection bias. The chosen facility may not be representative of other facilities, leading to a skewed or biased sample. This can compromise the validity and reliability of the study's findings.

Inability to assess facility-level factors: By focusing on a single facility, it may be challenging to examine facility-level factors that could affect the outcome of interest. Variables such as facility size, resources, staff expertise, and organizational culture may vary between facilities and influence the study results. Including multiple facilities allows for a more comprehensive analysis of these factors.

Limited comparison or control group: Single-facility studies may lack a comparison group or control facility, making it difficult to establish causal relationships or assess the impact of

interventions. Without a control group, it becomes challenging to attribute observed differences solely to the facility itself rather than external factors.

Inadequate sample size: With only one facility, the sample size may be limited, which can reduce the statistical power and increase the risk of type II errors (false negatives). A larger sample size improves the precision and reliability of the study findings.

This particular research is not comprehensive and captures all warehouses available under EPSS. There are around 19 branches throughout the country and the future study shall consider additional factors other than quality, response time, Cost and Productivity that may influence the performance and see the reason behind the difference in warehouse performance level across different categorical groups and other Warehouse performance measurement tools.

5.3 Conclusion

This research focus on measuring warehouse performance using Frazzle model (2002), this model is selected because it is commonly used and compressive since it is not only measures quality, cost, productivity and response time dimensions, but also measures in terms of warehouse activities (receiving, put away, storage, picking and shipping). To find performance score of the warehouse, the performance indicators are weighted using 5 point likert scale method. The average mean score values of the major performance parameters, namely quality, response time, productivity, and cost/financial, show that the Ethiopian Pharmaceutical Supply Service warehouse at the head office exerts moderate efforts. Based on this assessment, the research states that the Ethiopian Pharmaceutical Supply Service's overall warehouse performance graded as moderate across the Quality, Response time, Productivity, and Cost/Financial parameters. The result shows that most respondents agree on all warehouse KPIs to be critical. The EPSS warehouse Performance Regarding the Response time, Quality indicators and Productivity indicators were in good position. The EPSS warehouse performances regarding the Cost/Financial indicators rated as moderate. However, their mean average values were relatively the least one among the four independent indicators. Therefore, the Organization should more work hard to improve the cost/financial indicator in order to improve the warehouse performance.

Overall, the study concluded that the EPSS warehouse performances rated Moderate level of performance, regarding the quality, response time, productivity and financial indicator. Since the current study has used the cross sectional study design, the researcher highly recommends other researchers to conduct the study in the same organization in other method, which may use for the generalizability.

5.4 Recommendations

Based on the conclusions drawn from the findings, the following recommendations put forth to enhance the performance of the warehouses at the Ethiopian Pharmaceutical Supply Service (EPSS) head office:

Strengthen Quality, Response Time, and Productivity: EPSS should maintain and reinforce the positive aspects identified in the quality, response time, and productivity indicators. Special attention should have given to these areas for further improvement of the warehouse performance.

Improve Cost/Financial Indicator: the lower rating received for the Cost/Financial indicator, as reported by the respondents. EPSS should focus on this aspect to enhance warehouse performance. This includes implementing cost-saving measures, reducing the overall cost of warehouse operations, and optimizing financial resources.

Automation processes and Reduce Errors: Many warehouse activities currently performed manually, which leading to potential errors and delays. EPSS should prioritize the implementation of automation where feasible.

This will help minimize errors, reduce operational delays, and enhance overall efficiency in day-to-day warehouse activities. By implementing these recommendations, EPSS can achieve sustainable cost savings through reduced warehouse costs, enhance operational efficiency, and improve customer satisfaction. It is crucial for EPSS to prioritize these actions in order to optimize warehouse performance and ensure the integrity of the pharmaceutical supply chain.

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7 APPEDEX

QUESTIONNAIRE

ADDIS ABABA UNIVERSITY

SCHOOL OF PHARMACY GRADUATE STUDIES DEPARTMENT OF
PHARMACEUTICS AND SOCIAL PHARMACY STREAM OF HEALTH
SUPPLY CHAIN AND LOGISTICS MANAGEMENT

Dear respondents:

I am a graduate student at Addis Ababa University School of Pharmacy in the Department of Pharmaceutics and Social Pharmacy Stream of Health Supply Chain and Logistics Management. Currently, I am conducting a research entitled '*Assessment of Warehouse Performance: A Case of Ethiopian Pharmaceutical supply Agency*' as a partial requirement for the award of Master's Degree in Health Supply Chain and Logistics Management. The purpose of this questionnaire is to gather data for the proposed study, and hence you are kindly requested to assist the successful completion of the study by providing the necessary information. Your participation is voluntary and the questionnaire is completely anonymous. I confirm you that the information you share will stay confidential and only used for the aforementioned academic purpose, thus not affects you in any way rather it will may help you in improving the performance of your company warehouse. Therefore, your genuine, frank and timely response is vital for the success of the study. I want to thank you in advance for your kind cooperation and dedication of your precious time to fill this questionnaire

Note:

1. No need of writing your name

Indicate your answer with a check mark (X) on the appropriate cell for both
Section I and part of Section II questions and circle your choice for question 7 to
9.

- 2.If you need further explanation please do not hesitate to contact me through my
personal phone

+251912631913 or in person

Dagim Ayalew

Section I: Respondents Profile:

1. Age:_____
2. Gender: Female ☐ Male ☐
3. Educational Qualification: ☐ Below College Diploma ☐ College Diploma ☐
First Degree (BSc, BA,) ☐ Second Degree (MA, MSc) ☐ PhD and Above
4. Current Position_____
5. Year of service in the current position_____

Section II: KPI'S For measuring warehouse performance

Please indicate your choice by putting the check mark (x) on the appropriate cell. Where, 1 = StronglyDisagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree.

6. Please indicate the degree to which you agree with the following statements regarding the indicators of warehouse performance in your company. (Please take your key warehouse activities in mined while ratingthe statements).

Cod e.	Measurement Items	Score				
		SD	DA	N	A	SA
Quality Indicator						
QI1	Most of the time our warehouse or storage locations has no inventory discrepancies when bin cards compared with stock cards and physicalinventory count.					
QI2	Most of the time in our warehouse, items are placed in the correct location or bin					
QI3	Most of the time in our warehouse items or lines are picked accurately (i.e., the correct items and quantities) from storage based on a request,					
QI4	Most of the time accidents are not occurred in our warehouse like physical accident on daily laborers, warehouse personnel, and also on equipment’s					
QI5	In our warehouse there are guidelines or standard operating procedures (SOP) in place that provide instructions to prevent theft, deterioration or leakage at a given storage location.					

No.	Measurement Items	Score				
		SD	DA	N	A	SA
Response Time Indicator						
RTI1	Most of the time our warehouse personnel serve our customer on the reasonable time i.e. From the moment an order is received at the storage facility until the time the order is actually shipped to the client.					
RTI2	Most of the time our company makes product available for customer i.e. From the moment the cargo arrives in the port or airport until the moment that it clears customs, arrives at the warehouse, and is ready to distribution.					
RTI3	Most of the time our warehouse personnel serve our supplier and makesproduct ready for shipment on the reasonable time i.e. the amount of time it takes From when a product(s) has been unloaded from a truck after arriving at a warehouse or other storage location to when it is stored in its designated place and is ready for picking.					
Cost/Financial Indicator						
CI1	We are successful in minimizing total carrying/holding cost					
CI2	We are successful in minimizing total product damage in the warehouselike product deterioration, breakage, leakage etc.					
Productivity Indicator						
PI1	Most of the time our warehouse personnel utilizes warehouse spaces properly i.e. the total storage space actually being used out of the total Storage space available					
PI2	Most of the time our daily laborer are not idle i.e. the number of units (e.g., boxes, pallets) or weight moved during a defined period of time,per person-hour, for each person working during that period. It can be considered both when receiving and shipping inventory.					

PI3	Most of the time our warehouse personnel utilizes a reasonable warehouse spaces for product handling i.e. the total storage area that is dedicated specifically to product handling (receiving, unloading, packing, loading, and dispatching)..					
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7. Which key performance indicator do you believe that can heavily contribute to the overall performance of a warehouse?

- A. Quality Indicator B. Response Time Indicator C. Cost/Financial indicator D. Productivity indicator
E. All.

8. Based on your experience what type of Warehouse better enhance warehouse performance?

- A. Private Warehouse B. Public Warehouse C. Automated Warehouse
D. Climate-Controlled Warehouse E. Distribution Center F. Based on situation

9. Based on your experience what size of warehouse better enhance warehouse performance?

- A. Small B. Medium C. Large D. Based on situation