



INFORMATION TECHNOLOGY UTILIZATION ON THE PERFORMANCE OF
WAREHOUSE OPERATIONS: THE CASE OF PHARMACEUTICALS FUND AND SUPPLY
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“Information Technology Utilization on the Performance of Warehouse Operations: The Case of
Pharmaceutical Fund and Supply Agency”

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DECLARATION

I Nigatu Nigus hereby declare that the work which is being presented in this thesis entitled “Information technology utilization on the performance of warehouse operations: The case of pharmaceutical fund and supply agency” is original work of my own, has not been presented for a degree of any other university and that all sources of material used for the thesis have been duly acknowledged.

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CERTIFICATION

This is to certify that Mr. Nigatu Nigus has carried out a thesis entitled “Information technology utilization on the performance of warehouse operations: The case of pharmaceutical fund and supply agency” under my supervision and guidance. This thesis submitted to Addis Ababa University School of commerce department of logistics and supply chain management in partial fulfillment of the requirements for the Degree of Master of Arts in Logistics and Supply chain Management, complies with the regulation of the university and meets the accepted level of standards with respect to originality and quality.

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The Researcher

ACRONYMS and ABBREVIATIONS

PFSA: Pharmaceutical Fund and Supply Agency

WHO: World Health Organization

ICT: Information Communication Technology

IT: Information Technology

MSH: Management Science for Health

SIAPS: Systems for Improved Access for Pharmaceutical and Services.

USAID: United States Agency for International Development

SKU: Stock Keeping Unit

RDF: Revolving Drug Fund

FEFO: First Expired First Out

EDI: Electronic Data Interchange System

WMS: Warehouse Management System

ERP: Enterprise Resource Planning

RFD: Radio Frequency Identification

HCMIS: Health Commodities Management Information System

ABSTRACT

The main objective of this study is to assess the role information technology on the performance of warehouse operations at pharmaceutical fund and supply agency. The study employed descriptive method with a cross-sectional study design. The target population was all professional staffs working under stock and distribution directorate and all of them were included in the study. Therefore the employed sampling technique was census method and the sample size was fifty three (53). Two instruments namely questionnaire and interview methods were used to collect the relevant data. The finding showed that the perceived level of information technology utilization is low with the mean score of 2.34 and the perceived performance of warehouse operation is moderate with aggregate mean score of 3.25. Moreover the employed information technology tool helps to improve the performance of the main warehouse operations (namely inventory accuracy, picking accuracy, put-away accuracy, receiving time, order processing time, and warehouse space utilization) modestly with aggregate mean score of 3.40. In addition the study found that the employed information technology does not prevent theft and leakage of products. The frequent electric power interruption, slow and sometimes unavailability of internet connectivity, inadequate training and support, and low level of staff confidence with the employed information technology are the identified challenges for proper utilization of information technology for warehouse operations management.

Key words: Warehouse, Information, technology, warehouse, operations

CHAPTER ONE

1. Introduction

In this chapter, background of the study and the organization's profile are introduced. The study was about assessing information technology (IT) utilization on the performance of warehouse operations at pharmaceutical fund and supply agency (PFSA). The agency is the governmental entity which has the responsibility to forecast, procure, warehouse, and make distribution of health commodities across the supply chain. In addition statement of the problem, research questions, research objectives, significance of the study, scope of the study, and limitations of the study are also clearly presented here.

1.1 Background of the study

Warehouses management have been going through various challenges such as supply chains are becoming more integrated, more globalized operation, just in time trends, customers are more demanding and technology changes are occurring rapidly (Ramaa, Subramanya and Rangaswamy, 2012). Under these influences, warehouses today are expected to execute more and smaller transactions, handle and store more line of items, provide more product and service customization, offer more value added service, process more returns, receive and ship more international orders. At same time, warehouses today have less time to process an order, less margin of error, less young skilled personnel, and less WMS capability (Frazelle, 2014). Hence the efficient and effective utilization of logistics-related information can enhance firms' ability to reduce costs while simultaneously improving customer satisfaction (Sneha Vishnu More, 2016). Warehouse management systems (WMS) and other ICT tools are frequently implemented and used to cope up these challenges and for efficient and effective utilization of information across the supply chain (Sneha Vishnu More, 2016 and Ramaa, Subramanya and Rangaswamy, 2012).

Pharmaceutical warehousing or warehouse management is about managing the physical movement of stock into, within, out of a warehouse (SIAPS, 2014).The most common and basic types of warehouse activities are receiving/unloading, inspection, put away, storage, inventory control, replenishment, order-picking, checking, packing, cross-docking , staging (possibly) and shipping/loading (USAID, 2014 and Barthoidi , Hachman, 2017).

Warehousing faces problems created in higher level of the supply chain, such as poor quantification leading to incorrect stock procured. In addition in low-income country settings, warehouses are challenged by insufficient human resources, poor physical infrastructure and layout, and lack of good systems to effectively track products throughout the system. These barriers lead to stock-outs, overstocking, and wastage of health resources (SIAPS, 2014).

According to SIAPS (2014), information technology like barcoding or radio frequency identification (RFID) will help to improve poor product traceability, inventory visibility, stock leakage, and security by tracking the products in the warehouse and at every stage of supply chain.

Barcoding has been used successfully to improve health commodities warehouse operations in a number of developing countries like Pakistan and Tanzania. In Pakistan before the introduction of barcoding, the central warehouse used a time-consuming paper based system to track commodities, leading to delays in distribution, a large number of errors, and stock expiring. But after the introduction of barcoding with help of USAID | DELIVER PROJECT, the new system allowed for improved management of shipments, faster distribution of products to the sub-national level with easier tracking of dispatches, and improved control of leaks and theft. Because of the new system, the staff workload declined by approximately 30%, freeing them to complete other warehouse management functions. In addition, the time it takes to produce reports were reduced by 40% to 50% and reporting errors were substantially decreased (SIAPS, 2014).

A large number of central medical store(CMS) in sub-Saharan Africa (like the United Republic of Tanzania, Zambia and the majority of Francophone countries) now have warehouse management systems (WMS) to provide computerized process management and inventory control. The warehouse management system(WMS) support tasks such as ordering, receiving, put-away, replenishment, picking/packing, shipping, cycle counting, and inventory control which aims to reduce lead times, increase storage capacity and improve labor productivity at the CMS (Dickens, 2011).

Inventory management is key component of logistics management. The aim of inventory management is to hold inventories at the lowest possible cost, given the objectives to ensure uninterrupted supplies for ongoing operations. According to MSH (2012) “Inventory management is the heart of pharmaceutical supply chain”. So without healthy inventory management system, the whole pharmaceutical supply chain will not be healthy rather sick and wasteful. The results of poor inventory management are waste of financial resources, shortage or stock outs of some vital medicines, overstock of other leading to expiration, and decline in the quality of patient care (MSH, 2012).

According to Lwiki *et al.* (2013) finding, the inventory management practices such as utilization of information technology has strong positive correlation with the organization financial performance. Investing in modern technology and implementing EDI will help firms to reduce inventory cost and improve returns.

Information technology tools commonly used for warehouse and inventory operations management are warehouse Management System (WMS), Electronic Data interchange System (EDI), Enterprise Resource Planning (ERP), Barcode and Barcode Scanner, Radio-frequency Identification (RFID) and others.

1.2 Background of the organization

Pharmaceutical Fund and Supply Agency (PFSA) was established in 2007G.C. by proclamation no. 553/2007 with the objective of ensuring uninterrupted supply of health commodities to public health institutions with affordable price. The mission statement of organization is “to ensure uninterrupted supply of quality assured pharmaceuticals to the public at affordable price through strengthening integrated supply chain system, enhancing financial and human resources capacity, evidence based quantification, efficient procurement, improved warehousing and inventory management, direct delivery to health facilities, promoting rational use of medicine” (PFSA, 2017).

The pharmaceutical fund and supply agency currently operates with its nineteen hubs throughout the country to fulfill the increasing demand of health products. The agency aims to provide services for health facilities within 180 to 360km radius which is based on geographical

demarcation. Among PFSA hubs, two are located in Addis Ababa and the rest seventeen hubs are found out of Addis Ababa.

The pharmaceutical fund and supply agency is using an automated health commodity management information system (HCMIS) as warehouse and inventory operation management tool (PFSA, 2017). The health commodity management information system (HCMIS) is employed at center and all hubs and at most of high volume health facility. There is computer and mobile based health commodity management information system (HCMIS). There is also web based dashboard used for inventory management.

In Ethiopian, in the last ten years, number of hospitals increased from 73 to 411, health centers from 673 to 3562 and health posts from none to 16,000. For these health facilities, pharmaceuticals fund and supply agency is expected to equip them and continuously supply pharmaceuticals and medical devices (PFSA, 2017).

1.3 Statement of the problem

According to Systems for Improved Access to Pharmaceuticals and Services (SIAPS, 2014), warehousing is a key element of pharmaceutical supply chain management. Since warehousing is an integral part of logistics, good warehouse management helps to ensure the six rights of logistics namely the right products, the right quality, in the right quantity, delivered to the right place, at the right time and for the right cost, through the supply chain system. The researcher has made small scale assessment by presenting simple question “are PFSA’s warehouses contributing greatly to ensure the six rights of logistics?” for ten colleagues. Based the responses, researcher found that PFSA’s warehouses have gaps in fully realizing the six rights of logistics.

Pharmaceutical fund and supply agency (PFSA) is striving to ensure uninterrupted supply of health commodities to the public at affordable price. Since its establishment in 2007, the type and volume health commodities managed through its warehouse is increasing. According to PFSA (2017), warehouse operations like receiving, storage, and dispatch have problems which needs improvement. The warehouse safety and security issue also needs improvement.

The key player in Ethiopian public health commodities supply chain is pharmaceutical fund and supply agency (PFSA) which has the responsibility of quantification, procurement, warehouse

management, inventory management, and distribution of pharmaceuticals. One of the challenges in Ethiopian health commodities supply chain is high and frequent Stock-out rate which is leading to shortage of vital health commodities which may result in therapy discontinuation, death risk, good opportunity to drug resistance especially for the most dangerous cases in Tuberculosis, and poor health care service. Overstock of some commodities is leading to wastage of scarce resource due to expiry. There is also poor commodity tracing system through the supply chain (Mesay, 2016).

For many years, by recognizing the importance of warehousing to overall cost reduction, customer satisfaction, and for performance improvement of the business, the private sector has taken a professional, systematic approach to warehousing. Then after, organizations involved in public health in the developing world have also started to focus on commodity warehousing, by realizing its role as a critical resource for improving public health. Health commodity warehousing Challenges such as the increase in variety of products, or stock keeping units (SKUs), and the demand for reduced processing time, can be addressed by improving inventory and warehouse management with the help of technologies (USAID, 2014).

Warehouse and inventory management are a backbone of pharmaceutical supply system. Good inventory management helps to improve the performance of pharmaceutical supply chain whereas poor inventory management in pharmaceuticals supply chain systems leads to wastage of financial resources, shortage or stock out of some essential medicines or expirations of others due to overstocks (MSH, 2012). On top of this, information technology tools utilization in inventory and warehouse operations management leads to improvement of performance (Gyaw, Adzimah, Brako, 2015).

According to Tsenga *et al.*, (2011), information technology plays a paramount role for firms' performance and provides information flow which makes the supply chain more robust and resilient without undermining its efficiency.

The World Health Organization (WHO) defines access to medicine as a priority for citizens; to ensure this, robust and well-functioning medicine supply chain is necessary. The WHO report shows that the developed and transition economies countries expenditure on medicine ranges from 7% -30% of total healthcare expenditure (both public and private) whereas in developing

world it ranges from 25% - 65% of total health expenditures. In many developing countries' spending on medicines and human resources rank among the top two items in their health care budgets (Dickens, 2011). According to the Asian Development Bank brief (2016), supply chain costs make up about 25% of pharmaceutical costs; investments to strengthen their efficiency and effectiveness should be explored. Hence information technology tools are important to reduce the health commodity supply chain cost by improving the efficiency and effectiveness of warehouse operation in particular, the health commodity supply chain in general.

Warehouse operations management as key components of supply chain management, any inefficiency in warehouse management will greatly affect the performance of the whole supply chain which in turn affects the quality of health care services (Al-Saa'da *et al.*, 2013). So to improve the quality of health care services, effective and efficient health commodity supply chain management system should be in place. The adoption and utilization of ICT tools can help to optimize and improve the performance of warehouse operations (Ramma *et al.*, 2012) and (Barros, Ishikiriyama, Peres, 2015).

Therefore, this study has tried to assess the role of information technology tools on performance of warehouse operations at pharmaceutical fund and supply agency.

1.4 Research questions

The basic research questions of this study are;

1. What is the level of information technology utilization for warehouse operations management at pharmaceuticals fund and supply agency from employees' perspective?
2. What are the role of information technology on the performance of warehouse operations at pharmaceuticals fund and supply agency from employees' perspective?
3. What is the perceived performance of warehouse operations at pharmaceutical fund and supply agency from employees' perspective?
4. What are the challenges associated with the use of information technology in warehouse operations management at pharmaceuticals fund and supply agency from employees' perspective?

1.5 Research objectives

1.5.1 General objective

The main objective of this study is to assess the role of information technology on the performance of warehouse operations at pharmaceutical fund and supply agency.

1.5.2 Specific objectives

The specific objectives of this research are;

- ✓ To assess the level of information technology utilization for pharmaceutical warehouse operation management at pharmaceutical fund and supply agency.
- ✓ To examine the role of information technology on the performance of pharmaceutical warehouse operations at pharmaceutical fund and supply agency.
- ✓ To assess the perceived performance of warehouse operations at pharmaceutical fund and supply agency.
- ✓ To identify the challenges of information technology utilization in warehouse operations management at pharmaceutical fund and supply agency.

1.6 Significance of the study

Pharmaceuticals fund and supply agency have the responsibilities to select, forecast, procure, store , and distribute all health commodities which are primarily required and utilized by public health facilities. To fully realize the mission of the organization, robust and efficient health commodity supply chain which is supported by information technology should be in place.

Warehouse management is the key components of health commodity supply chain which help to provide time and place utility. Poor warehouse management leads to stock out of essential medicines, expiration of products due to over stocks, loses of financial resources, less visibility of products, and incurred high cost in warehouse operations. Generally poor warehouse operations performance greatly affects the whole supply chain performance which finally leads to lack of trust in the system. These situations can be averted by proper warehouse management. The utilization of information technology on the other hand helps to improve performance of warehouse operations and the whole health commodity supply chain (Ramma *et al.*, 2012) and (Barros, Ishikiriyama, Peres, 2015).

This study investigated the role of information technology on warehouse operations at pharmaceutical fund and supply agency. It also tried to identify the level and challenges of ICT utilization at the agency. The identification of challenges in ICT utilization may help the agency to propose a mechanism to solve those challenges. In addition, the findings of this study will be used as input for decision making and further improvement plan. This study may also contribute to the existing body of knowledge and used as reference for future studies in the same area.

1.7 Scope of the study

The scope of the study was limited to central pharmaceutical fund and supply agency located in Addis Ababa Ethiopia. This study investigated the role of information technology (ICT) on the performance of pharmaceuticals warehouse operations. The study also assessed the level, perceived warehouse operation performance and challenges of ICT utilization.

1.8 Limitation of the study

This study was conducted at central pharmaceutical fund and supply agency which did not include PFSA branches. The time and resource constraints were the major challenges that limit the depth of coverage of the research work. Finally limited number of empirical literature in similar study area especially in Ethiopia made it difficult for comparing the results of the study.

1.9 Definition of terms

Warehouse is a building for storage of pharmaceutical products (MSH, 2012).

Inventory is the sum of all usable pharmaceutical products held in warehouse (MSH, 2012).

Warehouse management is about managing the physical movement of stock into, within, out of a warehouse (SIAPS, 2014).

Inventory Management is about managing the product flow within a supply chain to achieve the required customer service level at an acceptable cost.

Operational Definition: The researcher aims to examine the perceived role of information technology on the performance of warehouse operations. Therefore the role of information on the performance of warehouse operations examined only with quality, timeliness, and

productivity perspectives. The financial/cost perspective of warehouse performance is not addressed in this research.

1.10 Organization of the Study

The research is organized in such a way that chapter one includes background of the study, statement of the problems, research questions, research objectives whereas related literature review, and methodology of the study are presented under chapter two and chapter three respectively. Chapter four briefly presents data analysis, interpretations, and discussions parts. Finally summary of findings, conclusions, recommendations, and suggestions for future research are described under chapter five.

CHAPTER TWO

RELATED LITRETURE REVIEW

2. Introduction

Before conducting any research, exhaustive review of the existing body of knowledge has indispensable role to have a clear image about the research area, to develop a conceptual framework, and to identify the literature gaps. Therefore, in this chapter, theoretical and empirical review, the developed conceptual framework, and the identified literature gaps are discussed.

2.1 Theoretical Literature Review

2.1.1 Overview of Warehouse management

Warehouse is a key component of the health commodities supply chain. In the long procurement cycles; any delays in procurement initiation create uncertainty in the supply chain and result in system-wide stock-outs (Yadav, 2015). But pharmaceutical products properly stored within warehouse act as buffers against uncertainties and breakdowns within the supply chain (USAID, 2014). In contrast to these, poor warehousing and distribution results in shortages, stock outs, and lost millions dollars due to expired product in warehouse (SIAPS, 2014). Stock out of vital pharmaceutical in the supply chain cannot be tolerated because the situation will result disruption of health care services. So keeping an appropriate quantity of stock in the warehouse will help to reduce the frequency of stock-out (USAID, 2014). Countries can reduce wastage, expand availability, and save money by improving the storage and distribution of pharmaceuticals (SIAPS, 2014).

There are various types of warehouses: they can be classified into production warehouses and distribution centers (Ghiani, Laporte, and Musmanno, 2004). By their roles in the supply chain they can be classified as raw materials warehouses, work-in-process warehouses, finished good warehouses, distribution warehouses, fulfillment warehouses, local warehouses direct to customer demand, and value-added service warehouses (Frazelle, 2014).

Raw material warehouse holds raw material at or near the point of inductions into manufacturing process. Work in process warehouse is the type of warehouse which holds partially completed assemblies and products at various points along an assembly or production lines. Finished goods warehouses type holds inventory used to balance and buffer the variation between the production schedules and demands. For this purposes, the warehouse is usually located near the point of manufacture. In ward and out ward movement of goods in such type of warehouse is usually in bulk or full pallet. A warehouse serving only this function may have demands ranging from monthly to quarterly replenishment of stock to the next level of distribution (Frazelle, 2014).

Distribution warehouses and distribution centers accumulate and consolidate products from various points of manufacture within a single firm, or from several firms, for combined shipment for customers. Such a warehouse may be located central to either the production location or customer base. The product movement may be typified by full pallets or cases in and full cases or broken cases out. The facility is typically responding to regular weekly or monthly orders. Fulfillment warehouses and fulfillment centers receive, pick, and ship small orders for individual consumers (Frazelle, 2014).

Local warehouses types are distributed in the field in order to shorten transportation distance to enable rapid response to customer demand. Frequently, single items are picked, and the same items may be shipped to customers every day. Value added service warehouse serve as the facility where key product customization activities are executed, including packaging, labeling, marking, pricing, and returns processing (Frazelle, 2014).

2.1.2 Warehouse design or Layout

To ensure the highest level of operational efficiency, conceptual design and facility layout planning are crucial (Jinxiang Gu, Marc Goetschalckx, Leon F. McGinnis, 2007). Warehouse Layout planning is the discipline of assessing the space requirements of a warehouse and specifying how that space should be organized to facilitate identifiable warehouse activities. The main objectives of layout planning are to use space efficiently, to promote the efficient handling of commodities, to provide economical storage and to provide flexibility to meet changing warehousing requirements. In a standard warehouse or storage facility, receiving/shipping and storing/retrieval are two main activities that require space or layout planning (USAID, 2014).

The two main warehouse layout options which are recommended by world health organization (WHO) for storage of pharmaceutical products are the 'U' flow and the 'Through' flow (USAID, 2014). In case of 'U' flow, goods receipt and dispatch are located on the same side of the building. This arrangement may result in congestion if there is heavy incoming and outgoing traffic occurs at the same time. The 'U' flow arrangement has the advantage of good utilization of dock resources, facilitates cross-docking, excellent lift truck utilization, and provides excellent security (USAID, 2014).

In case of 'Through' flow arrangement, goods receipt and dispatch areas are located on opposite sides of the building. The advantage of this arrangement is that there is little risk of congestion at the loading docks. However, security is an increased problem because of the two-sided arrangement (USAID, 2014).

2.1.3 Types of activities in the warehouse/ Warehouse operations

The most common and basic types of warehouse activities are receiving/unloading, inspection, put away, storage, inventory control, replenishment, order-picking, checking, packing, staging, labeling, kitting, cross docking, and shipping/loading. Each activity may have more than one task (USAID, 2014, Barthoidi and Hachman, 2017). Among these activities Order-picking is the most labor-intensive activity in most warehouses. Travel time can be reduced by careful put-away (Barthoidi and Hachman, 2017). These warehouse activities are described below.

Receiving: is the process of unloading supplier vehicles and moving the materials to inspection area (USAID, 2014). Preparation for receiving may begin with advance notification of the arrival of goods. This allows the warehouse to schedule and coordinate receipt and unloading efficiently with other activities (Barthoidi and Hachman, 2017). Receiving involves the physical activity of unloading incoming transports, checking deliveries against purchase orders and recording. Depending on the agreement of both parties, future checks may include quality control. Some or all of the delivered products are either rejected or accepted at this stage. Based on their agreements, rejected goods may send back to the supplier.

Inspection: is the process of drawing sample from shipment and inspect or arrange for inspection to ensure compliance with specifications on purchase orders (USAID, 2014).

Inventory control: is the process of operating manual or automated inventory control system or both and provide directions for moving supplies to/from storage and give information to management on receipts, issues, and stock balances. During physical inventory, coordinate and reconcile inventories with bin-cards and automated records (USAID, 2014).

Put-away: is the process of placing products into the right storage locations after they have been delivered to the warehouse (USAID, 2014).

Storage: Move incoming supplies to storage location (USAID, 2014). Pharmaceutical products and materials storage conditions should be in compliance with the labeling, which is based on the stability testing (WHO, 2003). Pharmaceutical products require controlled storage and transit conditions in order to ensure that their quality is maintained. Proper environmental control such as proper temperature, light and humidity, conditions of sanitation, ventilation, and segregation must be maintained wherever drugs and supplies are stored in the warehouse (Kausar *et al.*, 2013).

Replenishment: is the process of moving products from storage location to special picking locations to facilitate picking (USAID, 2014).

Picking/packing: is the process of gathering the products listed in a customer order and packaging them for shipment (USAID, 2014).

Shipping: is process of loading packages onto transport for distribution to customers (USAID, 2014).

Warehouse is a key element of logistics system and an integral part of supply chain of health commodities. Warehousing is (was) the weakest link of health commodities supply chain. Therefore efficient and effective management and optimization of all warehouse activities are vital to meet or exceed the customer expectation and reduce cost. To achieve these objectives, warehouse management system and other information technology tools have indispensable role (Kiril and Vera, 2013).

2.1.4 Overview of Inventory Management

Inventory management is very key component of logistics management. According to MSH (2012) “Inventory management is the heart of pharmaceutical supply chain”. So without healthy

inventory management system, the whole pharmaceutical supply chain will not be healthy rather sick and wasteful. The results of poor inventory management are waste of financial resources, shortage or stock-outs of some vital medicines, overstock of other leading to expiration, and decline in the quality of patient care (MSH, 2012).

2.1.5 The objective of holding an inventory

In inventory management, there is always trade-off between inventory holding cost and the cost of purchasing and shortage (MSH, 2012). According to management science for health (MSH), the main reasons to keep stock in the warehouse are to ensure availability, to maintain confidence in the systems, to reduce the unit cost of medicine, to avoid shortage costs, to minimize ordering cost, minimize ordering cost, and to cope up with fluctuation in demands.

In the typical pharmaceutical system, one cannot forecast demand with complete accuracy or cannot be certain about supplier performance. Therefore holding reasonable amount of stock within the warehouse is important to ensure availability and maintain confidence in the health care system. Ordering medicine in bulk allows quantity discounts and reduces transport and port-clearance cost which allows for providing affordable products to the public. Changes in demand for specific medicines are often unpredictable, and holding an adequate inventory in a warehouse allows the system to cope up with demand fluctuation (MSH, 2012).

Obviously, pharmaceutical supply system needs to hold reasonable quantity of inventory in the warehouse. However holding high stock level has disadvantages. First large amount of capital can be tied up in inventory and cannot be available for other purposes. In addition, the cost for personnel, utilities, storage facilities, and other inventory holding cost increase. High inventory level also increases the likelihood of losses caused by expiry, spoilage, obsolescence, and theft (MSH, 2012).

2.1.6 Warehouse operations Performance

It is difficult to judge the performance of warehouse operations based on daily observations (Bartholdi and Hachman, 2017). However warehouse performance is measured commonly by using indicators which is present in the majority of works (Staudt *et al.*, 2014). By reviewing literature, Staudt *et al.* (2014) identified indicators utilized by different authors to measure warehouse performance and then classified them according to the dimensions of time, quality,

cost/finance, and productivity. Aronovich *et al.* (2010) defines the four performance indicator dimensions as follows:

- I. **Quality indicators** are often the simplest to implement and measure. Typically, they tell you how well you are performing a specific activity. The common logistics indicator in this classification is accuracy including order accuracy, inventory accuracy, picking accuracy (Aronovich *et al.*, 2010).
- II. **Time indicators** focus on the time it takes to complete specific activities. They show where saving time during specific activities can improve the overall warehouse operations performance. The indicators under time dimension may include order processing time, customs clearance cycle, and put-away time (Aronovich *et al.*, 2010).
- III. **Financial indicators** help managers to identify the supply chain cost drivers and help to move toward a more efficiently managed warehouse operations. The indicators under cost dimension may include total warehousing cost, and value of products damaged in the warehouse (Aronovich *et al.*, 2010).
- IV. **Productivity indicators** examine how well resources are used. The resources may be material handling equipment, labor, vehicles, and warehouse space. Storage space utilization is one of the indicators under productivity dimension (Aronovich *et al.*, 2010).

Generally it is very important to view these indicators holistically to make sure they are harmonized and not working against each other and to identify the tradeoff required to strategically improving the overall warehouse performance.

Inventory Accuracy Rate measures the percentage of warehouse or storage locations that had no inventory discrepancies when stock cards or stock on data base were compared to a physical inventory count out of the total number of locations or warehouses under review, during a defined period of time (Aronovich *et al.*, 2010).

Put-Away Accuracy is the percentage of items placed in the correct location or bin in a warehouse or storage area. This indicator measures a warehouse's ability to stock items in the correct location so they can be quickly and easily located (Aronovich *et al.*, 2010).

Picking Accuracy Rate is defined as the percentage of items or lines of items picked accurately (both the correct items and quantities) from storage based on a request or picking list, and then placed into the appropriate container (Aronovich *et al.*, 2010).

Customs Clearance Cycle measures the amount of time (e.g., minutes, hours, days, and weeks) 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 be put away (Aronovich *et al.*, 2010). Receiving time measures the amount of time elapsed between the moment the cargo arrives at the warehouse and ready for put away.

Put-Away Time measures 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 (Aronovich *et al.*, 2010).

Warehouse order processing time measures the average amount of time from the moment the order is received at the warehouse until the time the order is actually shipped to the client (Aronovich *et al.*, 2010).

Storage Space Utilization shows the percentage of the total storage space actually being used out of the total storage space available (Aronovich *et al.*, 2010).

2.1.7 Commonly Used ICT Tools in Warehouse operations Management

The commonly used information technology tools (IT) to enable effective and efficient management of warehouse operation in particular, the whole supply chain in general include warehouse Management System (WMS), Electronic Data interchange System (EDI), Enterprise Resource Planning (ERP), Barcode and Barcode Scanner, Radio-frequency Identification (RFID) and others.

2.1.7.1 Warehouse Management System (WMS)

According to Gyawu *et al.* (2015) warehouse management system described as the advanced technology and operating processes that optimize all warehousing functions; includes all inventory movements and information flows between these functions.

Warehouse management system primarily aims to control the movement and storage of materials within a warehouse and process the associated transactions, including shipping, receiving, put-away and picking (Ramaa, Subramanya and Rangaswamy, 2012).

2.1.7.2 Radio-frequency Identification (RFID)

Radio frequency identification (RFID) is an emerging technology that is transforming the way warehouse operates. The technology uses radio signals to exchange data between handheld devices and a RFID tag. This technology enables smooth and efficient warehouse operation. It is believed that this type of technology could improve security, productivity, inventory control, and traceability. RFID technology can monitor the temperature of various products like perishable food, vaccine and other pharmaceutical products that need cold chain (Watson, Wysocki, Bucklin, 2015).

2.1.7.3 Electronic Data interchange System (EDI)

EDI is defined as computer-to-computer transmission of standardized business transactions (Walton and Maruchek, 1997). EDI is a drive towards paperless document transfer or transactions. These impacts logistics operating cost through reduced labor and material cost associated with printing, mailing, and handling paper-based transactions and reduced clerical cost. EDI helps to reduce order cycle time and inventory that will help to improve competitiveness and to reduce cost.

2.1.7.4 Barcode and Barcode Scanner

According to Bhandari (2015) bar coding is the placement of computer readable codes on items, cartons, containers, pallets, and even rail cars. The code is a sequence of parallel lines of different thickness with spaces in between which can be read by a scanner. The information printed in bar code includes country code, manufacturer name, product details, date of manufacture, expiry date, batch, etc. These details are required for inventory management at user end.

The bar coding has the advantage of easy identification of inventory items during storage, retrieval, pickup, inspection and dispatch. The use of bar coding also reduce paper work and processing time which may lead to reduce human error and increased logistics system productivity through speed, accuracy and reliability. During order processing the bar code will help in keeping identification of products based their date of entry in the warehouse or their

expiry date. This will ease material storage, replenishment and dispatch FIFO (first in first out) or FEFO (first expired first out) inventory management system. In a warehouse, the barcoding helps in real time updates of inventory records.

2.1.7.5 Enterprise Resource Planning (ERP)

Enterprise Resource Planning (ERP) Systems are Enterprise-wide information systems used for automating all activities and functions of a business. These are transaction-based information systems that are integrated across the whole business. Basically, they allow for data capture for the whole business into a single computer package which gives a single source for all the key information activities of business, such as inventory, customer orders and financials (Jadha. 2015).

Enterprise resource planning need huge investment but has many applications such as financial application, service application, human resource application, and reporting application. The ERP supply chain applications include the modules labeled inventory and supply applications, manufacturing applications, and sales and delivery applications. These three modules support supply chain activity, including raw materials acquisition, production, and customer order fulfillment. These modules incorporate the transactions and processes that initiate the entire range of supply chain activities.

2.2 Empirical Literature Review

Globally, many researches were done by different scholars to investigate information technology and supply chain management issues.

Study conducted in Vietnam textile industry by cause and effect analysis proves that there is a positive and strong relationship between information technology use and high firm performance (i.e. marketing performance, financial performance, and customer satisfaction (Tseng, Wu, Nguyen, 2011).

In 2013, \$300 billion was spent on Supply chain information technology by firms globally, an increase by 1.8% and 3.8% compared to 2012 and 2011, respectively (Harnowo, 2015). This shows that many firms have developing the awareness about the role of ICT in supply chain. Today competition is not between firms rather between supply chains. Therefore information technology enabled Supply chain give competitive edge to firms.

Study on a company that operates in fast-moving consumer goods in Turkey demonstrate that restructuring of the supply chain by using information technologies has positive effects on business performances criterions like supply, production and distribution(Gules, Caghyan, Beduk, 2012).

There are also some studies conducted in Africa to investigate the role of information technology in warehouse management and general in supply chain management.

The study conducted in Nairobi, Kenya revealed that usage of information technology has a positive relationship with logistics performance of Nairobi County firms (Wilson *et al.*, 2015). Another study in western Kenya had investigated the effect of inventory management automation on performance of supermarket and found that inventory management automation affect the performance of the supermarkets. The finding also revealed a positive linear relationship between inventory management automation and the performance of the supermarkets. According to this study, the organizational factors such as size, culture and age of organization, management structure have a moderating effect on relationship between inventory management automation and performance of supermarkets (Samuel, Ondeik, 2014).

The research done in Ghana witnesses a positive relationship between the use of information technology tools and warehouse operation performance (Gyaw *et al.*, 2015).Another study in Kenya showed that information technology plays a pivotal role to enhance warehouse performance (Karimi, Namusonge, 2014).

The study on sugar manufacturing firms in Kenya revealed that inventory management practices such as information technology, lean inventory system, and strategic supplier partnerships have strong positive correlation with the organization financial performance and based on their finding the researcher recommended that investing in modern technology and implementing EDI will help the firm to reduce inventory cost and improve returns (Lwiki *et al.*, 2013).

Barcoding has been used successfully to improve health commodities warehouse operations in a number of developing countries like Pakistan and Tanzania. In Pakistan before the introduction of barcoding, Central Warehouse used a time-consuming paper system to track commodities, leading to delays in distribution, a large number of errors, and expiration of stock. But after the introduction of barcoding, the new system allowed for improved management of shipments,

faster distribution of products to the sub-national level with easier tracking of dispatches, and improved control of leaks and theft. Because of the new system, the staff workload declined by approximately 30%, freeing them to complete other warehouse management functions. In addition, the time it takes to produce reports were reduced by 40% to 50% and reporting errors were substantially decreased (SIAPS, 2014).

The analysis of scientific articles published from 2009 to 2014 time horizon result suggest that information technology contributes to the management of the supply chain, especially in terms of quality, reliability and accuracy of information , operational efficiency and process improvement , and integration and collaboration (Barros *et al.*, 2015). According to Bhandari (2015) who had made an investigation about the impact of technology on logistics and supply chain management concluded that “technology is a vehicle to enhance supply chain competitiveness and performance by enhancing the overall effectiveness and efficiency of logistics system.”

Generally there is no or some studies which specifically examining the effect of information technology on performance of warehouse operation in supply chain of health commodities. But the result found in other supply chain can also be applied for pharmaceutical warehouse management. The professional and systematic approach used by the private sector is directly applicable to the challenges public health warehousing face in countries around the world (USAID, 2014).

So far there is no research conducted to assess the role of information technology on the performance pharmaceutical warehouse operations management at pharmaceutical fund and supply agency. Hence, this research endeavor has tried to fill the gaps.

2.3 Conceptual Framework of the Study

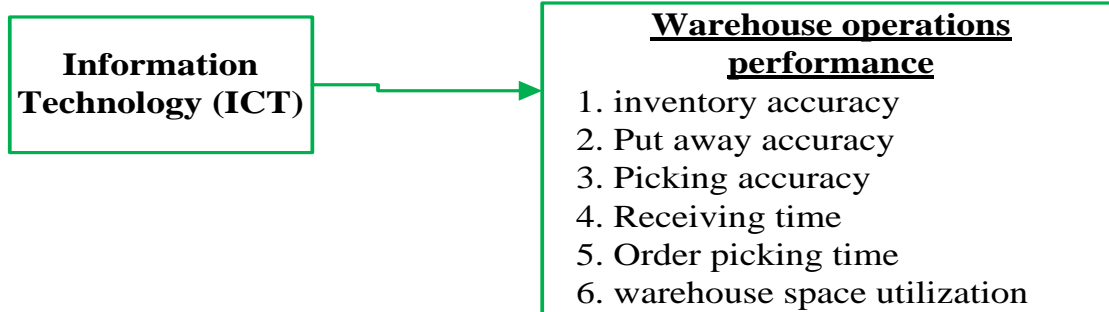
A conceptual framework is researcher’s synthesis of literature on how to explain the phenomena. It elucidates the main thing to be studied such as key factors, concepts, variables and presumed relationship among them; either graphically or in narrative form. According to Pandey and Pandey (2015), variable is a concept which can take on different quantitative values. The dependent variable is the one which depends upon or the consequence of the other variable whereas the independent variable is the antecedent of dependent variable (Kothari, 1990). In this

study, the independent variable is information technology (ICT) and the dependent variable is the performance of warehouse operations.

Based on the existing body of knowledge, the researcher developed the following conceptual framework.

Independent Variable

Dependent Variable



Source: Author (2018)

2.4 Identified Literature Gap

The researcher reviewed articles of different scholars which were conducted in the area of supply chain management, warehouse, and information technology. Most these studies had the aim of examining the role of ICT in the supply chain and its impact on the supply chain performance. The researcher also reviewed researches which were conducted in developing countries among which some of them had the aim of investigating warehouse and information technology issues. But all most all reviewed literatures were conducted in business sectors and not addressing the issues in health commodities supply chain. The researcher did not find any research which was conducted at pharmaceutical fund and supply agency (PFSA) to examine the role of information technology on warehouse operations performance. Hence, this research endeavor will try to fill that gap and will be used as a reference for future studies in the same area.

CHAPTER THREE

METHODOLOGY OF THE STUDY

3. Introduction

This chapter discusses the research design, sample and sampling method, data source and data collection instruments, data collection procedure and methods of analysis.

3.1. Description of the Study Area

The study was conducted at central pharmaceutical fund and supply agency (PFSA) which is located in Addis Ababa. The agency is a legal entity established under the law of Federal Democratic Republic of Ethiopia Government to assure uninterrupted supply of health commodities to the public at affordable prices. Currently the agency has nineteen branches among which only two branches are found in Addis Ababa and the rest are located out of Addis Ababa. The hubs are providing services based on geographical demarcation.

3.2 Research Design

Research design is a master plan or blue print which guides how the study will be conducted (Kothari, 1990). Basically there are two main approaches to research problems namely quantitative and qualitative methods. There is also a mixed approach which involves both qualitative and quantitative research design. In this research, a mixed approach with more of quantitative in nature was adopted.

The aim of this study is to assess the role of information technology (IT) on the performance of warehouse operations at central pharmaceutical fund and supply agency (PFSA). The researcher assessed the level of information technology utilization and perceived performance of warehouse operations management. The investigator has also tried to identify some of the challenges of information technology usage in warehouse operations management.

In order to answer research questions like “what is/ are?” or “how?” descriptive method is pretty much suit. Therefore for this study purpose, descriptive method with cross sectional design was adopted. According to Kothari (1990) descriptive research studies are concerned with describing a particular individual, group or situations. The main feature of descriptive research is that the researcher has no control over the variables rather he can only report what has happened or what is happening. Descriptive research is not merely description, good descriptive study will broad

the knowledge base about a particular individual, group, situation, or problem. According to Yalew (2006), descriptive research can investigate the level or significance of relationship between variables but do not determine or establish cause and effect relationships.

3.3 Population

In central pharmaceutical fund and supply agency (PFSA), Stock and Distribution Directorate have the responsibility of warehouse operations management. The Directorate is led by stock and distribution directorate director under which there are two teams namely revolving drug fund (RDF) team and health program team. In these two teams, there are different positions such as revolving drug fund coordinator, health programs coordinator, stock and distribution officers, warehouse managers, warehouse supervisors, data clerks and etc.

The population is a source from which samples will be formed (Pandey and Pandey, 2015). The target population for this study was all professionals working in relation to warehouse operations at central pharmaceutical fund and supply agency (i.e. the target population was all professionals working under stock and distribution directorate). Under stock and distribution directorate, there were (53) fifty three professional staffs who have the responsibility of managing and executing all warehouse operations. Hence, the target population for this study was fifty three (53) professional staffs.

3.4 Sample and Sampling methods

Sampling methods is a techniques or procedure by which a sample is formed from a target population (Pandey and Pandey, 2015). According to Yalew (2006), the two basic types of sampling methods are random or probability sampling, and non-probability sampling. In case of probability sampling, each individual of the population has equal probability to be taken into the sample (Pandey and Pandey, 2015).

For this study purpose, Census method was used by incorporating all elements of target population who were working under stock and distribution directorate. Therefore, the sample size of study was fifty three (53).

3.5 Data Sources and Data Collection Instruments

In this study, both primary and secondary sources of data were used. The main data collection instrument was a structured questionnaire by which the primary data were collected. According

to Kothari (1990), questionnaire is considered as a key tool to collect the primary data. Each questionnaire items were developed carefully to answer a research questions. The interview method was also used as data collecting method to support the data that were collected by using questionnaire. For interview, stock and distribution director, health program team coordinator, and RDF team coordinator were purposively selected. Secondary sources of data were obtained from published journals, books and internets.

3.6 Ethical Considerations

The necessary explanation about the purpose of the study and its procedure was given and verbal consent was reached with respondents. To assure confidentiality, anonymous questionnaires were collected after explaining to the respondents that writing name is not needed.

3.7 Validity and Reliability

Validity of the study

To ensure validity of a study, a pilot study was conducted and the results were scrutinized. The purpose of a pilot study is to identify possible errors in the measurement procedures such as ambiguous instructions and inadequate time limit given to fill the questionnaire items. It also helps to ensure the understandability the question items.

The researcher administered the questionnaire for five respondents who are working in stock and distribution directorate. The respondents were asked to fill the questionnaire in 25mintes and the researcher was there to assist them. They also asked to comment on the format and wording of the questionnaire. By taken their comments into account, a few changes were made to the questionnaire. Some of the changes were related to questionnaire's format and spelling errors.

Reliability

A reliability test was performed in order to see whether the study was given similar results if the same study is repeated. To ensure reliability of this study, a Cronbach's Alpha test was performed to check the reliability of data collecting instrument i.e. a five point likert scale questionnaire.

Reliability Statistics

| Cronbach's Alpha | N of Items |
|------------------|------------|
| .703 | 31 |

As indicated above the overall Cronbach's alpha score of the data collected from 50 respondents is 0.703. According to Nunnally, (1978) Cronbach's alpha score of 0.7 and above is an acceptable reliability coefficient.

3.8 Data Collection procedures

The primary sources of data were obtained by administering a structured questionnaire. By interviewing the directors and team coordinators, some qualitative data were also collected to support quantitative data that were collected by using questionnaire.

3.9 Methods of Data analysis

The quantitative data that were collected by using a five point likert scale questionnaire were coded and entered into Statistical Package for Social Sciences (SPSS version 20) to compute descriptive statistics. The descriptive statistics like mean and standards deviation were presented in table. The qualitative data that were collected by interviewing the respondents were presented in narration. The data collected by both methods were triangulated. The qualitative data were used to support the quantitative data.

CHAPTER FOUR

RESULTS, DISCUSSION, and INTERPRETATION

4. Introduction

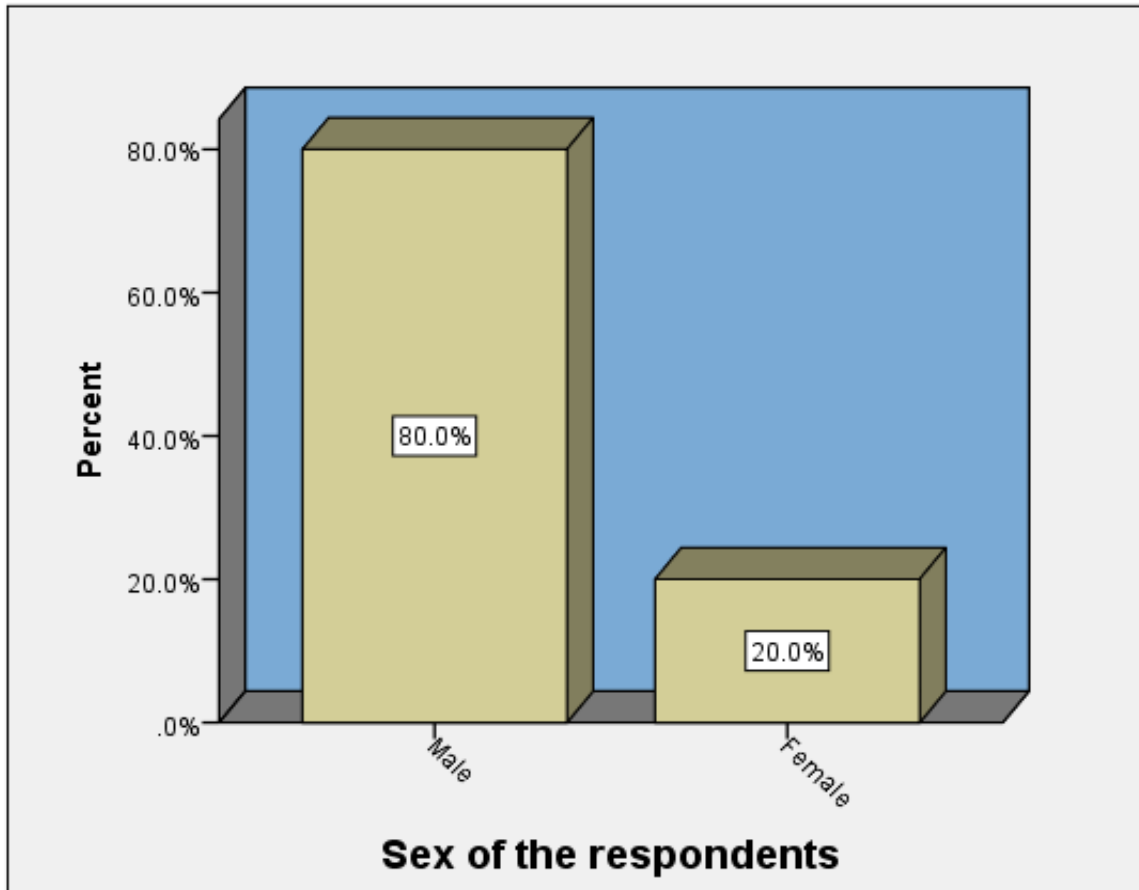
This chapter presents the analyzed data and the findings that were obtained from the primary data which were collected by using a five point liker scale structured questionnaire. Data analysis was done in line with the objectives of the study which were: to assess the level of information technology utilization, to assess the role of information technology in the performance of warehouse operations, to assess the perceived performance of warehouse operations and to examine the challenges associated with information technology utilizations in case of pharmaceutical fund and supply agency (PFSA).

4.1 Response Rate

Among the distributed 53 questionnaire, 50 complete questionnaires were collected. During data collection time, three respondents were not available at the works place for different reasons. Therefore the response rate is 94.30 percent.

4.2 Demographic Characteristics of the Respondent

4.1.1 Gender of the Respondents



Source: Own Survey, 2018

Figure4. 1: Gender of the respondent

Figure 4.1 shows gender compositions of the respondents. The majority of respondents (i.e. 80%), are males. The numbers of male respondents are much higher than that of female respondents. This shows that under stock and distribution directorate majority of workers are male workers.

4.1.2 Age of the Respondents

Table4. 1: age of the respondent

| | Frequency | Percent |
|----------------|-----------|---------|
| Valid 21-30yrs | 15 | 30 |
| 31-40yrs | 34 | 68 |
| Above 40yrs | 1 | 2 |
| Total | 50 | 100 |

Source: Own survey, 2018

As depicted in table 4.1, almost all of respondents' 52 (98%) are within 21 to 40 years of age. This shows that most of the stock and distribution directorate workers are adult. As result of this the investigator believed that the respondent would have good awareness about the employed information technology and gave reliable data.

4.1.3 The Current Position of the Respondents

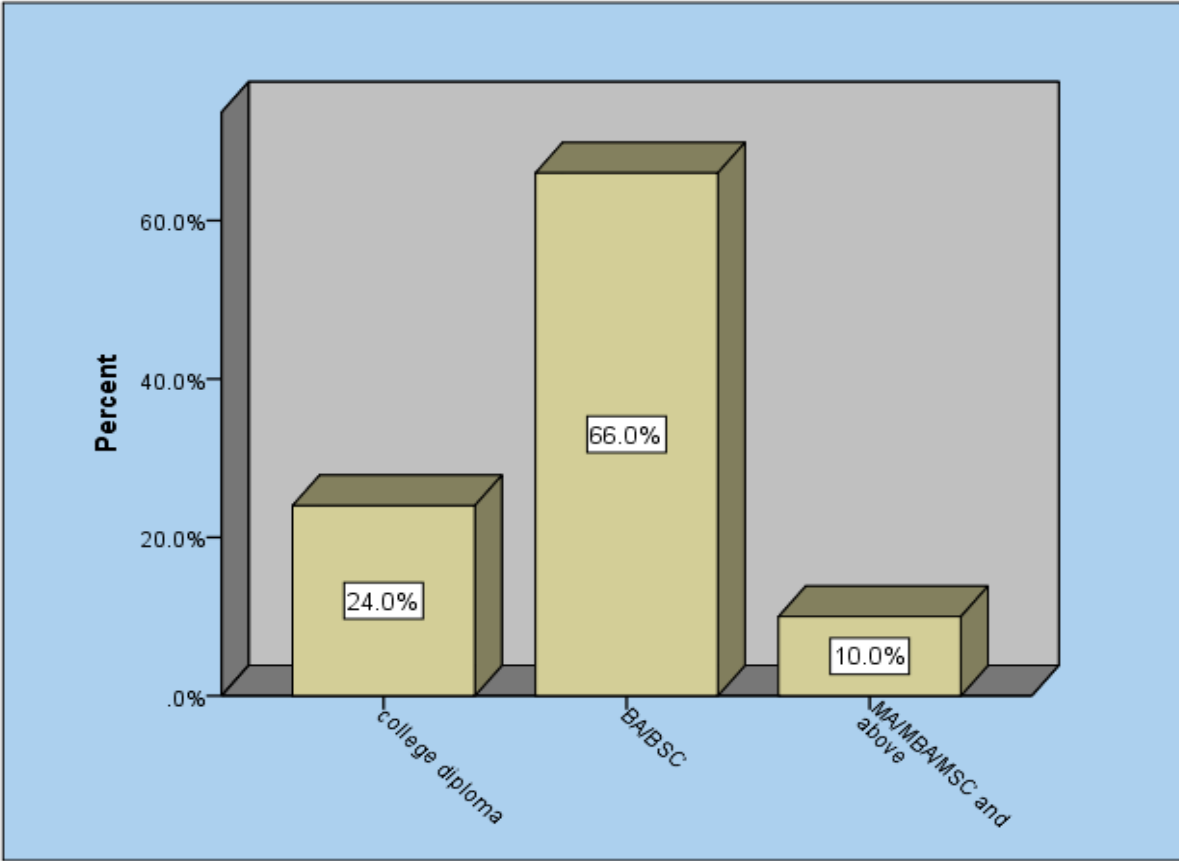
Table4. 2: current position of the respondents

| Position | Frequency | Percent |
|---|-----------|---------|
| Stock and distribution directorate director | 1 | 2 |
| Revolving drug fund coordinator | 1 | 2 |
| Health program coordinator | 1 | 2 |
| Warehouse manager | 24 | 48 |
| Stock and distribution officer | 19 | 38 |
| Warehouse supervisor | 2 | 4 |
| IT officer | 1 | 2 |
| Data Clerk | 1 | 2 |
| Total | 50 | 100 |

Source: own Survey, 2018

As presented in table 4.2, 48% of respondents were Warehouse managers whereas 38% of respondents were Stock and distribution officers. This shows that under stock and distributions directorate, most of professionals are warehouse managers, and stock and distribution officers.

4.1.4 The Qualification Level of the Respondents



Source: Own Survey, 2018

Figure4. 2: Respondent qualification level

As figure 4.2 indicates, majority of the respondents i.e. 66% were first degree holders whereas 24% of the respondents were college diploma holders. The respondents with first degree and above qualification level accounts 76% of the total respondents. As a result of this the researcher believed that the respondents could easily understand the questionnaire items and gave the correct answers.

4.1.5 Work Experience of the Respondents

Table4. 3: work experience of the respondents

| | Frequency | Percent | Cumulative Percent |
|------------------|-----------|---------|--------------------|
| Valid below 2yrs | 12 | 24 | 24 |
| 2-5yrs | 10 | 20 | 44 |
| 6-10yrs | 21 | 42 | 86 |
| above 10yrs | 7 | 14 | 100 |
| Total | 50 | 100 | |

Source: Own survey, 2018

As table 4.3 illustrates the respondents with work experience of below 2 years, 2-5 years, 6-10 years, and above 10 years accounts 24%, 20%, 42%, and 14% respectively. Majority of respondents (76%) have had two and above two years of experience at their current position. Hence the researcher believed that the respondents have had enough experience and gave correct answer for each question items.

4.3 The level of information technology (IT) utilization in warehouse operations

Table4. 4: Level of information technology utilizations

| S.no | Items | Frequency | | | | | Mean | Std. Deviation |
|------|--|-----------|----|----|----|----|------|----------------|
| | | SD | D | NS | A | SA | | |
| 1 | The agency is using information technology(IT) to manage the receiving activities of products into the warehouse | - | - | - | 35 | 15 | 4.3 | 0.46 |
| 2 | The agency is using information technology(IT) to manage the put-away activities(placing products into the right storage locations) of products into the warehouse | 5 | 23 | 22 | - | - | 2.34 | 0.66 |

| | | | | | | | | |
|---|---|---|---|----|----|----|------|------|
| 3 | The agency is using information technology(IT) to manage the order picking activities products within the warehouse | - | 2 | 11 | 33 | 4 | 3.78 | 0.65 |
| 4 | The agency is using information technology(IT) to generate invoices for receipts and issued products to/from warehouse | - | - | | 27 | 23 | 4.46 | 0.50 |
| 5 | The agency is using information technology(IT) to track batch, manufacturing, and expiry date of the products within the warehouse | - | - | 1 | 33 | 16 | 4.3 | 0.51 |
| 6 | The agency is using information technology(IT) to control and track overstocked, slow moving, under stocked, near expiry, and stock out products within the warehouse | - | - | 3 | 36 | 11 | 4.16 | 0.51 |
| 7 | The agency is using information technology(IT) to generate useful report easily to support decision making (provide real time data) | - | 2 | 12 | 31 | 5 | 3.78 | 0.68 |
| 8 | The level of information technology(IT) usage for warehouse operations is minimal | - | 8 | 5 | 33 | 4 | 3.66 | 0.85 |
| 9 | The management recognize the importance of information(IT) for warehouse operations management | - | - | 10 | 34 | 6 | 3.92 | 0.57 |

N=50

Source: Own Survey, 2018

The questionnaire items were designed using 5 point Likert scale to collect appropriate data from each respondent. Therefore the respondents showed their level of agreement with the statements by choosing: 5-Strongly Agree, 4-Agree, 3-Not sure, 2-Disagree, and 1-Strongly Disagree. A mean (M) score of 1-1.80 means that the respondents strongly disagreed, 1.90 to 2.60 means they disagreed, 2.70 to 3.40 means the respondents were not sure, 3.50-4.20 means they agreed and a mean score of 4.30 above means the respondents strongly agreed with the statement. A

standard deviation of >0.9 implies high variability in the respondents level of agreement with the statement.

As depicted in table 4.4, Most of the respondents strongly agreed (with mean score of 4.30) that the agency is using information technology (IT) to manage the receiving activities of products into the warehouse. The respondents disagreed (with mean score of 2.34) on the statement which says that agency is using information technology (IT) to manage the put away activities of the products into the right storage location. Majority of the respondents agreed (with mean score of 3.78) that the agency is using information technology to manage the order picking activities during customers order fulfillment. Most respondents strongly agreed (with mean score of 4.46) that agency is using information technology (IT) to generate invoices for receipts and issued products to/from warehouse.

The majority of respondents strongly agreed (with mean score of 4.3) that the agency is using information technology (IT) to track batch, manufacturing, and expiry date of the products. In addition most of the respondent agreed (with mean score of 4.16) that control and track overstocked, slow moving, under stocked, near expiry, and stock out products within the warehouse.

Again most of the respondents agreed on the statements namely the agency is using information technology (IT) to generate useful report easily to support decision making, level of information technology usage for warehouse operations is minimal, and the management recognize the importance of information for warehouse operations management) with mean score of 3.78, 3.66 and 3.92 respectively.

Majority of the respondents agreed that the level of information technology utilization in warehouse operations is low. This finding is consistent with the data collected by interview methods. The interviewees perceived that the level of information technology utilization for warehouse operations is minimal. Hence in addition to improving the existing information technology tool, the agency needs other technology like barcode technology and CCTV Camera.

Even though the perceived level of information technology utilization is low, still the agency is utilizing information technology to manage receiving, order picking, and to control and monitor the stock status of health commodities. This finding is comparable with study conducted in

Ghana which had investigated the effect of information technology on the performance of warehouse operations (Gyaw *et al.*, 2015).

4.4 The Performance of Warehouse Operations.

Table4. 5: warehouse operations performance

| S.no | Items | Frequency | | | | | Mean | Std. Deviation |
|---|--|-----------|----|----|----|----|------|----------------|
| | | SD | D | NS | A | SA | | |
| 1 | The agency warehouses inventory accuracy rate is good enough | - | 5 | 8 | 36 | 1 | 3.66 | 0.69 |
| 2 | The agency warehouses put-away accuracy is at good level | 2 | 11 | 21 | 16 | - | 3.02 | 0.84 |
| 3 | The agency warehouses picking accuracy is at good level | - | 5 | 11 | 31 | 3 | 3.64 | 0.75 |
| 4 | The time elapsed/required to process an order is minimal(or within reasonable time period) | - | 4 | 11 | 33 | 2 | 3.66 | 0.69 |
| 5 | The time elapsed to receive the incoming commodities is minimal(or within reasonable time period) | - | 5 | 14 | 30 | 1 | 3.54 | 0.71 |
| 6 | The agency warehouses space utilization is good enough | 10 | 31 | 9 | - | - | 1.98 | 0.62 |
| Aggregate mean and average Std. deviation | | | | | | | 3.25 | 0.73 |

N=50

Source: own survey, 2018

As indicated in table 4.5 most of the respondents agreed with the statements namely the agency warehouses inventory accuracy rate is good enough, the agency warehouses picking accuracy is at good level, the time elapsed/required to process an order is minimal (or within reasonable time period), and the time elapsed to receive the incoming commodities is minimal (or within reasonable time period) with the mean score of 3.66, 3.64, 3.66, and 3.54 respectively. However majority of the respondents disagreed (with mean score of 1.98) with the statement which says

that the warehouse space utilization is good enough. Most of the respondents were not sure about the warehouses put-away accuracy with mean score of 3.02.

Generally the overall perceived performance of warehouse operations is moderate with aggregate mean score of 3.25 and average std. deviation 0.73.

4.5 The Role of Information Technology on the Performance of Warehouse operations

Table4. 6: The role of information technology on the performance of major warehouse operations

| S.no | Items | Frequency | | | | | Mean | Std. Deviation |
|------|---|-----------|----|----|----|----|------|----------------|
| | | SD | D | NS | A | SA | | |
| 1 | The employed information technology(IT) tool helps to improve inventory accuracy | - | 2 | 4 | 43 | 1 | 3.86 | 0.50 |
| 2 | The employed information technology(IT) tool helps to improve put-away accuracy | 1 | 20 | 26 | 3 | - | 2.62 | 0.64 |
| 3 | The employed information technology(IT) tool helps to improve order picking accuracy during customer order fulfillments | - | - | 10 | 37 | 3 | 3.86 | 0.50 |
| 4 | The employed information technology(IT) tool helps to reduce order processing time | - | 1 | 7 | 37 | 5 | 3.92 | 0.57 |
| 5 | The employed information technology(IT) tool helps to reduce product receiving time | - | 1 | 5 | 38 | 6 | 3.98 | 0.55 |
| 6 | The employed information technology(IT) tool helps to improve warehouse space utilization | 9 | 24 | 17 | - | - | 2.16 | 0.71 |
| | Aggregate mean and average Std. deviation | | | | | | 3.4 | 0.58 |

N=50

Source: own survey, 2018

As presented in table 4.6, most of the respondents agreed with statements namely the employed information technology (IT) tool helps to improve inventory accuracy, the employed information technology (IT) tool helps to improve order picking accuracy during customer order fulfillments, the employed information technology (IT) tool helps to reduce order processing time and the employed information technology (IT) tool helps to reduce product receiving time with the mean score of 3.86, 3.86, 3.92 and 3.98 respectively. The findings are comparable to one study which was conducted in Pakistan and after introduction of barcode at central warehouse of Pakistan, most of warehouse operations shows improvement (SIAPS, 2014).

However majority of the respondents disagreed on the statement which says that the employed information technology (IT) tool helps to improve warehouse space utilization with the mean score of 2.16 whereas most of the respondents were not sure (with mean score 2.62) about item number 2 which says that the employed information technology (IT) tool helps to improve put away accuracy.

Table4. 7: The role of information technology on the performance other warehouse related activities.

| S.no | Items | Frequency | | | | | Mean | Std. Deviation |
|------|--|-----------|----|----|----|----|------|----------------|
| | | SD | D | NS | A | SA | | |
| 1 | The employed information technology(IT) tool helps to reduce wastage due to expiry by commanding first expired first out(FEFO) principle | - | 1 | 3 | 33 | 13 | 4.16 | 0.62 |
| 2 | The employed information technology(IT) tool helps to enhance stock visibility within the warehouse | - | - | 3 | 39 | 8 | 4.10 | 0.46 |
| 3 | The employed information technology(IT) tool helps to reduce paper based works and human errors | - | - | 2 | 35 | 13 | 4.22 | 0.51 |
| 4 | The employed information technology(IT) tool helps to prevent theft and leakage of products | 6 | 30 | 12 | 2 | - | 2.20 | 0.70 |
| | Aggregate mean and average Std. deviation | | | | | | 3.67 | 0.57 |

Source: own survey, 2018

N=50

As presented in table 4.7, most of the respondents agreed with question items number 1, 2, and 3 with mean score of 4.16, 4.10, and 4.22 respectively. They perceived that the employed information technology tool helps to reduce wastage due to expiry by commanding first expired first out (FEFO), to enhance stock visibility, and to reduce paper based works and human errors. However majority of the respondents disagreed about the role of employed information technology in preventing theft and leakage of products with mean score of 2.20. The findings are comparable with study conducted in Pakistan which investigated warehouse performance after introduction of barcode at central warehouse (SIAPS, 2014). The findings are also comparable with the study conducted in Ghana (Gyaw *et al.*, 2015).

4.6 Challenges Associated with the Use of Information Technology in Warehouse

Table4. 8: Challenges associated with information technology utilization in warehouse operations.

| S.no | Items | Frequency | | | | | Mean | Std. Deviation |
|------|--|-----------|----|----|----|----|------|----------------|
| | | SD | D | NS | A | SA | | |
| 1 | Frequent electric power interruptions/outages make it difficult to use the information technology(IT) | - | 2 | 4 | 28 | 16 | 4.16 | 0.74 |
| 2 | The employed information technology(IT) is not user friendly or requires longer time to learn it | 2 | 19 | 18 | 10 | 1 | 2.78 | 0.89 |
| 3 | Slow and sometimes unavailability of internet connectivity is a barrier for efficient utilizations of the information technology(IT) | - | - | 3 | 31 | 16 | 4.26 | 0.56 |
| 4 | Inadequate training and support makes it difficult to use the information technology (IT) effectively | - | 3 | 9 | 27 | 22 | 3.92 | 0.80 |
| 5 | Inadequate staffs knowledge and skill is a challenge for efficient utilization of information technology(ICT) | 1 | 8 | 16 | 22 | 3 | 3.36 | 0.90 |
| 6 | low level of staff confidence in the employed information technology(IT) is one of the challenge for effective utilization | 2 | 4 | 13 | 20 | 11 | 3.68 | 1.04 |

N=50

Source: own survey, 2018

As show in table 4.8, most of the respondents agreed that frequent power interruptions, slow and sometimes unavailability of internet connectivity, inadequate training and support, and low level of staff confidence in the employed information technology are the challenges associated with the use of information technology in warehouse operations management with mean score of 4.16, 4.26, 3.92, and 3.68 respectively. High variability have been seen (with std. deviation 1.03884) in the respondents' level of agreements about with item number 6. The finding is comparable with study conducted in Ghana which had investigated the effect of information technology on the performance of inventory and warehouse operations (Gyaw *et al.*, 2015).

However majority of the respondents were not sure about items number 2 & 5 with mean score of 2.78 &3.36 respectively.

Some qualitative data were collected by using semi structured guiding interview methods and the result presented as follows.

Currently the agency is using information technology namely health commodities management information system (HCMIS) and web based dashboard to facilitate warehouse and inventory operations management. The interviewee admitted that the information technology utilization level in warehouse operations is not at good level which needs improvement. In addition to improving the existing information technology tool, the agency needs other technology like barcode and CCTV camera. The role of information technology in warehouse operation needs improvement.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5. Introduction

This chapter presents summary of findings, conclusion, recommendation and direction for future research. Based on the results of the study, conclusions were drawn and recommendations were made.

5.1. Summary of findings

As the respondent perceived, the agency is using information technology (IT) to manage receiving and order picking activities with mean score of 4.30 & 3.78 and std. deviation of 0.463 & 0.648 respectively. However they were not sure whether agency is using information technology to manage put-away activities or not.

The agency is using information technology to generate invoices for receipt and issued products at same time the agency also using information technology to track the batch, manufacturing and expiry date of products with mean score 4.46 & 4.30 and std. deviation of 0.503 & 0.505 respectively. To control and track overstocked, under stocked, near expiry and stock out products and to generate use full report, the agency is using information technology with mean score of 4.16 & 3.78 and std. deviation of 0.509 & 0.678 respectively. The management body of the agency recognizes the importance of information technology for warehouse operation management with mean score 3.92 and std. deviation 0.565.

Even though most of the respondents perceived that the agency is using information technology to manage different warehouse activities like receiving and order picking, still majority of the respondents perceived/agreed that the level of information technology usage for warehouse operation is low with mean score of 3.66.

Most of the respondents perceived that inventory accuracy rate and picking accuracy are at good level with mean score of 3.66 & 3.64 and std. deviation 0.688 & 0.749 respectively while order processing time and receiving time are minimal with the mean score 3.66 & 3.54 and std. deviation 0.688 & 0.705 respectively. But most of the respondents were not sure about put away

accuracy with mean score of 3.02 and std. deviation 0.844 and they perceived that warehouse space utilization is not good enough with mean score of 1.98 and std. deviation 0.622. Generally the performance warehouse operations is modest with aggregate mean of 3.25 and average std. deviation 0.73.

The employed information technology (IT) tool helps to improve the performance of the main warehouse operations modestly with aggregate mean score of 3.40 and average std. deviation .58. The technology helps to improve inventory accuracy, picking accuracy, receiving time and order processing time with mean score of 3.86, 3.86, 3.92 and 3.98 respectively. But the employed information technology does not help for improving warehouse space utilization with mean score 2.16 and std. deviation 0.71.

The employed information technology tool plays a role in improving the performance of other warehouse and related activities with the aggregate mean of 3.67 and average std. deviation 0.57. It helps to reduce wastage due to expiry, enhance stock visibility, and reduce paper based works and human errors with mean score of 4.16, 4.10, and 4.22 respectively. But the existing information technologies do not to prevent theft and leakage of products with mean score of 2.20 and std. deviation of 0.69.

Frequent electric power interruption, slow and sometimes unavailability of internet connectivity, inadequate training and support, inadequate staff knowledge and skill, and low level of staff confidence in the employed information technology are the identified challenges in the use of information technology for warehouse operations management with mean score of 4.16, 4.26, 3.92, 3.36 and 3.38 respectively.

5.2. Conclusion

Based on the finding of the study, the following conclusions were made;

5.2.1. Level of Information Technology Utilization for Warehouse Operations

Even though the agency is using information technology (IT) to manage warehouse operations such as receiving, order picking, and inventory controlling and tracking, the perceived level of information technology (IT) utilization in warehouse operations is low. The management bodies

of the agency have had recognition on the importance of information technology to improve the performance of warehouse operations.

5.2.2. The Perceived Performance of Warehouse Operations

The perceived performance of warehouse operations is modest with aggregate mean score of 3.25. This might be due to low level of information technology utilization in warehouse operations. By maximizing the role of information technology and improving other related factors, the agency should have to improve the performance of warehouse operations to fully realize the six rights of logistics.

5.2.3. The Role Information Technology on the Performance of warehouse Operations

The perceived role of the employed information technology in improving the performance of the major warehouse operations (i.e. inventory accuracy, put-away accuracy, picking accuracy, receiving time, order processing time, and warehouse space utilizations) is modest. This might be due to low level of information technology utilization in warehouse operations management and the associated challenges. But the employed information technology tool plays a high role in improving the performance of other warehouse and related activities (i.e. wastage reduction due to expiry, enhancing stock visibility, and reduction of paper based works and human errors).

5.2.4. The Challenges Associated with Information Technology Utilization

The perceived challenges in the utilization of information technology for warehouse operations managements are frequent electric power interruption, slow and sometimes unavailability internet connectivity, inadequate training and support, and low level of staff confidence in the employed information technology.

5.3. Recommendation

Based on the research finding, the following recommendations are suggested for considerations

- ✓ The level of information technology utilization for warehouse operations is minimal. Therefore strengthening the existing information technology by adding additional feature and integrating it with other technology like barcode is important to improve

- the performance of warehouse operations. Since the management recognizes the importance of information technology, persuading them might be an easy task.
- ✓ The existing information technology does not prevent theft and leakage of products. The agency warehouses are managing health commodities their values estimated around many billion birr. In addition to security guards, to improve the security, and prevent and detect theft and leakage of products, information technology system plays indispensable role. Therefore the researcher recommends buying and using of CCTV camera at each warehouse.
 - ✓ Since frequent electric power interruption is one of the challenges, the researcher recommends stand by generators for those warehouse which does not have generators
 - ✓ Giving training and support is important to scale up the knowledge and skills of staffs about the existing information technology.

5.4. Future Research Forward

The scope of this research endeavor was limited to central pharmaceutical fund and supply agency. The result of this study could not show the situation at branch level. Therefore it is better if other researcher investigate the role of information technology on the performance of warehouse operations at PFSA branch level. It would be also interesting if other researcher conduct the same study in pharmaceutical manufacturing industry warehouses found in Ethiopia. This is important to have country level image and for experience sharing and scale up, and for benchmarking.

The performance of warehouse operation is not only affected by information technology (ICT) rather warehouse layout, availability of material handling equipment (MHE) and others related factors can have effect on the performance of warehouse operations. Hence it will be good if other interested researcher make a study on this area. The situation might help the agency to enhance the role of warehouse in health commodities supply chain and pave a way to make the warehouses operations more efficient and effective.

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Appendix A: Questionnaire
QUESTIONNAIRE

ADDIS ABABA UNIVERSITY

SCHOOL OF BUSINESS & ECONOMICS GRADUATE STUDIES

DEPARTMENT OF LOGISTICS AND SUPPLY CHAIN MANAGEMENT

Dear Respondents,

I'm a graduate student of logistics and supply chain management at Addis Ababa University School of Commerce. Currently, I'm undertaking a research project on information technology (IT) utilization on the performance of warehouse operations: the case of Pharmaceuticals Fund and Supply Agency in Addis Ababa as a partial fulfillment of the requirement for the award of Masters of Art Degree in Logistics and Supply Chain Management.

The questionnaire items are developed to collect relevant data for information technology utilization on the performance of warehouse operations. Be sure that the data provided by you will be treated as confidential; remain anonymous and used only for academic purpose. For the success of this research project, your genuine, frank, and complete responses are required. Hence, I kindly requested you to participate in responding to the questions listed below. Thank you in advance for taking time to fill this questionnaire.

General instructions

- ✓ There is no need of writing your name
- ✓ Put the mark (✓) on the appropriate space provided

Contact Address

If you have any question, please contact me at any time by phone or email (phone number; 0910135373, email: nigatunigus@gmail.com)

Part one: Respondents Profile

Please put the mark (√) on the appropriate space

| | | | |
|-----|---|---|--|
| 1.1 | Sex | Male | |
| | | Female | |
| | | | |
| 1.2 | Age | below 20yrs | |
| | | 20- 30yrs | |
| | | 21-30yrs | |
| | | 31- 40yrs | |
| | | above 40yrs | |
| | | | |
| 1.3 | Your current position | Stock and Distribution Directorate Director | |
| | | Revolving drug fund coordinator | |
| | | Health program Coordinator | |
| | | Warehouse manager | |
| | | Stock and Distribution officer | |
| | | Warehouse Supervisor | |
| | | IT officer | |
| | | other, please specify it | |
| | | | |
| 1.4 | Respondent's qualification level | College Diploma | |
| | | BA/ BSC | |
| | | MA/MBA/ MSC and above | |
| | | | |
| 1.5 | Respondent's Work experiences at their current positions | Below 2yrs | |
| | | 2-5yrs | |
| | | 6-10yrs | |

| | | |
|--|-------------|--|
| | Above 10yrs | |
|--|-------------|--|

Part Two: The role of Information Technology (IT) on the performance of warehouse operations at Central pharmaceuticals Fund and Supply Agency (PFSA).

2.1 Regarding level of information technology (IT) utilization in warehouse operations at pharmaceuticals fund and supply agency; please put the mark (√) on your level of agreements.

| s.no. | Statements | Strongly disagree | disagree | not sure | Agree | Strongly agree |
|-------|---|-------------------|----------|----------|-------|----------------|
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | The agency is using information technology (IT) to manage the receiving activities of products into the warehouse. | | | | | |
| 2 | The agency is using information technology (IT) to manage the put-away (placing products into the right storage locations) activities of products into the warehouse. | | | | | |
| 3 | The agency is using information technology (IT) to manage the order picking activities of products within the warehouse | | | | | |
| 4 | The agency is using information technology (IT) to generate invoices for receipts and issued products from the warehouse | | | | | |
| 5 | The agency is using Information technology (IT) to track the batch, manufacturing and expiry date of the products within the warehouse | | | | | |

| | | | | | | |
|---|---|--|--|--|--|--|
| 6 | The agency is using information technology (IT) to control and track overstocked, slow moving, under stocked, near expiry, and stock-out products within the warehouse. | | | | | |
| 7 | The agency is using information technology (IT) to generate useful report easily to support decision making(real time data availability) | | | | | |
| 8 | The level of information technology (IT) usage for warehouse operations is minimal | | | | | |
| 9 | The management recognize the importance of information technology(IT) for warehouse operations management | | | | | |

2.2 Regarding the role of information technology (IT) on the performance of warehouse operations at pharmaceutical fund and supply agency; please put the mark (√) on the level of your agreements.

| s.n o. | Statements | Strongly disagree | Disagree | not sure | Agree | Strongly agree |
|-----------|---|----------------------|----------|-------------|-------|-------------------|
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | The warehouse inventory accuracy rate is good enough | | | | | |
| 2 | The warehouse put-away accuracy is at good level | | | | | |
| 3 | The warehouse picking accuracy is at good level | | | | | |
| 4 | The time elapsed/required to process an order is minimal(or within a reasonable time | | | | | |

| | | | | | | |
|----|---|--|--|--|--|--|
| | period) | | | | | |
| 5 | The time elapsed to receive the incoming commodities is minimal(within the standard time period) | | | | | |
| 6 | The warehouse space utilization is good | | | | | |
| 7 | The employed information technology (IT) tool helps to improve inventory accuracy. | | | | | |
| 8 | The employed information technology (IT) tool helps to improve put-away accuracy. | | | | | |
| 9 | The employed information technology(IT) tool helps to improve order picking accuracy during customer order fulfillments | | | | | |
| 10 | The employed information technology (IT) tool helps to reduce order processing time. | | | | | |
| 11 | The employed information technology (IT) tool helps to reduce product receiving time. | | | | | |
| 12 | The employed information technology (IT) tool helps to improve warehouse space utilization. | | | | | |
| 13 | The employed information technology (IT) tool helps to reduce wastage due to expiry by commanding first expired first out (FEFO) principle. | | | | | |
| 14 | The employed information technology (IT) tool helps to enhance stock visibility within the warehouse | | | | | |
| 15 | The employed information technology(IT) tool helps to enhance the visibility, quality, and accessibility of warehouse transaction data(provide real time data) | | | | | |

| | | | | | | |
|----|---|--|--|--|--|--|
| 16 | The employed information technology (IT) tool helps to reduce the paper based works and human errors. | | | | | |
| 17 | The information technology (IT) tool helps to prevent theft and leakage of products. | | | | | |

2.3. Regarding the challenges associated with use information technology (IT) in warehouse operations at pharmaceuticals fund and supply agency; please put the mark (√) on the level of your agreements.

| S.no | Statements | Strongly disagree | Disagree | not sure | Agree | Strongly agree |
|------|---|-------------------|----------|----------|-------|----------------|
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | Frequent electric power interruptions/outages make it difficult to use the information technology (ICT) | | | | | |
| 2 | The employed information technology (ICT) is not user friendly or requires longer time to learn it | | | | | |
| 3 | Slow and sometimes unavailability of internet connectivity is a barrier for efficient utilization of the information technology (ICT) | | | | | |
| 4 | Inadequate training and support makes it difficult to use the information technology (ICT) effectively | | | | | |
| 5 | Inadequate staffs knowledge and skill is a challenge for efficient utilization of information technology (ICT) | | | | | |
| 6 | Low level of staff confidence in the employed information technology (ICT) is one of the | | | | | |

| | | | | | | |
|--------------------------------------|--|--|--|--|--|--|
| challenges for effective utilization | | | | | | |
|--------------------------------------|--|--|--|--|--|--|

Appendix B: Interview Questions

1. What types of information technologies (ICT) does the agency use for warehouse operations management?
2. For which type of warehouse operations management, the employed information technologies (ICT) are used more?
3. Do you think the current information technologies (ICT) are enough for the agency’s warehouse operation management? If the answer is yes why? If no why?
4. What are the challenges and limitations in the utilization of information technologies (ICT)?
5. Which area of information technology (ICT) utilization in warehouse operation management do you think need improvement?