



School of Commerce

**THE EFFECT OF INVENTORY MANAGEMENT PRACTICE ON
LOGISTICS PERFORMANCE**

THE CASE OF ETHIOPIAN DEFENSE FORCE LOGISTICS MAIN DEPARTMENT

BY

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A THESIS SUBMITTED TO THE DEPARTMENT OF LOGISTICS AND SUPPLY CHAIN
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Statement of Declaration

I, Liul Weldeyes Weldemeskel, declare that the thesis entitled “The Effect of Inventory Management Practice on Logistics Performance” is my original work. I have carried out the present study independently with the guidance and support of my research advisor Busha Temesgen (PhD). Moreover, this study has not been presented for any other program or university and that all sources of materials used have been acknowledged accordingly.

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This is to certify that Liul Weldeyes has carried out his research work on the topic “The Effect of Inventory Management Practice on Logistics Performance”. The work is original and is suitable for submission for the award of Master of Arts in Logistics and Supply Chain Management

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Abstract

The purpose of this study was to assess the effect of inventory management practice on logistics performance in the case of Ethiopian Defense Force Logistics Main Department. Inventory is a crucial part of an asset in any business firm, organization, large or small industry and public service. Because without inventory items, there is no production or service. Therefore managing the inventory is the essential part of the management part. Generally, effective inventory management is the high success of any organization. So, this study concerned to assess the inventory management and its effect on logistics management that may be enables the only military organization in the country to improve the quality service rendering to its end users since its mission is very sensitive. The study was employed both descriptive and explanatory research designs to conduct this research. It contained a qualitative and quantities component that enables the researcher to assess the study easily. The study encompasses the main root of the organization's inventory management areas of departments (purchasing, warehouse & finance. The sampling technique of the study was stratified sampling technique. The target population was 150 employees of Ethiopian Defense Force Logistics Department. The sample taken was 109 employees which was 73% of the total population and selected proportionally from each stratum. 4 department heads and 1 head of logistics main department were selected for interview and the remaining 104 members for questionnaire. According to the objectives of the study, the key findings of the study revealed that there is a gap on purchasing department in relation to applying competitive based purchasing practice, lack of information sharing between purchasing and warehouse departments, lack of computerized inventory management system, lack of proper inventory handling and disposal system and lack of on job and of job training programs in relation to inventory management practice. These gaps may highly affect the logistics performance in Ethiopian Defense Force Logistics Main Department in relation to customer satisfaction and delivery performance. The researcher recommended for those problems that the inventory management practice should be improved in relation to purchasing, controlling and handling & disposal of inventory items in order to improve logistics performance especially in relation to customer satisfaction and delivery performance.

Key words – inventory, inventory management, and performance

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Inventory refers to the value or quantity of raw materials, supplies, work in progress (WIP) and finished stock that are kept or stored for use as need arises (Lyons and Gillingham, 1981). According to Stevenson (2010), Inventory Management is defined as a framework employed in firms in controlling its interest in inventory. It includes the recording and observing of stock level, estimating future request, and settling on when and how to arrange. On the other hand, Inventory management is a method that companies use to organize, store, and replace inventory, to keep an adequate supply of goods at the same time minimizing cost. Choi (2012) indicates that effective inventory management is essential in the operation of any business. Thus, keeping stock is used as an important strategy by companies to meet customers' needs without taking the risk of frequent shortages while maintaining high service level.

Inventory management has enabled organizations to have adequate quantities of high quality items available to serve customer needs, while also minimize the costs of carrying inventory (Brigham & Ehrhard, 2005). However, Lysons & Farrington (2006) explained that managing these inventories in order to achieve their objectives has posed a great challenge to the organizations. Many organizations have not yet established how much to invest in inventories and the right inventory levels to hold so as satisfy customers. Too much inventory consumes physical space, creates a financial burden, and increases the possibility of damage, spoilage and loss. On the other hand, too little inventory often disrupts manufacturing or service operations, and increases the likelihood of poor customer service. In many cases good customers may become irate and take their business elsewhere if the desired product is not immediately available. Effort must be made by management to decide on the optimum investment in inventory since it costs more money to tie down capital in excess inventory.

As stated by Mohammad et.al (2016), every organization has their own inventory where each of the organization manages the inventory by various ways of managing system. However, the purpose of the inventory is the same, where the inventory must always ready to be used and the inventory cost must be low. Inventory management refers to all the activities involved in

developing and managing the inventory levels either the inventory is raw materials, semi-finished material or finished goods, so the adequate supplies must be always available and the firm must make sure the cost of over or under stocks are always low.

Ministry of National Defense (MoND) (2004) explained that for modern military forces, the need to store and maintain a vast inventory of equipment, spares and consumable items represents their single largest supply chain investment. With huge physical stocks, numerous storage and distribution facilities, and a large labor force of both civilian and military personnel, inventory must be managed efficiently and cost-effectively. In the commercial sector, inventory management is a major area for deploying performance management solutions to support streamlined operations, for reductions of costly 'in-stock' inventory, and to ensure that all internal processes are optimized. The same benefits are sought by defense logistics organizations in response to new operational and performance targets.

As explained by Headquarters department of the army (1985), the management of inventory is central to Army logistics management. Army operations depend on supplies; the flow of these supplies depends upon the effectiveness of the management of inventories for many months prior to the issue of the supplies. The objective of inventory management is effective, efficient, and economical supply of the combat soldier. With the many compromises and trade-offs which are necessary in the operation of Army logistics, this ultimate objective can become obscure, for at all levels of the supply system there are limitations on the resources of logistic—transportation, facilities, and labor, as well as materiel. Logistics managers specify standards for materiel support which will ensure an acceptable level of service to supported units, and managers repeatedly examine every operation in the system in an attempt to balance available resources to reach or surpass the defined standards. However, even with the best possible management practices, emergency supply actions are often necessary to meet unpredictable contingencies. The standards set for any operation serve as guidelines for operating personnel and control indicators for management, but success in supporting the troops must always be the ultimate criterion for evaluating the supply system. The principal reason for maintaining inventories is to improve customer service by compensating for time needed to produce, handle, and ship supplies. If goods are on hand, a customer may draw them as needed. If, however, goods must be shipped a considerable distance or even manufactured before they can be provided to the

customer, the resulting delay may produce serious consequences on the customer's operations. Some of the inventory is also maintained for protection against uncertainty. None of the time factors involved in acquisition and delivery of goods is constant. Furthermore, the customers' needs for goods are, in most cases, variable. Stocks must be maintained at a level which will ensure units will be supplied with their needs an acceptable percentage of the time.

Ministry of National Defense (MoND) (2000) stated that military logistics is the discipline of planning and carrying out the movement and maintenance of military forces. In its most comprehensive sense, it is those aspects of military operations that deal with: Design, development, acquisition, storage, distribution, maintenance, evacuation, and disposition of materials. It is the processes, resources, and systems involved in generating, transporting, sustaining, and redeploying or reallocating materiel and personnel. A nation's ability to perform these functions relates directly to its military power. Their successful execution will provide a country strategic flexibility, and has the potential to grant a decisive position of advantage. In general terms the success of any military mission is highly depends on the effectiveness and efficiency of its logistics. The ability of a military logistics to manage inventory items in a proper way determines the success and failure of military operation.

1.2 Background of the Organization

According to Ministry of National defense (MoND) (2004), Military logistics was established in Ethiopia in 1950 for the first time. It was an English man named Colonel Hanson who organized the logistics unit in three departments which were food, material and ordnance departments. MoND (2004) further explained that the current Ethiopian defense force logistics main department is a military organization under defense head quarter which was re-established in 2004 by ministry of national defense in order to provide reliable and quality army logistics service to achieve its military mission effectively and efficiently. Defense logistics main department basically consists of different departments under its structure. These are; food and material supply department, transportation department, ordnance department, maintenance department, human resource department and finance directorates. The main purpose to organize Ethiopian defense force logistics main department is to maximize the freedom of action of the operational commanders by arming, fueling, feeding, wearing, moving and maintaining forces during peace and war time.

1.3 Statement of the Problem

Inventories constitute the most significant part of current asset of large majority of organizations. Because of that, a considerable amount of fund is committed in it by organizations. Therefore it is of great importance to manage inventories efficiently and effectively so as to avoid unnecessary tying up of capital. Inventory management practices involve the active participation of various departments. Inventory level should not be left to chances, it should be carefully planned. (Morrison et al, 1994). As explained by Altekar (2005), the efficient operation of any organization demands a planned flow of materials to service its activities. Inventory management is the key to any organization due to the vast reception, storage and distribution of various inventory items and the need to manage them in a cost effective and satisfying manner.

As explained by Headquarters department of the army (1985), the management of inventory is central to Army logistics management. The success of Army operations and combat readiness depend on supplies; the flow of these supplies depends upon the effectiveness of the management of inventories for many months prior to the issue of the supplies. The objective of inventory management is effective, efficient, and economical supply of the combat soldier. The combat readiness of any military force is dependent on the quality of its inventory management. The performance on inventory management highly reflects on the performance of logistics and has a significant effect on the win-lose situation of the military mission.

According to Ministry of National defense (MoND) (2004), Ethiopian Defense Force was established with the goal of protecting the constitutional system from external invaders, terrorists & anti peace elements. The organization purchases, stores and distributes a huge amount of military and non-military inventory items in order to achieve combat readiness. Managing that huge amount of inventory items is a big challenge in Ethiopian defense force since it has a significant effect on logistics performance especially in terms of customer satisfaction and delivery performance. Logistics strength also cannot be successful without reliable inventory management system. The logistics performance of the organization is highly dependent on its inventory management quality.

The organization under study, Ethiopian Defense force logistics main department is the military organization in Ethiopia that requires bulky purchases of military and non-military materials centrally in order to meet its ultimate mission which is timely providing combatant and

supportive military units with the needed materials. Those materials purchased to stock in the warehouses include ammunitions, military clothes, spare parts and other office equipments from abroad and local market to store in the organization's different warehouses in different locations. Ethiopian defense force also purchases different types of petroleum products such as lubricant oil, benzene and diesel fuel to deposit at its fuel stations and other depots for operational works. According to Ethiopian Defense Force's Financial Report (2018), the organization's annual expense for inventory items was birr 1,122,350,432.36. This amount is 7.7% of the organization's total annual budget 13,426,000,000. It is a significant amount to the organization and the inventory amount shows that Ethiopian defense force logistics main department manages huge and various inventory items and the need for a serious inventory management system. Ethiopian defense force is a military organization which differs from other business organizations with protecting the sovereignty of the country. So, the effectiveness of its logistics activity particularly its inventory management performance is directly related to the success or failure of military mission.

According to Ethiopian defense Force Logistics main department 2018 annual report, it is evaluated that there are some gaps that should be filled in the inventory management practice such as wrong decision on when to order & how much to order, quality problem on purchased products and holding excess idle and obsolete inventory items. The existence of those gaps implies that there is a gap on inventory controlling system, purchasing practice and adequate handling and disposal system as well as lack of knowledge and skill in human resource. The identified problems may lead to critical problems in inventory management practice and finally affect logistics performance. However, the indicated information is not enough to show all the gaps and the whole inventory management practice and what effects does it have on logistics performance should be assessed in order to reach on the proper conclusion and forward possible recommendation based on tangible evidence. So, this study tried to fill the identified gaps in inventory management practice based on the annual report of Ethiopian defense force logistics main department by focusing on three main inventory management practice determinants which are purchasing, inventory control and handling & disposal of inventory items which were be the focusing areas for the identified gaps.

Even if there are different researches which were conducted in different cases of business organizations concerning inventory management, there is no other research conducted before in the case of Ethiopian defense force logistics main department inventory practice. Hence, this research is the first that focuses on “The effect of Inventory Management practice on Logistics Performance in the Case of Ethiopian Defense force Logistics main department”. The study encompassed problems which were not assessed by other researchers specifically focusing on purchasing practices, internal control and handling & disposal of inventory items. Ethiopian defense force is the only organization that provides military services in the country. Therefore, more understanding of the gap in inventory management system in the organization is one of the major solutions for the organization to improve its mission accomplishment quality.

1.4 Research Questions

In light of the problem discussed above, the research aimed to answer the following questions:

1. To what extent inventory management is being practiced?
2. What is the relationship between inventory management practice and logistics performance?
3. What is the effect of inventory management practice on logistics performance?

1.5 Objectives of the Study

1.5.1 General Objective

The general objective of the study was to assess the effect of inventory management practice on logistics performance in case of Ethiopian Defense force Logistics main department.

1.5.2 Specific Objective

In addition to the above general objective, the study aimed to:

1. measure the extent of inventory management practice
2. identify the relationship between inventory management practice and logistics performance.
3. find out the effect of inventory management practice on logistics performance.

1.6 Significance of the Study

Every research is expected to contribute in some ways to various parties. The study was important to assess the effect of inventory management practice on logistics performance in the case of Ethiopian defense Force Logistics main department. Because, the inventory materials have a direct effect on logistics performance as well as on the organization's military mission accomplishment performance. So, the study's findings and recommendations are highly important to Ethiopian National Defense Logistics main department for making the right decision in military logistics activities by improving their inventory management system. The study is also important to top level management of Ethiopian defense force in understanding of the study finding and recommendation to improve their inventory management system. In addition to these, the study will serve as information source for those who are interested to conduct further study on related topics.

1.7 Scope of the Study

It is impossible to encompass all aspects of inventory management system of the organization considered in this study. The study was thus limited to assess the effect of inventory management practice on logistics performance in Ethiopian defense force Logistics main department. In general, the scope of the study was categorized in to three main parts which were geographical scope, conceptual scope and time scope. In the geographical scope, the study was limited in Addis Ababa region Ethiopian Defense Force Logistics main department finance and purchasing departments, different warehouses in different departments such as food & material management main department, transport main department, maintenance main department and petroleum, oil and lubricants (POL) main department. The reason to encompass only the selected target department was that they have direct relationship with inventory management system. In the conceptual scope, the study was limited in assessing the inventory management practice in terms of purchasing, internal control and handling & disposal of obsolete materials and identifying what effect do those variables have on logistics performance in relation to customer satisfaction and delivery performance. In time scope, the study was limited to be accomplished within the time frame of nine months.

1.8 Limitation of the Study

Almost every research faces different limitations in different degrees. The researcher faced different problems that made the study hard to conduct properly such as the respondents did not return the questionnaire on time; due to the interviewees appointed according to their program and urgency of other organizational issues, it took a long time to conduct the interview discussion.

1.9 Definition of Terms

As stated by Ministry of National Defense (MoND 2004), the following military and other terms were defined as they are listed below:

- **Ammunition** – the projectiles with their fuses, propelling charges fired from guns.
- **Explosive** - a chemical compound or mixture ignited by heat, shock, impact, friction, or a combination of these conditions with harmful metallic particles and dusts.
- **Armament** –weapons and military equipment used by an army, navy, air force etc.
- **Defense Force** – armed services of a country that protect the country from any attack
- **Combat** – fighting between armed forces
- **Combat readiness** – the condition of armed forces and their constituent units to perform and win a war
- **Inventory Management** - the process of supervising and controlling of the stock items for a military organization.
- **Logistics Performance** – the ability of logistics units to deliver the right material at the right time with the right quantity, the right quality to the right soldiers.

1.10 Organization of the Research Study

The study is composed of five chapters. The first chapter comprises introductory background of the study, statement of the problem, basic research questions, objective of the study, significance of the study, scope of the study, limitation of the study, definition of terms and organization of the study. Chapter two dwells on the review of related literature. The third chapter deals with research methodology with particular focus on the description of the study area, research approach, research design, population & sample, data source and types and data collection procedures. It also includes ethical consideration and data analysis. The fourth chapter comprises data presentation, analysis and interpretation. The last chapter contains the summary of findings, conclusions, and recommendations.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

This chapter introduces different literature and writing on inventory management. The researcher highlighted the conceptual definitions of the key words which were used in the research proposal, theoretical literature review, empirical studies that highlighted what other researchers observed in the relevant study and conceptual framework of the study.

2.1 Theoretical review

2.1.1 Concept of Inventory

Inventory refers to the value or quantity of raw materials, supplies, work in progress (WIP) and finished stock that are kept or stored for use as need arises (Lyons and Gillingham, 1981). According to Stevenson (2010), Inventory Management is defined as a framework employed in firms in controlling its interest in inventory. It includes the recording and observing of stock level, estimating future request, and settling on when and how to arrange. On the other hand, Inventory management is a method that companies use to organize, store, and replace inventory, to keep an adequate supply of goods at the same time minimizing cost. Choi (2012) indicates that effective inventory management is essential in the operation of any business. Thus, keeping stock is used as an important strategy by companies to meet customers' needs without taking the risk of frequent shortages while maintaining high service level. As Axsäter (2006) describes, inventories make high cost, both in the sense of tied up capital and also operating and administrating the inventory itself. It is argued that time from ordering to delivery of replenishing the inventory, referred to as the lead time, is often long and the demand from customers is almost never completely known. Therefore, managers should consider how to achieve the balance between good customer service and reasonable cost, which is the purpose of inventory management, involving the time and volume of replenishment.

Datta, (2003) noted that inventories are materials or resources of any kind having some economic value. It is also a major asset that should provide return for capital invested and either awaiting conversion or use in future. Apart from these, there are many indirect materials such as maintenance materials, fuels and lubricants, and other materials which are used in a manufacturing or service rendering organizations. They are also classified as inventories of materials for future use. But they differ only in their use and classification from raw and other direct materials. All required items are stocked in to warehouse to be used when the needs arise.

Jessop, (1999) explained that inventory management is the art and science of maintaining stock levels of a given group of items incurring the least cost consistent with other relevant targets and objectives set by management. It is important that managers organizations that deals with inventory, to have in mind, the objective of satisfying customer needs and keeping inventory costs at a minimum level.

2.1.2 Inventory Management

According to Sharma (2006) inventory management can be described as the protection of over investment and under investment in inventories, by improving on the main necessary operational activities. Determination of the right level of investment in inventories, consistent with production operation schedules and prompt services, is the activities of inventory management. Mohammad et al. (2016) Inventory management refers as the total activities in each operation stage may be in raw material, semi-finished materials or finished goods, so make sure the availability of stock and the over or under stocks always must be low. Brutus (2015) explains that inventory materials represents an important asset .it is the largest single item and it has accost in every organization. Material management is the important aspects of any organization to function handling and acquisition of stock, assigning line management, storage, and material transport. Material management and control components role are very similar in order to make organization effective and efficient.

According to Reid & Sanders (2007) inventory management mostly serves two main purposes. First, all responsible inventory management takes responsibility for availability of stock material. The availability of inventory is important for the smooth running of operation. The second goal is by performing the required activity; efficient service level can be achieved by minimizing the optimal costs.

Mohammad et al. (2016) said that every company manages its inventory items by using different ways of their own managing system. However, the usage of inventory is similar, and also where the inventory is stored or is ready to be used and the cost must expect to be low.

As stated earlier in chapter one, Inventory management is vital for the successful operation of most organizations due to the cost inventory represents. Effective management of inventory is a major concern for all organizations. (Mentzer, et al 2007). In order to achieve this, there is therefore the need for those organizations to effectively and efficiently manage their inventories.

There are two main concerns about inventory management. First, inventory management concerns the level of customer service, that is, to have the right goods in sufficient quantities, in the right place and at the right time. Another concern is the cost of ordering and carrying inventories (Stevenson, 2009).

2.1.2.1 The Role of Inventory Management

The role of inventory management is to determine the level of inventory items in a way that continuous satisfaction of customers can be achieved. The system of planning and controlling of inventory items are based on the product, customer needs and the operational activities according to the available inventory. In addition, inventory is important for balance sheet that used as an increase the asset group on the organization's balance sheet, because many firms play a role to reduce their investment in fixed asset, plants, warehouses, office buildings, equipment and machinery by increasing their inventory (Mohamed, et.al 2016). Inventory management system is essential to improve the quality of control in stock handling and the area of customers served by consumer goods. A good inventory system will lead the organization easily to know the time to order the needed materials. Inventory management system is also an essential means of tracing large shipment within short time. An automated inventory system enables organizations to minimize the risk of error and helps by providing up to date information of the stock items in the warehouse (Ackah & Ghansh, 2016).

2.1.3 Inventory Control

According to Schonsleben (2000), inventory control refers to “the process whereby the investment in material and parts carried in stock is regulated within predetermined limits set in accordance with inventory policy established by the management” (Gordon B. Carson). The activities of inventory control, thus, include the following: determination of limits of inventories to be held, determination of inventory policies, setting out of investments pattern and its regulation as per individual and collective requirements and follow up to examine the working of the inventory policy and effecting changes as and when needed.

Sharma (1997) stated that the inventory control is a very important activity of inventory management and it plays an essential role for managing economic operation. “To achieve higher operational efficiency and profitability of an organization, it is very vital to reduce the amount of capital locked up in inventories. This will not only help in achieving return on investment by

minimizing tied-up working capital, but will also improve the liquidity position of the concern. And also Benedict and Margeridis (1999) described that inventory control means anytime and anywhere the required availability of materials in stock. The sum total of those activities of an organization is important to procurement, storage, sales, disposal or usage of materials can be identified by material management. Inventory management is ready when required and utilize available storage space and the items are in balance. The maintain accountability and responsibility of inventories asset is the inventory management. Inventory management, before decision they must be checked plan budget and also must know how to order and when to be order. Therefore, without any problem the stock is available easily in store at an optimum level. Hence, inventory management must practice on the activities of planning system through the operation of the service points and distribution.

2.1.3.1 The Importance of Inventory Control

Reid & Sanders (2007) noted that the benefits of a computerized inventory control system can be derived, when the business integrates its inventory control system with the other systems such as accounting and purchasing, that helps in better control of inventory levels. In practice, when the inventory level reaches to its minimum point, the system automatically generates a purchase order, which is sent to the supplier electronically. The primary objective of an inventory control is:

- a) to minimize idle time caused by shortage of inventory and non-availability of inventories as per requirement, and
- b) to keep down capital investment in inventories, inventory carrying cost and obsolescence losses.

2.1.3.2 Inventory Decision

The main objective of inventory management is identifying the effects of cost that having items in stock and not having items in stock and compute the cost of holding and ordering the inventory. In order to attain a balance between inventory availability and cost, it must be addressed the main target of inventory management is the volume that how much to order and when to order (Porter, 2011). Therefore, since inventory is a key to any organization, inventory management must pay attention on decision making. There are different techniques and models that can help inventory management control systems.

ABC Analysis

As stated by Jessop (1999), in inventory management, ABC inventory control technique is based on the principle that a small portion of the items may typically represent the bulk of money value of the total inventory used in the production process, while a relatively large number of items may form a small part of the money value of stores. The money value is ascertained by multiplying the quantity of material of each item by its unit price. According to this approach to inventory control, high value items are more closely controlled than low value items. Each item of inventory is given either A, B or C denomination depending upon the amount spent for that particular item. "A" or the highest value items should be under the tight control and under responsibility of the most experienced personnel, while "C" or the lowest value may be under simple physical control. It may also be clear with the help of the following examples:

"A" Category items – 5% to 10% of the items represent 70% to 75% of the money value.

"B" Category items – 15% to 20% of the items represent 15% to 20% of the money value.

"C" Category items – The remaining number of the items represent 5% to 10% of the money value.

The purpose of this classification is to ensure that purchasing staff use resources to maximum efficiency by concentrating on those items that have the greatest potential savings. Selective control will be more effective than an approach that treats all items identically (Lysons and Gillingham, 2003).

The relevance of this theory to this study is that it suggests that though all categories of inventory is important, inventory must be categorized or classified in accordance to their relative impact or value and treated differently.

Re-Order Level (ROL)

Schonsleben (2000) explained that re-order level is another inventory control technique. It is that level of stock at which a purchase requisition is initiated by the storekeeper for replenishing the stock. This level is set between the maximum and the minimum level in such a way that before the material ordered for are received into the stores, there is sufficient quantity on hand to cover both normal and abnormal circumstances. The fixation of ordering level depends upon two important factors, namely the maximum delivery period and the maximum rate of consumption.

Economic Order Quantity (EOQ)

Plasecki (2001) defines Economic Order Quantity as an accounting formula that determines the point at which the combination of order costs and inventory costs are the least. Lysons and Gillingham (2003), also defines Economic Order Quantity as the optimal ordering quantity for an item of stock that minimizes cost.

According to Lysons and Gillingham (2003), to calculate the Economic Order Quantity, a mathematical model of reality must be constructed. All mathematical models make assumptions that simplify reality. The model is valid only when the assumptions are true or nearly true. When an assumption is modified or deleted, a new model must be constructed. Economic Order Quantity approaches have proven to be effective inventory management technique when the demand and lead time are relatively stable, as well as when significant variability and uncertainty exist.

Material Requirement Planning (MRP I)

Ballou (2000) defined material requirement planning as a mechanical method of supply scheduling where the timing of purchase or of production output is synchronizing to meet period by period operations requirement. Ballou (1999), explained further that material requirement planning methods try to avoid carrying more inventory than is needed at a time. Thus the emphasis is on carrying only the quantities of stock needed at any point in time, and this is achieved through precise timing of material flows to meet requirements. Lysons and Gillingham (2003), defined material requirement planning as a product- oriented computerized technique aimed at minimizing inventory and maintaining delivery schedules. It relates the dependent requirements for the materials and components comprising an end product to time periods known as 'buckets' over a planned horizon (typically one year) on the basis of forecasts provided by marketing and sales and other input information. Coyle et al. (2003), explained material requirement planning as a set of logically related procedures, decision rules, and records designed to translate a master production schedule into time-phased net inventory requirements for each component item needed to implement this schedule. Lysons and Gillingham (2003), outlined the aims of material requirement planning as follows:

- i. To synchronize ordering and delivery of materials and components with Production requirements.

- ii. To achieve planned and controlled inventories and ensure that required items are available at the time of usage or not much earlier.
- iii. To promote planning between the purchaser and the supplier to the advantage of each.
- iv. To enable rapid action to be taken to overcome material or component shortage due to emergencies, late delivery and so on.

Coyle et al. (2003) also explained the goals of material requirements planning as follows:

Ensure the availability of materials, components and products for planned production and for customer delivery.

- i. Maintain the lowest possible inventory level.
- ii. Plan manufacturing activities delivery schedule, and purchasing activities.

In doing so, the material requirement planning system considers current and planned quantities of parts and inventory products, as well as the time used for planning.

Material requirement planning (MRP I) is relevant to this study in that it places emphasis on carrying quantities of stock that is needed at any point in time and avoid unnecessary stock. This therefore helps reduce holding or carrying cost.

2.1.4 Inventory Recording

Inventory control rescored is important to make decision to buy and sell. Some company control their stock by taking physical inventories at regular intervals, monthly or quarterly. Others use a dollar inventory rescored that what the inventory gives a rough idea of what the inventory may be from day to day in terms of dollars. If the stock is made up of thousands of items, as it is for a convenience type store, dollar control may be more practical than physical control (Amold, 1998).

2.1.4.1 Inventory Accuracy

Inventory accuracy can be defined how well the inventory is recorded, specifically the quantities on hand, match the actual quantities in the storeroom. Accurate records are a prerequisite to effective inventory management. Susan & Michael (2000) accuracy of inventory records is necessary to provide satisfactory customer service, determine replenishment of individual items; ensure that material availability meets repair or project demand, analyze inventory levels and dispose of excess and obsolete inventory.

2.1.4.2 Inventory Reconciliation

Sharma (1997) noted that Inventory reconciliation is the process matching your stock records with what you physically have in your store. In addition to counting items and updating your records, this whole process also lets you find stock discrepancies, so you can address them.

How inventory reconciliation works

Sharma (1997) further noted that the finer details of the inventory reconciliation process will vary from one retailer to the next, but generally, this is what happens when organizations reconcile their stock:

Step 1: Counting your products

First, the organization shuts its doors to the public, typically for a few days. It can be helpful to spend some time to make inventory easier. Proper preparation can save hours of time over the course of stock reconciliation.

Some retailers, in particular large department stores, will spread out stock reconciliation over the course of a week, paying employees overtime to spend an extra few hours every night – this method keeps the business running, but it presents other costs, like overtime pay.

Step 2: Checking (and re-checking) your records

Next, employees compare written inventory records with the physical presence of each item in stock. The lists are checked and re-checked to make sure that no employee misreads a stock number. *Non-serialized* items may have no stock number and need to compare to supplier invoices.

Once this time-consuming process is complete, you can compare the results to determine what inventory discrepancies exist. These can be due to missing paperwork, bad math, human error, supplier fraud, or unlisted products sold on consignment.

Step 3: Addressing the missing items

Once these discrepancies are found and accounted for, you have to address the missing items. This requires going through sales paperwork to identify whether certain sales have been overlooked. Often, when a simple math error does explain an inventory discrepancy, a missing sales receipt can. If there is no missing sales receipt, then you are left with theft or supplier fraud. The difference between the amounts of stock you show on paper and the amount you physically have is called *shrinkage*. Shrinkage is typically expressed as a percentage using the following formula:

Step 4: Figuring out the reasons behind any discrepancies

At this point, you can interview your employees to determine if anyone is misappropriating organization's inventory. Begin with inventory employees, fanning out towards those who have access to the stockroom and ending with your issuing team. But finding the culprit is not guaranteed – despite this effort, you may have to simply accept unexplained shrinkage as a fact of life.

Step 5: Ensuring your records match

Regardless of the motive for inventory loss, you need to reconcile your inventory records to match the actual number of items you have in your inventory. Doing this requires creating a stock reconciliation statement that overrides your previous figures and represents your current stock accurately.

2.1.5 Purchasing Inventory Items

As stated by Brutus (2015), Procurement is the processes of determining the order quantity purchase of items, work processing, store requisitions, issue of enquiries, and evaluation of quotations, supplier appraisal, negotiations, placing of contracts, progressing of deliveries and clarifying payments. Berling, (2011) noticed that Successful inventory management involves creating a purchasing plan and design that will ensure that items are available when they are needed but that neither too much nor too little is purchased and keeping track of existing inventory and its use. Purchasing responsibility is to buy materials of the right quality, in the right quantity, at the right time, at the right price, from the right source with delivery at the right place. Furthermore this objective must be achieved with a minimum investment in inventories. Purchasing also has an objective of avoiding duplication, waste and obsolescence. The purchasing department can do much to eliminate these risks by considering each purchase in relation to long range operating plan and short range considerations of immediate purchases. Amlod (1998) noted that effective purchasing encompasses the following cycles; Review selection, Determine need quantities, Reconcile needs & funds ,Choose procurement method, Select suppliers, Specify contract terms, Monitor order status, Receipt & inspection.

2.1.5.1 Methods of Procurement

Department of Army Field Manual (1958) explained that the legality of purchasing activity plays a significant role on inventory management effectiveness. Based on this, some of important purchasing methods are stated below:

I. Procurement by Formal Advertising

Formal advertising should be the law of the organization in order to establish real transparency and accountability in relation to overall purchasing performance as well as to assure maximum competition. This competition should result in better products, better service, and lower costs. For purposes of comparison with negotiated procurement, the mechanics of formal advertising proceed as follows:

- a. **Bids are solicited** by invitation and public announcement. The Invitation for Bid includes the identification of the item with appropriate specifications cited and with the delivery schedule which must be met. Invitations are sent to those prospective bidders whose names are on the Bidders' Mailing List for the item desired. A copy of the invitation is displayed in a public place such as the local post office or reception room of the contracting office. An announcement may be placed in the trade journals or newspapers likely to be read by other prospective bidders.
- b. **Bids are submitted** by those potential suppliers who are desirous of furnishing the goods or services the organization proposes to buy. Bidders must meet certain administrative requirements as to form and time of submission. The bid must be responsive to the invitation, to the extent that no exceptions are taken to the qualitative or quantitative requirements or to the delivery requirements.
- c. **Bids are opened** in public at a preannounced time.
- d. **Bids are recorded** on a "spread sheet" or abstract by entering the names of the bidders and the prices bid. This record is available for public inspection.
- e. **Bids are evaluated** as to price, the bidder's financial and technical capability, skill and experience; foreseeable costs and delays in connection with inspection and shipping; and other factors.
- f. **Award is made** by written notice, to that responsible bidder whose bid, responsive to the invitation, will be most advantageous to the organization price and other factors considered.

II. Procurement by Formal Negotiation

Department of Army Field Manual (1958) explained that negotiation might better be called "informal competitive bidding" This more descriptive term would tend to emphasize the concept that negotiation is an informal method of determining the best price available. Negotiation procedures are less formal than advertising procedures but nevertheless are required to be competitive whenever feasible and, when properly conducted, they result in fair and reasonable prices. Department of Army Field Manual (1958) further explained that in contrast to formal advertising, negotiation proceeds as follows:

- a. Requests for proposals are sent to selected suppliers.* If there is more than one source of the desired items or services, proposals are requested from enough potential suppliers to insure competition.
- b. The contracting officer may summon any or all quoters to negotiation conferences.* One at a time, the potential producers are interviewed. (1) to insure that they understand what is wanted, (2) to determine in greater detail what elements were included in cost estimates and how estimates were computed,(3) to discuss methods of manufacture, (4) to clarify drawings and specifications, and (5) to arbitrate any other point of possible misunderstanding so as to arrive at a "meeting of the minds." The Government negotiator sometimes is supported in such conferences by engineering personnel, cost analysts, legal advisors, and other specialists needed for a proper representation of public/organizational interest. The manufacturers' representatives are given an opportunity to revise their quotations on the basis of a fuller understanding of the requirement.
- c. The successful quoter is selected* after are view and evaluation of finally revised quotations. As with advertised procurement, awards made by written notice to that responsible quoter whose responsive quotation will be most advantageous to the Government, price, and other factors considered.
- d.* The final contract describing the agreements reached by negotiation may take one of several forms. In formal advertising, contracts are limited to fixed price types with occasional provisions for price escalation; whereas, in negotiated procurement, a wide variety of contract types are used.

Department of Army Field Manual (1958) further noted that procurement by negotiation is essentially informal, simple in procedure but complex in execution. It must insure competition unless there is only one source of the supplies or services desired.

Supplier evaluation and selection

As explained by Brutus (2015), some of the key aspects of the procurement process are the evaluation and selection of suppliers, the purchase of the goods themselves, the services and support provided by suppliers to the company. This is important because the buying activity is one of the main parts of business management. In today's competitive environment, it is highly unlikely to be successful at low cost production, and produce quality products without satisfactory suppliers. Therefore, one of the most important decisions in procurement is the selection activity and maintaining good relationships with eligible suppliers. Thus, the evaluation and selection of a competent supplier is one of the most important functions that the purchasing department should do. After choosing the final supplier, monitoring of selected suppliers i.e. evaluation and assessment should be done based on certain criteria such as quality, delivery, past performance, price, quality, financial position, technical capability etc.

2.1.6 Obsolete Inventory

Obsolescence cost results from deterioration of product during storage. A Prime example of obsolescence is product that ages beyond recommended distribution date, such as pharmaceuticals and clothes. Obsolescence also includes financial loss when a product becomes obsolete in terms of fashion or model design. Obsolescence costs are typically estimated based on past experience concerning markdowns, and quantity destroyed. This expense is the percent of average inventory value declared obsolete each year (Bowersox, 2002). According to Grondys, Kott & Strzelczyk (2014), on processes of warehouse management to control the excess and obsolete inventory; it needs sum controlling management mechanism to indicate the inventory material condition and the level. To manage properly the excess and obsolete inventory items, it needs some first indicator to separate nonmoving stock, identify the level of slow moving stock in warehouse, which may be treated as excess or obsolete inventory, including excess and obsolete then made analysis allowing to show the reason of the occurrence of utilization of the inventory.

Excesses vs. Obsolescence- Excesses arise from obsolescence of equipment and supplies. When the amount of obsolete items increase in relation to changes in design, color, and other aspects of improvements of the products then they become excess.

Residual stocks - The excess stocks that result from the introduction of new items must be disposed of as promptly as possible to free storage space and reduce the costs of preservation and storage.

The Cost of carrying excess stocks

Kott & Strzelczyk (2014) further stated that the excess stocks that arise from the several factors already described must be eliminated from the system. Excess stocks take up warehouse space that may be required for needed items, add unnecessarily to the costs of manpower and materials required for care and preservation and lessen recoverable value as a result of both deterioration and obsolescence. Failure to dispose of excesses can result in the use of unprotected outside storage for needed items and the inside storage of excesses. Even though items may not deteriorate physically, they deteriorate in usefulness through the passage of time as obsolescence takes its toll. The substantial costs associated with stocks that are excess to needs makes disposal action a necessity.

2.1.6.1 Disposal of Obsolete Inventory Items

Department of Army Field Manual (1958) stated that when the material is clearly become obsolete, excess or surplus to needs, it should be disposed of to conserve ware-house space and reduce operating costs. Several types of disposal actions are available. In many cases, the type of material controls the type of disposition. For example, scrap and salvage narcotics and distinctive articles of uniform must be disposed of differently from civilian type items. Military-type items such as guns, tanks, and flamethrowers must be demilitarized before passing into civilian control. Classified material must be destroyed or so converted as to be unrecognizable before disposal. As further explained by Department of Army Field Manual (1958), some of the alternative disposal actions are discussed in the paragraphs which follow.

Disposal by Transfer to other Government Agencies

Excesses in one technical service, one military department or one Government agency should not, in general, be disposed of if the material is required elsewhere in the Government service, unless the cost of repairs plus the cost of transportation to the place where needed exceeds the cost of procurement.

Disposal by Donation

Surplus property may be donated to service schools, educational and public health institutions, veterans' organizations, museums, state and local governments, and certain other organizations. The intent of the Congress in this regard was to donate government surplus property to state educational and public health institutions in preference to sale of the property at some fraction of its original cost. Such institutions have been rather active in acquiring property under the law, particularly with respect to the more desirable small quantities of property in good condition.

Disposal by Sale

Items for which there is wide civilian demand are disposed of rapidly with a high rate of return to the Government. The object of property disposal is not just to dispose of property no longer needed but to dispose of this property for as high a return as possible. Grouping of items into salable lots is the first step in disposal by sale. Various questions need to be considered. Should all the accumulated items be sold as a single miscellaneous lot? Or should the items be grouped in to more than one lot? and, if so, upon what basis? If the lots are small, a large number of small bidders may be attracted and the return to the Government may be higher. But the costs of sorting the items and preparing invitations to bid, abstracts of bids and sales documents would also be higher and would tend to offset the higher prices obtained. Conversely, if the lots are too large and consist of widely different kinds of material, fewer bidders may be interested and prices obtained may be lower. Vehicles, typewriters, office machines, and other such items that are attractive to smaller buyers can generally be sold to the advantage of the Government under terms whereby the bidder must bid separately on each item. It is difficult to establish one set of rules to cover the many kinds of surplus property sold to local markets. The local disposal officer must carefully analyze the results of various sales to determine what kinds of lots bring the best return to the government in this geographical area.

Abandonment, Destruction and Demilitarization

When the cost of removal of property to place where it may be sold is prohibitive and sale in place cannot be made, the most economical method of disposal may be abandonment. Of course, if the property is dangerous to public safety and health, destruction is the only recourse. Dangerous military-type items that may fall into the hands of the enemy or the unscrupulous must first be demilitarized or rendered useless as weapons of war. Components, assemblies,

accessories, and parts of such items can be removed, demilitarized and sold separately when the probable recovery by sale will exceed the cost of disassembly.

2.1.7 Inventory Costs

Inventory represents an investment in the organization whether as a result of deliberate policy or not (Lucey, 2009). According to Coyle et al. (2003) Inventory cost are important for three major reasons. First, inventory cost represents a significant component of total logistics cost in many organization. Second, the inventory levels that a firm maintains at points in its logistic system will affect the level of service the firm can provide to its customers. Third, cost tradeoff decisions in logistics frequently depend upon and ultimately affect inventory carrying cost. As with any other investment, the cost of holding stock must be related to the benefits to be gained. To do this effectively, the costs must be identified. The categories of cost associated with inventory are: costs of holding stock (carrying costs), costs of obtaining stock (ordering cost), stock out costs, and the cost of the stock itself.

According to Drury (2004) inventory costs include holding costs, ordering costs and shortage costs. Holding costs relate to costs of having physical items in stock. These include insurance, obsolescence and opportunity costs associated with having funds which could be elsewhere but are tied up in inventory. Selecting the right level of inventory involves balancing three groups of costs namely, ordering cost which takes into consideration the costs involved in the process of ordering materials such as - costs of placing an order and receiving inventory, determining how much is needed, preparing invoices, transport costs and the cost of inspecting goods; carrying cost which is the cost involved in the transfer of ordered materials from the supplier to the recipients warehouse; and the cost of not carrying sufficient inventory which constitutes resultant costs of not performing adequate inventory in the organization such as shortage costs which result when demand exceeds the supply of inventory on hand.

2.1.7.1 Costs of Obtaining Stock

The costs, sometimes known as ordering or procurement cost is the expense of placing an order for additional inventory and does not include the cost or expense of the product itself. It includes the clerical and administrative costs associated with purchasing, accounting and goods received departments and transport. In general the following are included in ordering costs; Costs to place an order, Costs to transport the products, Costs to receive the order, Costs to store the order (Coyle et al., 2003; Lucey, 2009).

2.1.7.2 Stock-out Costs

Lucey (2009) defines stock out cost as “the costs associated with running out of stock”. Coyle et al. (2003) also asserts that it is the cost of not having product available when a customer demands or needs it. Stock out cost may be difficult to quantify. The avoidance of stock out cost is the basic reason why stocks are held in the first place.

2.1.7.3 Cost of the Stock

Cost of the stock also called purchasing cost is the cost of the purchased item itself. These costs according to Coyle et al (2003), are buying in prices or the direct cost of production. These costs are needed to be considered when discount are available for bulk purchases.

2.1.7.4 Costs of Holding Stock (Carrying Cost)

Costs of Holding Stock, also known as carrying cost, is the variable cost of keeping inventory on hand, and is a combination of the costs associated with opportunity costs, interest on capital invested on the stock, storage charges (rent, lighting etc.), taxes, equipment maintenance and running cost, insurance and security, shrinkage, and other variables. It represents one of the highest costs of logistics (Lucey 2009).

If a firm can determine the cost of holding one unit of inventory for one year, it can determine its annual holding cost by multiplying the cost of holding one unit by the average inventory held for a one-year period. Average inventory can be computed by dividing the amount of goods that are ordered every time an order is placed by two. Thus, average inventory is expressed as $Q/2$; annual holding cost can be expressed as $H (Q/2)$. Where H = Holding cost, Q = Quantity. In general inventory carrying cost includes the following costs (Coyle et al., 2003).

Cost of Warehousing and Handling

The second category comprises all the costs related to the handling and storage of the inventory. In case the warehousing-activity is outsourced these costs are more or less transparent because the provider will charge us per pallet or per sq meter or other variable. Although these costs are not exactly related to the value of the inventory because of different value-densities of the products stored, it will give us a fair estimate (Berg, 2007). In this case we consider the storage costs as being variable. If however, you own a warehouse it becomes more complicated. Because you only want to include costs which directly relate to the amount of inventory you are holding. If you own a warehouse which can take 5000 pallets, it doesn't matter for the storage costs if you

use only 1 pallet place or 3000 pallet places. The same holds for equipment like forklift trucks etc. Unless you are able to rent free space to others, storage space will be probably fixed costs.

Cost of risk

These costs comprise everything connected to the risks of holding inventory; the main component being obsolescence. Even in the same company or in the same product family costs regarding obsolescence can vary widely. It can depend on the product-life cycle (product with a short product-life cycle are prone to higher risk of obsolescence) or stage in the product-life cycle (products in the phase-out stage will have higher risks). We think it might be wise to allocate different risk-costs to different products.

2.1.8 Inventory Planning and Replenishment

How to determine What and How Much Inventory Is Needed

Mercado (2008) noted that the questions of what and how much inventory are related. Planning is undertaken to determine the level of inventory that will be needed for operations, and replenishment is the process of maintaining this level through some combination of reorder and other techniques. This definition is suitable for inventory in all operations, be it for assembly, production, shop supplies or sales to a customer. Of course, depending on the nature of the operation, the specific planning and replenishment technique that would be used will be different. A company would generally not use just one inventory technique for all items in operations.

Mercado (2008) further noted that different inventory items require different types of control simply because of the various factors that come into play. These various factors include unit price, ordering cost, weight of the item, hazardous nature, customer demand, etc. In this chapter, we will introduce additional factors that should be taken into account. These have to do with situations in which the inventory is used. For example, the planning and replenishment approach for inventory for a potato chip production line would be different from that of a shop that makes wedding cakes by special order. Also, a computer assembly operation would be different from a dairy that produces milk, butter, and cheese. Consider the following businesses in the list to follow, and you can see that they all have different operational situations and hence will require different inventory approaches.

2.1.8.1 The Basic Reorder Point Technique

Muller (2013) explained that perhaps the most basic approach to reordering inventory is the reorder point technique. A reorder point is simply a level of inventory that is designated as the signal to replenish. That is, whenever the inventory level reaches the reorder point, a replenishment order is placed. It can be written as follows:

Stock No. A

Reorder point 100 pieces

This rule is interpreted as follows: When the level of inventory of “A” drops to 100 pieces, place a replenishment order. The quantity to reorder is generally dictated by the level of demand, packaging units, market availability, storage space available, shelf life considerations, and other factors. The reorder point is the designated level of inventory at which a replenishment order is placed. The reorder point is commonly set such that the inventory level will reach zero at about the time the replenishment order is expected to arrive. We can use the following formula to compute for the reorder point:

Reorder point = lead time in days demand per day

Here is a computational example:

Lead time in days: 7 days Demand per day: 2,000 per day Reorder point = 7 days × 2,000 per day = 14,000 units

2.1.9 Warehouse Management

Warehousing is an integral part of every logistics system. We can define warehousing as that part of a firm’s logistics system that stores products (raw materials, parts, goods-in-process, finished goods) at and between point of origin and point of consumption of items being stored (Richard 1995). The term distribution centre (DC) is sometimes used, but the terms are not identical. Warehouse is the more generic term.

Richards (2014) noted that Warehouse management has been defined as the combination of planning, decision-making and controlling inbound, storage and outbound flows. Appropriate warehousing infrastructure involves considerations of efficient layout, appropriate storage installations (e.g., pallets, shelving), good housekeeping, safety, quality control, and stock management. Proper product layout is a key for effective and efficient warehouse/inventory management. Warehouses should be organized into sections or zones according to the intended function they will have, or the characteristics of the products that will be kept in them. For

example, if products require cold storage or special security measures, the zone should be equipped to meet these needs. Products should be kept off the floor on pallets or shelving that maximizes the use of space. Careful consideration should be given to how products are arranged and labeled in the zone to maximize space utilization. An appropriate location numbering system should be used to (1) make it easier to find a particular pallet; (2) maximize the use of space in the warehouse; (3) store faster-moving items closer to the location where orders are assembled and dispatched; and (4) facilitate the use of electronic warehouse management systems. Numbering every pallet location in the warehouse allows for the reorganization of the warehouse based on volume dispatched criteria. This will make inventory management, including stock-taking, much easier, and prevents double-handling when specific areas of the warehouse are full. It may also facilitate the development and implementation of a fully computerized warehouse management system. Often, warehouses are poorly designed with inadequate storage space and conditions. Infrequent distribution of products may result in large amounts of stock being stored in warehouses with limited storage capacity, which may be further complicated by cold chain requirements for some temperature-sensitive commodities.

2.1.10 Handling of Inventory

Zijm (1999) defined that inventory material management is a movement of materials (raw material, scrap, semi-finished, finished products spare parts) in processes of any operation system, and in warehouse storage, in resaving processes and shipping areas. The main material handling is concerned material flow with warehousing. There is some materials typical support the material flows like forklifts, automated guided vehicles, shuttles, overhead crane and power and free conveyors. Warehousing uses those materials for flow activities from place to place and also to receiving and shipping areas. Essentially, according to materials usage and type the receivers of inventory material warehouse may be divided as Distribution Warehouse, Production Warehouses and Contract Warehouses.

2.1.10.1 Design of Material handling system

Inventory material handling system designed is taking into consideration of cost minimization. Material handling approach is most important activities in many conditions since, while material handling can add a value to an organization, it is typically difficult to measure and enumerate the benefits included with material handling. But the material handling cost is much easier to measure the cost (Heragu, 2009).

2.1.10. 2 Principles of Material Handling

According to Heragu (2009), there are ten principles of material handling:

- a) Planning Principle. All material handling necessarily planned according to the required objectives.
- b) Standardization Principle. Material handling method to be standardized, fixable equipment and software, keeping the modularity to the organization to achieve its setting goals.
- c) Work Principle. Material handling works it defines by the material movement without stacking the activity of the organization keeping the level of inventory.
- d) Ergonomic Principle. Balancing the human capabilities and limitations must be included in designing and also material handling tasks and equipment must ensure on operation.
- e) Unit Load Principle. The material flow and inventory objectives in each operation activity must be insured and must be checked the availability of materials by supply management.
- f) Space Utilization Principle. Effective and efficient use must be equally available on every stage and place.
- g) System Principle. Every material movement on operation and storage all activity integrated to form a coordinated, operational system which spans receiving, inspection, storage, production, assembly, packaging, unitizing, order selection, shipping, and transportation, and the handling of returns.
- h) Automation Principle. Material handling should be in every place must be systemized or using computer system to improve the operational activity and efficiency, decrease operating costs and also minimize the using unsafe manual labor.
- i) Environmental Principle. At the time of designing and selecting the alternative equipment, material handling system must be in to consideration.
- j) Life Cycle Cost Principle. On material handling life cycle the economic analysis should be considered (Heragu,2009).

2.1.11 Logistics Activities

Matiwos (2013) explained that logistics is the flow of material, information, and money between consumers and suppliers. In the definition, logistics is comprised of five interdependent activities: customer response, inventory planning and management, supply, transportation, and warehousing. Some of these activities and their objectives are described briefly below:

2.1.11.1. Customer Response

Customer response links logistics externally to the customer base and internally to sales and marketing. Customer response is optimized when the customer service policy (CSP) yielding the lowest cost of lost sales, inventory carrying, and distribution is identified and executed. The logistics of customer response includes the activities of: Developing and maintaining a customer service policy, Monitoring customer satisfaction, Order Entry (OE), Order Processing (OP), and Invoicing and collections.

2.1.11.2 Inventory Planning and Management

The objective of inventory planning and management (IP&M) is to determine and maintain the lowest inventory levels possible that will meet the customer service policy requirements stipulated in the customer service policy. The logistics of inventory planning and management includes Forecasting, Order quantity engineering, service level optimization, replenishment planning and inventory deployment.

2.1.11.3. Supply

Supply is the process of building inventory (through manufacturing and/or procurement) to the targets established in inventory planning. The objective of supply management is to minimize the total acquisition cost (TAC) while meeting the availability, response time, and quality requirements stipulated in the customer service policy and the inventory master plan. The logistics of supply include:

2.1.11.4 Warehousing

Warehousing is the last of the five logistics activities because good planning in the other four activities may eliminate the need for warehousing or may suggest the warehousing activity be outsourced. In addition, a good warehouse plan incorporates the needs of all the other logistics activities. Good or bad, the warehouse ultimately portrays the efficiency or inefficiency of the entire supply chain. The objective of warehousing is to minimize the cost of labor, space, and equipment in the warehouse while meeting the cycle time and shipping accuracy requirements of the customer service policy and the storage capacity requirements of the inventory plan. The logistics of warehousing includes, Receiving, Put away, Storage, order picking and shipping. (Matiwos 2013)

2.1.12 Logistics service and Performance Measurement

Logistics management is an integrating function which coordinates and optimizes all logistics activities with other functions in supply chain and logistics management, finance, and information technology. Logistics must ensure that a recipient is supplied from a point of origin in accordance with his requirements with the correct product (in quantity and variety), in the right condition, at the right time and in the right place at minimum cost, (Smyth, 2004). DeHaan et al., 2007 explained that logistics management is a one of the contributing operations that encompasses activities ranging from customer service; order processing, inventory management, transportation, warehouse management, packaging, demand and forecasting, purchasing and procurement, facility location, and distribution. Effective logistics provides the right product in the right place at the right time. Logistics encompasses a complex set of activities which require a collection of metrics to adequately measure performance. Chow et al. (1994) were probably the first to attempt to define supply chain (logistics) performance and they presented some measures for measuring logistics performance. Since then, most of the literature on logistics performance appears to focus on models and frameworks. Mansidão (2014) explained that Logistics performance measures can be categorized into two categories such as qualitative and quantitative measures. Qualitative measures include such as **customer satisfaction** and product quality etc., and quantitative measures include such as order-to-delivery lead time, supply chain response time, flexibility, resource utilization, cost effectiveness, **delivery performance**, etc.

For the purpose of this research, Logistics performance may be defined in terms of customer satisfaction and delivery performance by ensuring that the right item is bought and made available to the right operation at the right time, right place with the lowest possible cost and in the right quality (Watts & Hann 1993).

2.1.13 The Effect of Inventory Management on Logistics Performance

Matiwos (2004) stated that inventory management is one of the major logistics activities that determine the performance of logistics. Logistics performance measures selected for this study is customer satisfaction and delivery performance. The selected performance measures have a direct relation with inventory management activity in terms of purchasing inventory items, inventory control and handling & disposal of obsolete inventory items. The effect of inventory management on logistics performance in terms of selected measures is stated as follows;

2.1.13.1 Inventory management and customer satisfaction

Muhammad Asif (2012) the goal of inventory is to meet customer demand. Therefore, the absence of real time inventory information on customer demands can result to inaccurate forecast hence translate to late, insufficient and inconsistent deliveries of goods and eventually causes customer dissatisfaction. He further explained that inventory availability is the most important aspect of customer service. Inventory management systems are designed to monitor product availability, determine purchasing schedules and cycle out obsolete inventory items. The availability of inventory item is one way in which an inventory management system attempts to create customer satisfaction. Time to fulfillment is the other effect of inventory management on customer satisfaction. A good inventory control means that your time to fulfill orders stays low. Timely replenishment of inventory items is a key to satisfy customer needs. A comprehensive understanding of the impact of inventory control on customer satisfaction helps you to create an effective management system.

2.1.13.2 Inventory Management and Logistics Delivery Performance

Wanjiku G. (2015) noted that delivery of the right product to the right customer at the right time to the right place with the right quantity and quality is one of the major performance indicators of logistics. Logistics must ensure that a recipient is supplied from a point of origin in accordance with his requirements with the correct product (in quantity and variety), in the right condition, at the right time and in the right place at minimum cost. According to Mohamed, et.al (2016), the main objective of inventory management and control is to provide the needed services to the customers by delivering the right product at the right time. On time delivery of the needed items is highly depends on availability of the right inventory with the right amount, quality and variety. The ability of inventory management to hold the optimum inventory level has a direct effect on logistics delivery performance.

2.1.14 Training

Effective training and development programs aimed at improving the employees' performance. Training refers to bridging the gap between the current performance and the standard desired performance. Training could be given through different methods such as on the coaching and mentoring, peers' cooperation and participation by the subordinates. This team work enable employees to actively participate on the job and produces better performance, hence improving organizational performance. Training programs not only develops employees but also help an

organization to make best use of their humane resources in favor of gaining competitive advantage. Therefore, it seems mandatory for any organization to plan for training programs for its employees to enhance their abilities and competencies that are needed at the workplace (Jie and Roger, 2005). Training not only develops the capabilities of the employee but sharpen their thinking ability and creativity in order to take better decision in time and in more productive manner (David, 2006).

2.2 Empirical Review

Many researchers have analyzed different inventory management practices and performance and these studies have amassed an enormous knowledge related to inventory management and organizational performance. Maria and Jones (2003) argue that purchasing function has a direct link with inventory level control and cost management since implementation of proper inventory management practice involves providing high-quality products at relatively less cost. They further point out that it is essential to establish a daily ordering and frequent calculation of inventory turns. On the other hand, Ballon (2000) argues that inventory cost should be considered while taking inventory decisions. He found that inventory carrying costs typically range from 20% to 40% of inventory value. Selection of right inventory management practice is a must for a company's inventory management performance.

Gill, Biger, and Mathur (2010) argue that excess and obsolete inventory is an operational liability, because it uses valuable storage space and increases inventory costs. Raw material ordering frequency is identified as an important factor contributing to inventory cost. Frequent ordering in small quantity is considered as an important strategy. Their purchase requirement quantity of material is normally less to enable them to get these benefits. Hence for SMEs, frequent purchasing is appreciated.

Ackah & Ghansha (2016) by their study, on the title of Assessment of Inventory Management, the researchers assessed the Performance of the Production and service Sector to find out how the management of inventory within work would be effective and bring a lot of cost savings for the organization to increase organizational performance. In order to reduce the cost of holding and to ensure the continuity of supply at the same time shows how the management of inventory within operational works would be effective and bring a lot of cost savings to the organization. Musau, Namusonge & Makokha (2017) who conducted a research on the title of "The Effect of Inventory Management Organizational performance" argue that inventory management has a

significant effect on organizational performance in terms of lean practices and keeping constant availability of inventory items with the right quantity and quality. They further argue that inventory leanness is the best inventory control tool. The theory elaborates on how manufacturers gain flexibility in their ordering decisions, reduce the stocks of inventory held on site and eliminate inventory carrying costs. At the aggregate level, the empirical strength of the lean explanation lies both in the timing and the magnitude of the adoption. However in the theory, inventory constrains a firm's ability to respond to fluctuations in demand. Scholarly studies indicate that companies successfully optimize inventory through lean supply chain practices and systems to achieve higher levels of asset utilization and customer satisfaction leading to improved organizational growth. According to Lean Theory, inventory management act as a major component of any supply chain irrespective of whether it is product or service supply chain.

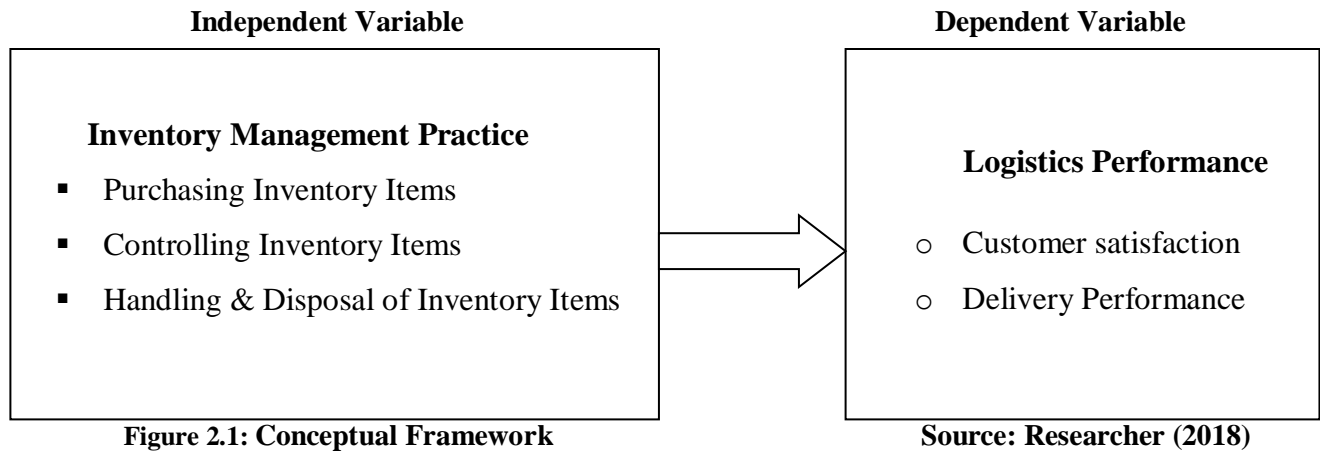
Another study suggesting a positive relationship between inventory management and performance was that of Masudin & S. Karma (2018) in which their study focused on "The Impact of Inventory Management and procurement practices on organizational performance". They found that inventory management plays an important role in customer satisfaction and lowering total costs of the organization.

2.3 Conceptual Framework

As noted by Kombo and Tromp (2009), a concept is an abstract or general idea inferred or derived from specific instances. A conceptual framework is a set of broad ideas and principles taken from relevant fields of enquiry and used to structure a subsequent presentation. Mugenda (2003) defined a conceptual framework as a hypothesized model identifying the model under study and the relationship between the dependent and independent variables. Kothari (2004) defined an independent variable also known as the explanatory variable as the presumed cause of the changes of the dependent variable, while a dependent variable refers to the variable which the researcher wishes to explain. The goal of the conceptual framework is to categorize and describe concepts relevant to the study and map relationships among them. Such a framework helps the researcher to define the concept, map the research terrain or conceptual scope, systematize relations among concepts and identify gaps in literature (Creswell, 2003).

The conceptual framework of the study was based on key concepts of the study and literature review. The conceptual framework was then used to analyze the results of the research. It was

based on the inventory management practices having an effect on logistics performance in Ethiopian Defense Force Logistics Main Department. This is shown in the figure below:



2.4 Summary of Empirical Review and Research Gap

In all the above studies, different researchers conducted their studies on inventory management from different perspective such as the effect of inventory management on firm’s performance, the effect of inventory management on financial performance, the effect of inventory management on organizational performance and assessment of inventory management practice. This show that how inventory managing is the key part of the management functions to perform in effective and efficient manner for any organization. There are a lot of researches done on inventory management in different problem areas but most of them were done in business firms focusing on organizational performance and financial performance. There is no research concerning on logistics performance on nonprofit organization especially Ethiopian Defense force. As explained by Headquarters department of the army (1985), the management of inventories is central to Army logistics management. Army operations depend on supplies; the flow of these supplies depends upon the effectiveness of the management of inventories for many months prior to the issue of the supplies. The objective of inventory management is effective, efficient, and economical supply of the combat soldier. Most researchers suggested that inventory management has a significant effect on organizational performance and financial performance. However, there is no study that has been comprehensively done on the effect of inventory management on logistics performance in the case of Ethiopian defense force and hence the study intended to fill that gap.

CHAPTER THREE

RESEARCH METHODOLOGY

This chapter includes explanation concerning the area of the study, research design, types of data and information required. It also explains about sampling procedures, sample size, data collection techniques or instrument, data analysis and expected result. (Kothari, 2004) defined research methodology as a science of studying how research is done scientifically; also he defines research methods as all those methods/techniques that are used for conducting a research. This chapter presents the methods used for the study. It explains the research approach and design by giving details about the population, sample and sampling techniques as well as the research instruments used in collecting the data for the study. It also discusses the data collection methods and data analysis plan.

3.1 Description of the Study Area

The study is titled as “The effect of Inventory management Practice on Logistics performance”. The key organization to collect data for this study was Ethiopian defense Force Logistics main department in Addis Ababa. The organization’s main department was located in Addis Ababa region Torhailoch area with different departments. These departments were also located in different areas such as janmeda and kaliti.

3.2 Research Design

A research design is the conceptual structure within which research is conducted; it contributes the blue print for the collections, measurement and analysis of data (Kothari, 2006).

The study used both descriptive and explanatory research designs because the main objective of this study was to find out the existing problems from the current inventory management practice and to describe those problems, find out the relationship between each inventory management practice and logistics performance and finally to identify the effect of inventory management practice on logistics performance. Due to the fact that the study was conducted once and involved only few variables which seemed essential, cross-sectional survey method was used to gather information through asking questions to representative cross section of the population point in time.

The researcher employed descriptive and explanatory types of research design methods. It contained a qualitative and quantitative component that enabled the researcher easily assess the

effect of inventory management practice on logistics performance in case of Ethiopian Defense Force. Now a day's, mixed method is considered as a tool to triangulate the result of single approach through multiple methods (Johnston, 2010). A quantitative method was selected because it is viewed as an effective tool to gather large data and comprehensive issues at a specified period of time. The qualitative method was selected based on the assumption that it enabled the researcher generate meanings and phenomena within the real context of the research participants and to fill the gap left by the quantitative one (Kothari, 2004). Therefore, mixed method was adopted in order to make the study more reliable through triangulation.

3.3 Research Approach

The researcher applied both qualitative and quantitative research approaches in order to conduct effective and efficient data collection and analysis. The qualitative approach enabled the researcher to describe the actual phenomenon in a deep comprehensive manner. The quantitative method was also the appropriate approach to conduct statistical techniques based up on numerical facts.

3.4 Population and Sample

3.4.1 Population

Population is defined as a cluster of statistically equivalent individuals or a collection of individuals who are genetically exchangeable (Lawson, 2012). The target population to be used for this study included all employees in finance directorate department, purchasing department and all warehouse employees under Defense Logistics main department. The warehouse employees were mainly composed from four departments that was transport main department, food & material management main department, petroleum, oils & lubricants main department and maintenance main department. The total number of target population was 150 employees which were 55 employees from finance directorate, 35 employees from purchasing and 60 employees from warehouse departments.

3.4.2 Sample

A sample is a subset or portion of the total population, whereas population is totality of the objects under investigation (Kothari, 2004). As indicated before in the population part in the above, in this study, the target population on which the study obtained information was all

employees in finance, purchasing and warehouse departments under Defense Logistics main department and the representative sample was taken from the indicated population.

3.4.2.1 Sampling Technique

Sampling technique refers to method used in selecting the items for the sample. The sampling technique to be used in this study was stratified random sampling technique. As explained by Yamane (1967), Stratified random sampling is useful method for data collection if the population is heterogeneous. As indicated before in the population part, since the target population in this study was heterogeneous, stratified random sampling technique was appropriate in order to take representative sample. The technique was also appropriate to keep the proportionality of the sample from each stratum. Based on this, the target population was stratified in to three strata which were finance directorate, purchasing and warehouse departments. After stratifying the target population, the proper sample was taken from each stratum randomly and proportionally by using Yamane formula.

3.4.2.2 Sample Size

Sample size is the number of items to be selected from the universe to constitute a sample. The size of sample should neither be excessively large nor too small. It should be optimum; an optimum sample is one which fulfills the requirements of efficiency, representativeness, reliability and flexibility. Budgetary constraint must invariably be taken into consideration when we decide the sample and the sample size (Kothari, 2004). As indicated before, the target population for this study was 150 employees which were 35 from purchasing, 55 from finance directorate and 60 from warehouse departments and the target population was stratified in to three strata which is finance directorate, purchasing and warehouse departments. After stratifying the target population, the following Yamane formula was applied to determine the appropriate sample size.

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

Where n is the sample size, N is the population size, and e is the level of precision as 95% confidence and 5% precision level.

$$n = \frac{150}{1+150(0.05)^2} = 109$$

Proportional sample size from each stratum will be calculated by using the following formula:

$$ni = \frac{n * Ni}{N}$$

Where:

ni= sample size for individual departments

Ni= the total number of employees in each department/stratum

N=the total number of population in the study

n= the total sample size for selected stratum:

(<http://ocw.jhsph.edu/courses/statmethodsforssamplesurvey>)

Strata 1: $ni = \frac{60*109}{150} = 44$

Strata 2: $ni = \frac{55*109}{150} = 40$

Strata 3: $ni = \frac{35*109}{150} = 25$

Table 3.1: Total population and sampling from each stratum

No	Sampling area		Location	Population	Sample size	
					percent	sample
1	Ethiopian	Purchasing department	Addis Ababa	35	71%	25
	Defense Force	Warehouse	Addis Ababa	60	73%	44
	Logistics Main	Finance directorate	Addis Ababa	55	73%	40
Total				150	54%	109

3.1 Data Sources and Types

3.1.1 Data Sources

In order to collect valuable and all-round data from the sample population, both primary and secondary data sources were used. The primary data sources were the selected people directly engaged in finance, purchasing and warehousing activities. The secondary data sources were Ethiopian Defense Force Logistics department annual reports and different internet sources.

3.4.3 Data types

Data are facts, figures and other relevant materials past and present serving as bases for study and analysis (Krishnaswami, 2003).

There are two types of data namely primary data and secondary data on which the study kept in mind. For the effectiveness and reliability of the study in bringing good value of the collected data, the study employed both primary and secondary data in assessing the effect of inventory management practice on logistics performance.

3.5.2.1 Primary Data

Primary data are those which are collected afresh and for the first time, and this happen to be original in character (Kothari, 2004).

The study used personal interviews with structured questionnaires where by the respondents were requested to fill in the questionnaires; the questionnaires had closed ended questions.

3.5.2.2 Secondary Data

Secondary data are those data obtained from literature sources, which have already been collected by other people for some other purposes; it is the second hand information which includes both raw data and published one (Saunders, et al. 2007).

The study extracted data from recorded documents at Defense Logistics main department which seemed relevant to the study on assessing the effect inventory management practice on logistics performance.

3.4.4 Data Collection Instruments

Interview

Interview method is the method of collecting data that involves presentation of oral - verbal stimuli and reply in terms of oral – verbal responses. Personal interview is the method of collecting data that requires a person known as the interviewer asking questions generally in a face to face contact to the other person or persons. At times the interviewee may also ask certain

questions and the interviewer respond to these questions, but usually the interviewer initiates the interview and collects the information (Kothari, 2004).

For this study, structured and open ended interview questions were forwarded to selected respondents such as department heads and head of logistics main department..

Questionnaire

Questionnaire is simply a formalized set of questions for eliciting information (Kothari, 2004).The study constructed structured questionnaires with close ended questions so as to grasp the reliable and valid data regarding to the assessing the effect of inventory management practice on logistics performance at Ethiopian Defense Force Logistics main department to which these questionnaires were filled by the respondents targeted. Closed ended questions were easier to analyze, easier to administer and were economical in terms of time and money and also Preferable to eliminate biasness. Most of the questions were adopted and some of them were modified by the researcher. The author from which the questionnaire adopted was OSEI MENSAH with the study title “The Effect of Inventory Management Practices on Service delivery at St. Martin’s Hospital, Agroyesum” order to ensure the validity of the questions, the researcher made the questions evaluated by those experts having specialized knowledge and skill in inventory management practice.

Review of Documents

Documentation method is about gathering data from a secondary source. The documentary sources of data play an important role in disseminating knowledge in all disciplines. The documentary sources of data for research purposes include published books, journals, research reports, newspapers, annual reports of the organization to be studied and other unpublished literally works (Saunders, et al. 2007).

For this study, the researcher used Defense logistics main department annual reports and other internet sources.

3.5 Ethical Consideration

Research requires cooperation and coordination among different people and diverse disciplines, institutions, standards which are ethical so as to foster collaborative efforts. This includes; trust, accountability, mutual respect and fairness. Researchers should adhere to guidelines which are associated with authorship, copyright and patenting policies, data sharing policies and confidentiality rules in conducting research (AkarangaandMakau, 2016). As noted by Kothari,

C.R (2004), people should be invited voluntarily to participate in research according to their understanding on the study area.

The researcher conducted this study by taking in to consideration all ethical issues such as formal letter was written from Addis Ababa University school of commerce to the organization of the study area, keeping confidentiality of respondents, awaring respondents in advance about the purpose of the study and asking them to be volunteer and conducting the research formally by asking the permission of the organization to be studied. Irrelevant information concerning the organization as well as each respondent was not used for this study. The questions focused on the views of the respondents based on each of the effects rather than personal information. Moreover, after the proper collection, the questionnaires were coded and kept confidential. Finally, proper citation was performed in order to avoid plagiarism.

3.6 Data Analysis

Data processing was performed by editing, coding and tabulation before data is analyzed. Editing will be done to ensure that the data were accurate consistent uniformly entered and were arranged to facilitate coding and tabulation. The data were arranged in columns and rows to facilitate a basis for various statistical computations.

The researcher then applied descriptive and regression data analysis method by using Statistical Package for Social Science (SPSS). The reason for this type of approach was the characteristic of this study which was to identify the effect of inventory management practice on logistics performance and describe those effects as they are and find out what effects they have on logistics performance. The research approach of this study was based on describing the facts to be gained from the sample population. So, the data to be collected from questionnaire was analyzed by using Statistical Package for the Social Science (SPSS) version 20, table, percentage & regression model and they were interpreted according to their type. According to Philip Mayring (2014), the data to be collected from interview will be analyzed by using inductive content analysis method. Finally the responses from interview and questionnaire were triangulated in order to make the study more valid. The study included both dependent and independent variables. The relationship between these variables was measured by using multiple regression analysis. The relation was assumed linear in the form of:

$$Y = B_0 + B_1X_1 + B_2X_2 + B_3X_3 + e \quad Y \text{ is logistics performance}$$

Where

B_0 is the intercept of the model

$B_1 \dots B_3$ is coefficient of the independent variable

X_1 is purchasing inventory items

X_2 is Controlling inventory items

X_3 is Handling & disposal of inventory items

e is Error

3.7 Validity and Reliability

3.7.1 Validity

The validity of an instrument is the degree to which an instrument measures what it is intended to measure (Polit and Hungler, 1993). Validity can be categorized into internal and external validity. Internal validity refers to the ability of the research design to accurately answer the research questions. External validity refers to the capacity to generalize findings and develop inferences from the sample to the study population. To achieve internal validity, questionnaires included a variety of questions on the knowledge of the top management officials and their staff about inventory management and its effect on service delivery performance of Ethiopian Defense Force Logistics main department. The Questions was based on information gathered during the literature review to ensure that they were representative of what respondents should know. Internal validity was further ensured by consistency in administering the questionnaires. All questionnaires were distributed to 109 respondents by the researcher personally. The questions were formulated in simple language for clarity and ease of understanding. Clear instructions were given to the subjects. Finally the researcher made the questionnaires evaluated with those experts having specialized knowledge in inventory management. The experts confirmed that most of the questions are standard and fit to be distributed but some of the modified questions needed to be reshaped in relation to the research objective and the researcher corrected them accordingly.

3.7.2 Reliability

The reliability of an instrument refers to its ability to produce consistent and stable measurements. According to Cooper and Schindler (2003) reliability tests the stability, equivalence and internal consistency of an instrument. Polit and Hungler (1993) refer to

reliability as the degree of consistency with which an instrument measures the attribute it is designed to measure. The most common reliability coefficient is the Cronbach's alpha which estimates internal consistency by determining how all items on a test relate to all other items and to the total test - internal coherence of data. In this study, to ensure the reliability of the instrument, Cronbach's Alpha was used to test the reliability of the proposed constructs. The researcher conducted a pilot test on 11 employees which were 10% of the total sample population before getting into the main data collection activity.

Table 3.2: Reliability Statistics of the pilot test

Cronbach's Alpha	N of Items
.831	50

Cronbach (1951) argued that a reliability coefficient of 0.70 is considered "acceptable" in most social science research situations. The Cronbach's alpha model of the pilot test showed 0.831 and implying that the measurements in this study were internally consistent and stable as indicated below on table 3.

The reliability test of the main data for this study was also performed by using Cronbach's alpha testing method for each variable as indicated below in table 3.

Table 3.3: Reliability Test for the Main Data

	No of Items	Coefficient Alpha Reliability
Purchasing Inventory Items	17	.863
Controlling Inventory Items	17	.870
Handling and Disposal of Inventory Items	9	.869
Logistics Performance	7	.799

As indicated in the above table, the test results indicate that all of the components in the study had relatively high internal consistency. Carmer (1998) explained that a reliability coefficient of 0.70 is considered "acceptable" in most social science research situations.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND INTERPRETATION

4.1 Introduction

This chapter includes presentation, analysis and interpretation of data collected through questionnaire, interview, and document analysis. The data were collected from purchasing, warehouse and finance departments in Ethiopian defense force logistics main department. The researcher distributed 109 questionnaires to the respondents and collected 92 of them which were 84% of the total sample size. Five questionnaires from purchasing department, six questionnaires from warehouse department and six questionnaires from finance department totally seventeen questionnaires were missed which were 16% of the total sample size. This response rate was favorable according to Mugenda (2003) in which they assert that a 50% response rate is adequate, 60% good and above 70% rated very well. The researcher conducted interview with the chief of logistics main department, chief of purchasing department and chief of finance department. Based on this, the data analysis and interpretation were done as follows. Both descriptive and explanatory research designs were used to conduct this study.

4.2 Demographic characteristics of Respondents

Table 4.1: Respondents' job status

	Job Status	Frequency	Percent
Valid	Clerk	49	45
	Supervisor	27	24.8
	Head of section	12	11
	Head of department	4	3.7
Missing		17	84.4
	Total	109	15.6
			100.0

As it was indicated in the above table, 49 (45%) of the total respondents are clerks, 27(24.8%) of them are supervisors, 12(11%) of them are heads of sections and 4(3.7%) of them are head of departments. The rest 17 (15.6%) of the total respondents are non-responses. This implies that there are enough respondents from each job category that helped the researcher to triangulate the responses collected by different data collecting instruments.

Table 4.2: Respondents' Work Experience

	Work Experience	Frequency	Percent
Valid	1-5 years	23	21.1
	6-10 years	30	27.5
	11-15 years	28	25.7
	above 15 years	11	10.1
Missing		17	15.6
Total		109	100.0

Concerning respondents' work experience, the above table shows that 23(21.1%) of the total respondents served 1-5 years, 30(27.5%) of them served 6-10 years, 28(25.7%) of them served 11-15 years and 11(10.1%) of them served above 15 years. The rest 17 (15.6%) of the total respondents are non-responses. Majority of the respondents served more than five years. This implies that the majority of the respondents have a good experience on inventory management practice and better understanding of the research questions.

Table 4.3: Respondents' Level of Education

	Level of Education	Frequency	Percent
Valid	Below 10th grade	5	4.6
	10th - 12th complete	16	14.7
	Certificate	14	16.5
	Diploma	13	12.8
	Degree	43	39.4
	Masters and above	1	.9
	Missing	17	84.4
Total		109	100.0

As it is shown in the above table, 5 (4.6%) of the total respondents is below 10th grade, 16(14.7%) of them are 10th - 12th complete, 14(16.5%) of them have certificate, 13(12.8%) of them have diploma, 43(39.4%) of them are degree holders and 1(0.9%) of them has a master's degree and above. The rest 17 (15.6%) of the total respondents are non-responses. Majority of the respondents are took formal education and certified on inventory management practice. This implies that they were fit to give relevant response to the research questions based on formal knowledge and skill.

Table 4.4: Interviewees' Background Information

No	Respondents	Level of education	Field of Study	Year of service	Frequency
1	Chief of Purchasing Department	1 st Degree	Purchasing	12	1
2	Chief of Warehouse Department	1 st Degree	Logistics Management	15	1
3	Chief of Finance Department	1 st Degree	Accounting	9	1
4	Chief of Logistics Main Department	1 st Degree	Logistics Management	21	1
Total Respondents					4

As indicated in the above table, all the interviewees are 1st degree holders in logistics management, purchasing and accounting which are very much related professions to inventory management practice with longer work experience. This implied that the interviewees were capable of considerable knowledge on inventory management practice and logistics operational works and were able to give valuable responses for the raised interview questions.

4.3 The Extent of Inventory Management Practice Performance

The researcher applied 5 point likert scale to measure inventory management practice. As explained by Chih-hui (2011), mean scores are standardized as very low performance (1- 1.9), low performance (2 – 2.8), moderate performance (2.9 – 3.4), high performance (3.5 – 3.9), very high performance (4 – 5) (Chih-hui, 2011).

Table 4.5: Descriptive Statistics for Purchasing Inventory Items

No	Description	Mean	Std. Deviation
1	The human resource power working in my department is full of the required skill and knowledge with the necessary formal education in purchasing profession.	3.87	.975
2	There is a mechanism for knowing the level of inventory items to determine annual demand of the organization	3.86	.944
3	My department applies competitive purchasing method to buy inventory items	2.13	.892
4	My department invites all possible suppliers in purchasing inventory items.	2.07	.959
5	My department has a mechanism for assessing the overall performance of selected suppliers of inventory items.	2.13	.892
6	My department facilitates fair and legal competition between all possible suppliers in purchasing inventory items	2.08	.975
7	Purchasing of inventory items is not timely done to maintain the level of inventory items.	2.11	.907
8	There is a dalliance of finance department in the processes of preparing the payment of suppliers	2.08	.975
9	Dalliance of central store is affecting your work in timely receiving the delivery of purchased items	2.12	.875
10	My department takes feedback from our customers about the quality of inventory items before purchasing.	2.08	.975
11	All inventory items are being delivered according to pre-stated specifications.	3.70	.911
12	There is serious inspection of purchased inventory items in relation to quality before storage.	3.86	.944
13	My organization's financial flow is being affected due by excess inventory items.	2.13	.892
14	My department has a systematic mechanism to get up-to-date information about inventory items.	2.08	.975
15	Finance department has a systematic mechanism to reconcile the total balance of the stock catalogue with the balance of stock ledger account.	3.88	.982
16	There is quality problem on purchased inventory items.	3.72	.894
17	My organization is incurring storage costs due to excess & obsolete inventory items.	3.82	.983
Cumulative		2.80	.446

As shown in the above table, majority of the respondents agreed that there is low purchasing performance (Chih-hui, 2011) with a major problems on implementation of competitive purchasing system (mean 2.13, std. dv. .892), inviting all possible suppliers for fair competitive bidding (mean 2.08), assessing the performance of active suppliers (mean 2.13, std. dv. .892), taking feedback from customers about the quality of inventory items (mean 2.08, std. dv. .975), having up-to-date information about inventory items on hand (mean 2.08, std. dv. 975), timely ordering of inventory items (mean 2.11, std dv. .907) and quality problem on purchased inventory items (3.72, std dv. .894). Department of Army Field Manual (1958) explained that the legality of purchasing activity plays a significant role on inventory management effectiveness. Formal advertising should be the law of the organization in order to establish real transparency and accountability in relation to overall purchasing performance as well as to assure maximum competition. Maria and Jones (2003) argue that purchasing function has a direct link with inventory level control and cost management since implementation of proper inventory management practice involves providing high-quality products at relatively less cost. As stated by Porter (2011), the main objective of inventory management is identifying the effects of cost that having items in stock and not having items in stock and compute the cost of holding and ordering the inventory. In order to attain a balance between inventory availability and cost, it must be addressed the main target of inventory management is the volume that how much to order and when to order. As noticed by Mohamed et al (2016), a good inventory system will lead the organization easily to know the time to order the needed materials.

In general, the existence of the indicated responses implies that there is lack of competitive based purchasing policy that gives a chance to all possible suppliers to fairly compete for common benefit of the buyer and suppliers and lack of sharing information between purchasing and warehouse departments to have a common understanding about the overall status of inventory items and decide what items to be purchased.

Majority of the respondents also responded that there is a high extent of performance in purchasing profession (mean 3.87, std dv. .975), delivering inventory items in accordance with pre stated specification (mean 3.70, std dv. .911), dalliance of warehouse department in timely receiving the delivery of purchased items (mean 2.12, std dv. .907), inspection of inventory items for quality and quantity before storage (mean 3.86, std dv. .944).

According to the interview response from head of purchasing department, even if there is competitive bidding in purchasing stationery and other office equipments, the organization does not apply competitive purchasing method especially for military clothes for the reason of giving a special chance to its own garments and shoe factories that produce different military clothes and shoes and Some feedbacks are coming from army members that there is a quality problem on military clothes, shoes and socks. The feedback shows that military clothes are easily fading and becoming very hot in high temperature areas, military shoes are also easily tearing. Muhammad Asif (2012) noticed that the goal of inventory is to meet customer demand. Therefore, the absence of real time inventory information on customer demands can result to inaccurate forecast hence translate to late, insufficient and inconsistent deliveries of goods and eventually causes customer dissatisfaction.

Table 4.6: Descriptive Statistics for Controlling Inventory Items

No	Description	Mean	Std. Deviation
1	The human resource power working in my department is full of the required skill and knowledge with the necessary formal education in inventory management profession.	2.13	.892
2	Purchasing department always sends the necessary document of purchased items to your warehouse for processing the receiving activity.	3.86	.944
3	warehouse department faces a problem of dalliance of inspection to processes the receiving activity of purchased items	2.22	.900
4	Defective inventory materials are being seen frequently in receiving process of warehouse department.	2.08	.975
5	Warehouse department always receive similar items with sample received items	2.13	.892
6	Too much warehouse space is occupied by idle and obsolete inventory items	3.77	.939
7	All inventory items are categorized by ABC classification.	2.13	.892
8	Computerized inventory controlling system is applicable in the warehouse.	2.07	.959
9	There is networked computerized system between warehouse, purchasing and finance departments.	2.13	.892
10	Obsolete items are kept separately from active inventory items for best handling system	2.08	.975
11	There are no active inventory items outside the store without shelter for long time	2.07	.959
12	Warehouse department applies a scientific method to control over and under stock inventory items	2.08	.975
13	There is a mechanism for reconciliation of actual inventory items with registration document.	3.85	.960
14	There is a mechanism to determine reorder point in warehouse.	2.08	.975
15	There is no scheduled inventory counting mechanism in warehouse.	2.07	.959
16	There is timely ordering of inventory items to maintain or replenish the inventory items	1.83	.720
17	The current inventory management system in Ethiopian Defense Force Logistics Main Department is well organized to manage inventory items.	1.98	.726
Cumulative		2.65	.508

As indicated in the above table, majority of the respondents agreed that there is small extent of inventory controlling performance with a major problems on occupation of warehouse spaces by obsolete inventory items (mean 3.77, std. dv. .939), classifying inventory items in ABC classification (mean 2.07, std. dv. .959), application of computerized inventory controlling system (mean 2.07, std. dv. .959), keeping obsolete inventory items separately from active inventory items (mean 2.08, std. dv. .975), keeping active inventory items outside the store without shelter (3.86, std. dv/ 944), determining the exact reorder point (mean 2.08, .975) and the current inventory management practice of Ethiopian defense force logistics main department. Department of Army Field Manual (1958) stated that when the material is clearly become obsolete, excess or surplus to needs, it should be disposed of to conserve ware-house space and reduce operating costs. As stated by Jessop (1999), inventory items should be classified based up on their money value of the total inventory kept in the store which is called ABC classification. Reid & Sanders (2007) noted that the benefits of a computerized inventory control system can be derived, when an organization integrates its inventory control system with the other systems such as accounting and purchasing, that helps in better control of inventory levels. In practice, when the inventory level reaches to its minimum point, the system automatically generates a purchase order, which is sent to the supplier electronically as well as what and how much items left on hand. Musau, Namusonge & Makokha (2017) who conducted a research on the title of “The Effect of Inventory Management Organizational performance” argue that inventory management has a significant effect on organizational performance in terms of lean practices and keeping constant availability of inventory items with the right quantity and quality.

In general, the existence of the indicated problems implies that there is lack of computerized inventory management system that enables the organization to exactly know what and how much inventory is and should be on hand, what and how much inventory is not available and needed to be replenished, what and how much inventory is idle and obsolete.

Majority of the respondents also responded that there is a high extent of performance with better practices on sending documents of purchased items to warehouse personnel (mean 3.86, std. dv. .944), serious inspection of purchased items in terms of quality and quantity without dalliance (mean 2.22, std. dv. .900), delivery of defective materials (mean 2.08, std. dv. .975), dissimilarity of purchased items with selected samples (2.13, std. dv. .982), reconciliation of

actual items with recorded items (mean 3.85, std. dv. .960), scheduled inventory counting (mean 3.86, std. dv. .944).

According to the interview response from the head of warehouse and head logistics main department, there is no computerized inventory management system; there is a need of on job and of job training especially for warehouse personnel because there is lack of enough knowledge and skill in warehouse human resource to perform scientific inventory controlling practice. The inventory controlling system is being conducted in manual way mostly with experience. Many spaces in warehouse are occupied by obsolete inventory items. Because of this, active inventory items are kept outside the store without shelter. As explained by Jie & Roger (2005), training programs not only develops employees but also help an organization to make best use of their humane resources in favor of gaining competitive advantage.

Table 4.7: Descriptive Statistics for Handling and Disposal of Inventory Items

No	Description	Mean	Std. Deviation
1	Warehouse is free from obsolete inventory items that cannot be used due to change in technology, design or color.	2.13	.892
2	There is a problem in application of well-organized disposal system for obsolete inventory items.	3.86	.944
3	Warehouse spaces are being utilized properly without the effect of obsolete inventory items.	2.22	.900
4	All actively needed inventory items are kept in the store with proper safety.	2.08	.975
5	The organization is free from caring costs of obsolete inventory items.	2.13	.892
6	The stock materials which were kept out side of the stores for a long time are exposed to damage as well as theft	3.77	.939
7	There are sufficient spaces to handle active inventory items properly in warehouse	2.13	.892
8	Obsolete inventory items are kept separately from active inventory items for the best handling system	2.07	.959
9	The current inventory management system in Ethiopian Defense Force Logistics Main Department is well organized to manage inventory items in safe and good handling	2.13	.892
Cumulative		2.66	.597

As shown in the above table, majority of the respondents agreed that there is small extent of inventory handling and disposal performance with a major problems on occupation of warehouse spaces by obsolete inventory items (mean 2.12, std. dv. .875), lack of well-organized disposal system (mean 3.86, std. dv. .944), proper utilization of warehouse spaces (mean 2.13, std. dv. .982), keeping all active and obsolete inventory items in warehouse together (mean 2.08, std. dv. .975), incurring carrying costs due to obsolete inventory items (mean 2.13, std. dv. .982), exposure of outdoor active inventory items for damage and theft (mean 3.77, std. dv. .939), availability of sufficient spaces for active inventory items (mean 2.13, std. dv. .982) and keeping obsolete inventory items separately from active inventory items (2.07, std. dv. .959). Department

of Army Field Manual (1958) stated that when the material is clearly become obsolete, excess or surplus to needs, it should be disposed of to conserve ware-house space and reduce operating costs. According to Drury (2004) obsolescence cost is one of the main inventory carrying costs that highly affect an organizations financial performance. Gill, Biger, and Mathur (2010) argue that excess and obsolete inventory is an operational liability, because it uses valuable storage space and increases inventory costs.

In general, the existence of the indicated problems implies that there is lack of effective handling and disposal policy in Ethiopian defense force logistics main department.

According to the interview response from the head logistics main department and the head of warehouse department as well as the annual report of the organization, there are obsolete inventory items that should be disposed in warehouse such as obsolete military clothes that became useless due to design and color changes, spare parts that cannot be used for the current vehicles, inactive explosives and other harmful chemicals that should be carefully disposed. There is no well-organized disposal system for these obsolete inventory items; due to this, many warehouse spaces are occupied by obsolete inventory items and this forced the organization to keep active inventory items outside the store with weak safety. The interview response also indicates that dangerous military inventory items like ammunitions, anti-tank and anti-human explosives and other toxic chemicals that could cause significant damage on the warehouse personnel and the overall environment are being kept carelessly with a weak safety. The concerning higher body is not giving enough attention for this critical issue.

Table 4.8: Descriptive Statistics for Logistics Performance

No	Description	Mean	Std. Dev.
2. Customer Satisfaction			
1	To what extent inventory items are being purchased based on customers' quality requirements?	2.12	.875
2	To what extent customer satisfaction survey is being applied to measure customer satisfaction level?	2.13	.892
3	What is the extent of Customer satisfaction level in terms of timely delivery of the right product with the right quality and quantity?	2.07	.959
4	What is the extent of Customer satisfaction level in terms of product quality?	2.13	.892
1. Delivery Performance			
1	To what extent the logistics main department perform on delivering the right product with the right amount with the right quality to the right customer at the right time?	2.12	.875
2	To what extent the inventory items are available whenever they are needed to perform timely delivery to the end users?	2.04	.876
3	To what extent military missions failed due to poor delivery performance?	2.23	.866
Cumulative		2.62	.581

As indicated in the above table, majority of the respondents agreed that there is small extent of logistics performance in relation to customer satisfaction and delivery performance with major problems on extent of purchasing inventory items based on customers quality requirements (mean 2.12, std. dv. .875), extent of applying customer satisfaction survey (mean 2.13, std. dv. .892), extent of customer satisfaction level in terms of timely delivery (2.07, std. dv. .959), extent of customer satisfaction level in terms of product quality (mean 2.13, std. dv. .982), extent of delivering the right product with the right amount with the right quality to the right customer at the right time (mean 2.12, std. dv. .875) and extent of inventory availability whenever they are needed to perform timely delivery to the end users (2.04, std. dv. .876). Muhammad Asif (2012) the goal of inventory is to meet customer demand. Therefore, the absence of real time inventory information on customer demands can result to inaccurate forecast hence translate to late, insufficient and inconsistent deliveries of goods and eventually causes customer dissatisfaction. Wanjiku G. (2015) noted that delivery of the right product to the right customer at the right time to the right place with the right quantity and quality is one of the major performance indicators of logistics. Logistics must ensure that a recipient is supplied from a point of origin in accordance with his requirements with the correct product (in quantity and variety), in the right condition, at the right time and in the right place at minimum cost.

In general, the existence of indicated problems implies that there is low extent of logistics performance in Ethiopian defense force logistics main department.

Majority of the respondents also responded that there is a high extent of logistics performance in terms of mission accomplishment (mean 2.23, std. dv. .892).

According to interview response from logistics main department Ethiopian defense force logistics main department perform in war and peace time missions. More attention is given for satisfying fighting soldiers and timely delivery of inventory items in war time in order to motivate the fighting troops and win the war. This time, there will be no any problem on inventory availability and delivery performance. However all the indicated inventory management problems will occur in peace time after the war is ended. In peace time, no one cares much about soldier satisfaction and timely delivery of inventory items.

4.4 Normality Test

Assumption of normality means that you should make sure your data roughly fits a bell test normality of the data distribution as shown below: (<https://en.wikiversity.org>). For this study, the researcher used histogram in order to test normality of the data distribution as indicated below:

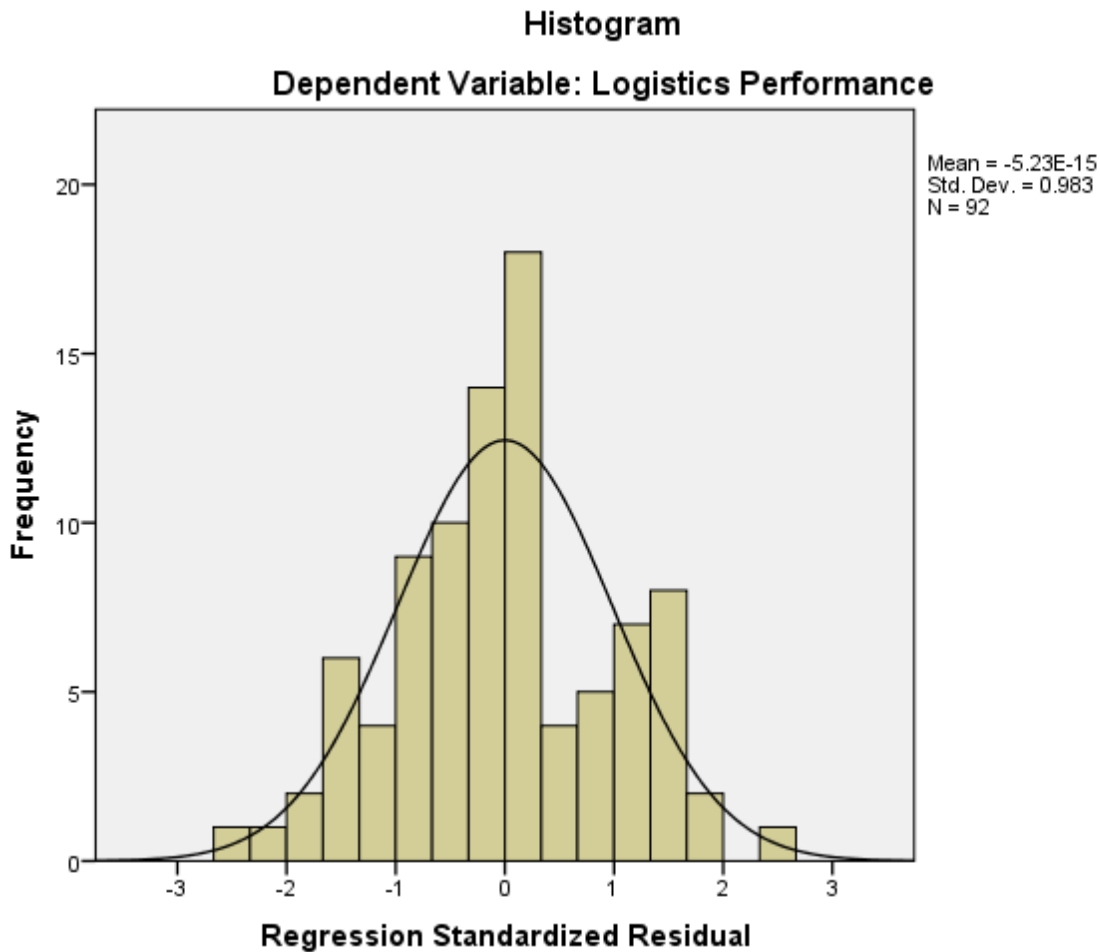


Figure 2: Normality Test

As indicated in the above graph and visual inspection of the researcher, the assumption of normality has been met because the sample data produced bell-shaped curve having a peak in the middle with a balanced Skewness of 3 and -3. This implies that the data were approximately normally distributed (Asghar, 2012.).

4.5. Relationship between Inventory Management Practice and Logistics Performance

4.5.1 Pearson’s Correlation

This study was interested in establishing if there is a relationship between inventory management practice and logistics performance i.e. to see if they are correlated or not. The previous descriptive analysis showed the extent of inventory management practice performance in Ethiopian defense force logistics main department. In this part Pearson’s correlation was used to categorize the type of correlation (positive or negative) by considering the predictor variables (purchasing inventory items, controlling inventory items and handling & disposal of inventory items) that were strongly or weakly correlated with the dependent variable (logistics performance).

In order to develop the Pearson’s correlation matrix, the means of the variables were calculated and grouped into three dimensions; purchasing inventory items, controlling inventory items and handling and disposal of inventory items. As explained by Robert B. & Richard A (2008), the Pearson’s correlation coefficient is denoted by r and is by design constrained as follows: $-1 \leq r \leq 1$. The decision rule is such that if $p \leq 0.05$, the test is significant and if $p \geq 0.05$, the test is not significant. Furthermore, positive values denote positive linear correlation; negative values denote negative linear correlation; and a value of 0 denotes no linear correlation. The closer the value is to 1 or -1 , the stronger the linear correlation. Table 4.9 shows the Pearson’s correlation coefficient matrix.

Table 4.9: Pearson’s Correlation Coefficient Matrix

		PII	CII	HDII	LP
PII	Pearson Correlation	1			
	Significance				
CII	Pearson Correlation	.688	1		
	Significance	.000			
HDII	Pearson Correlation	.542	.539	1	
	Significance	.000	.000		
LP	Pearson Correlation	.735	.678	.811	1
	Significance	.000	.000	.000	

Note: Correlation is significant at the 0.01 level

Key: **PII** is purchasing Inventory Items, **CII** is Controlling Inventory Items, **HDII** is Handling and Disposal of Inventory Items and **LP** is Logistics Performance.

As shown in table 4.9, all the independent variables (inventory management practices) have a positive correlation with logistics performance. This relationship shows that as the inventory management practices change, logistics performance changes in the same direction at varying degrees. The positive relationship between all inventory management practices (purchasing, controlling and Handling & disposal) and logistics performance is strong based on the assumption of Pearson's correlation $1 < |r| < .3$... small / weak correlation, $.3 < |r| < .5$... medium / moderate correlation and $.5 < |r|$ large / strong correlation. Pearson's correlation coefficient assumes that each pair of variables is bivariate normal and it is a measure of linear association. (<https://libguides.library.kent.edu/>)

Test for Multicollinearity

In statistics, multicollinearity is a situation in which two or more independent variables in a multiple regression model are extremely correlated, implying that one can be linearly predicted from the others with a considerable degree of accurateness (Hair et al., 2010). The results of multicollinearity for the variables under study are documented in table 4.10.

Table 4.10: Test for Multicollinearity

Variables	No Of Items	Collinearity Statistics	
		Tol.	VIF
Purchasing Inventory Items	17	.709	1.410
Controlling Inventory Items	17	.706	1.417
Handling & Disposal of Inventory Items	9	.526	1.900

Note: Tol. = tolerance, VIF = variance inflation factor

The values of tolerance for each independent variable are within the threshold of .10 with VIF of $1 < VIF$ and $VIF < 10$ showing that there was no multicollinearity problem in the study. (Hair et al., 2010).

4.6 The Effect of Inventory Management Practice on Logistics Performance

4.6.1 Model Fit

Table 4.11 shows the results for variations between the dependent and independent variables. Although R^2 value does not guarantee that the model fits the data well, this study assumed that R^2 was the best indicator for how well the independent variables explain variations in dependent variable. R^2 is the coefficient of determination and shows how logistics performance is influenced by inventory management practices in combination.

Table 4.11: Model Summary

Model	R	R^2	Adjusted R Square	Std. Error of the Estimate
1	.890 ^a	.793	.786	.26924

As shown in table 4.11, with R^2 of .793 for the model, the independent variables in the model (purchasing inventory items, controlling inventory items and handling & disposal of inventory items) could offer about 79.3% explanation of the variance in the dependent variable logistics performance. This means that variations in independent variables causes 79.3% change in dependent variable logistics performance with 20.7% explained by other factors. Thus, the result shows that the predictors identified in this study were influencers of logistics performance to a high extent. (Hair et al., 2010)

Table 4.12: ANOVA

	Model	Sum of Squares	df	Mean Square	F	Sig.
	Regression	24.390	3	8.130	112.152	.000
1	Residual	6.379	88	.072		
	Total	30.769	91			

a. Dependent Variable: Logistics Performance

b. Predictors: (Constant), Handling and Disposal of Inventory Items, Controlling Inventory Items, Purchasing Inventory Items

The outcomes in table 4.12 show that the F statistic was 112.152 and was significant at 5% level of confidence i.e. $p = 0.000$. This means that inventory management practices explain variation in logistics performance and this explanation was significant.

Distribution of Coefficients

The table of coefficients below measures the individual contribution of each independent variable to changes in the dependent variable. This is represented by the coefficient Betas for each of the predictor.

Table 4.13: Distribution of Coefficients

Model	No of Items	Unstandardized		Standardized	
		Coefficients	Std. Error	Coefficients	t Sig.
		B	Std. Error	Beta	
(Constant)		-0.507	0.188		-2.695 .008
Purchasing Inventory Items	17	0.433	0.091	0.332	4.768 .000
Controlling Inventory Items	17	0.177	0.080	0.155	2.227 .028
Handling and Disposal of Inventory Items	9	0.532	0.058	0.547	9.108 .000

a. Dependent Variable: Logistics Performance

The model shows a strong and statistically mostly significant positive relationship between Purchasing Inventory Items ($\beta = .433$, $t = 4.768$, $p = 0.000$), controlling Inventory Items ($\beta = 0.177$, $t = 1.134$, $p = 0.00$); Handling and Disposal of Inventory Items ($\beta = .532$, $t = 9.702$, $p = 0.028$), and Logistics Performance. The coefficients are positive for Purchasing Inventory Items, Controlling Inventory Items and Handling and Disposal of Inventory Items which would indicate that as the selected inventory management practices become larger or increased, it is related to a higher logistics performance which is what we would expect. Overall, the consistency of regression coefficients on the selected inventory management practices suggests that these variables are important factors influencing operational efficiency although at different degrees. All the independent variables were significant predictors of logistics performance since their significance value was less than 0.05 ($p < 0.05$). Additionally, the results show that multicollinearity did not pose a problem in the study since all the variables met the criteria of Tolerance should be > 0.1 or VIF (variance inflation factor) should be > 1 and < 3 . The predictive model developed by the study is $Y = -.507 + .433X_1 + .177X_2 + .533X_3$, where Y is logistics performance, X1 is purchasing inventory items, X2 is controlling inventory items and X3 is handling and disposal of inventory items (Hair et al., 2010).

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATION

5.1 Introduction

This chapter gives a summary of the findings of the study, the conclusions and the recommendations for stakeholders to ensure effective and efficient management of inventory in Ethiopian Defense Force Logistics Main Department. These have been discussed in the next sub-sections.

5.2 Summary of Findings

In order to ensure achievement of the study objectives, the summary of the study findings is presented in relation to the pre-stated objectives of the study (to measure the performance of the organization on inventory management practice, to identify the relationship between inventory management practice and logistics performance and to find out the effect of inventory management practice on logistics performance) based up on the data analysis in the previous chapter.

5.2.1 Measuring Inventory Management Practice

The first objective of the study was to measure that to what extent inventory management practice was being performed in Ethiopian defense force logistics main department.

5.2.2.1 Purchasing Inventory Items

- ✓ As the data analysis part shows Majority of the respondents indicated that there is small extent of purchasing performance (cumulative mean 2.87, Std. dv. .446) with major problems on lack of competitive purchasing policy that gives a chance to all possible suppliers to fairly compete and offer inventory items with better quality and price for common benefit of the buyer and suppliers.
- ✓ Majority of the respondents responded that there is lack of sharing information between purchasing and warehouse departments about the inventory on hand; (cumulative mean 2.87, Std. dv. .446) because of this, purchasing is being done without checking the exact stock balance and this leads to make wrong decision on what to order, when to order and how much to order.
- ✓ Majority of the respondents indicated that the purchasing department has no a mechanism to assess suppliers' performance and collect customers' feedback to prevent defection and

quality problems on purchased inventory items. As explained by Brutus (2015), After choosing the final supplier, monitoring of selected suppliers i.e. evaluation and assessment should be done based on certain criteria such as quality, delivery, past performance, price, quality, financial position, technical capability etc.

5.2.1.2 Controlling Inventory Items

- ✓ Majority of the respondents responded that inventory items are not classified in to ABC classification. Lysons and Gillingham, (2003) stated that ABC classification is important to ensure effective controlling on inventory items based up on their money value. It is also essential to ensure that purchasing staff use resources to maximum efficiency by concentrating on those items that have the greatest potential savings. Selective control will be more effective than an approach that treats all items identically..
- ✓ Majority of the respondents responded that that there is lack of computerized inventory management system (cumulative mean 2.65, Std. dv. .508) that enables the organization to exactly know what and how much inventory is and should be on hand, what and how much inventory is not available and needed to be replenished, what and how much inventory is idle and obsolete.
- ✓ Majority of the respondents responded that there is lack of sharing information between purchasing and warehouse departments about the inventory on hand; (cumulative mean 2.87, Std. dv. .446) because of this, purchasing is being done without checking the exact stock balance and this leads to make wrong decision on what to order, when to order and how much to order.

5.2.1.3 Handling and Disposal of Inventory Items

- ✓ Most of the respondents responded that there is lack of effective handling and disposal policy in Ethiopian defense force logistics main department (cumulative mean 2.87, Std. dv. .446) that led the warehouse department to the problem of keeping obsolete inventory items including harmful explosives and chemicals in warehouse and keeping active inventory items outside the store with the exposure to damage and theft.

5.2.1.4 Logistics Performance

- ✓ Majority of the respondents implies that there is low extent of logistics performance in Ethiopian defense force logistics main department in relation to customer satisfaction and delivery performance (Cumulative mean 2.62 and Std. Dev. 5.81).

- ✓ The interview response from the heads of warehouse logistics departments indicates that there is lack of up-to-date knowledge and skill especially in warehouse personnel and there is a need of on job and of job training program in relation to inventory management in order to upgrade their performance.

5.2.2 Relationship between Inventory Management Practice and Logistics Performance

The second objective of the study was to identify the relationship between inventory management practice and logistics performance.

- ✓ According to the correlation test of SPSS data analysis, there is a positive relationship between each independent variable (purchasing inventory items, controlling inventory items and handling and disposal of inventory items) and logistics performance with Pearson correlation value of .735, .678 and .811 respectively. This relationship shows that as the inventory management practices change, logistics performance changes in the same direction at varying degrees. The positive relationship between inventory management practices and logistics performance is strong. (Krishna, 2003)
- ✓ The results also show that multicollinearity did not pose a problem in the study since all the variables met the criteria of Tolerance should be >0.1 or VIF (variance inflation factor) of >1 and <10 which was within the acceptable thresholds.

5.2.3 The Effect of Inventory Management Practice on Logistics Performance

The third objective of the study was to find out the effect of inventory management on logistics performance.

- ✓ The regression model shows a strong and statistically mostly significant positive relationship between Purchasing Inventory Items ($\beta = .433$, $t= 4.768$, $p = 0.000$), controlling Inventory Items ($\beta = 0.177$, $t=2.227$ $p = 0.028$); Handling and Disposal of Inventory Items ($\beta = .532$, $t=9.108$, $p = 0.000$), and Logistics Performance. The coefficients are positive for Purchasing Inventory Items, Controlling Inventory Items and Handling and Disposal of Inventory Items which would indicate that as the selected inventory management practices become larger or increase, it is related to a higher logistics performance which is what we would expect. Overall, the consistency of regression coefficients on the selected inventory management practices suggests that these variables are important factors in influencing operational efficiency although at different degrees. All the independent variables were significant

predictors of logistics performance since their significance value was less than 0.05 ($p < 0.05$). Additionally, the results show that multicollinearity did not pose a problem in the study since all the variables met the criteria of Tolerance should be > 0.1 or VIF (variance inflation factor) of > 1 and < 10 .

5.3 Conclusion

Based on the preceding findings of the study, the following conclusions were made in relation to the three research objectives;

Capable management of inventory system requires an appropriate system of making the decisions to keep track of items in inventory, how much and when the order is applied. In every organization the decision on inventory is based on the facts about the balance of inventory on hand, forecasting demand information, lead time and time variation, stock cost, ordering cost and shortage cost (Naliaka & Namusonge 2015). The legality of purchasing activity plays a significant role on inventory management effectiveness. Formal advertising should be the law of the organization in order to establish real transparency and accountability in relation to overall purchasing performance as well as to assure maximum competition (Department of Army Field Manual 1958). But according to the study finding of the organization, Ethiopian defense force logistics main department purchasing practices had certain gaps. The first gap was lack of competition based purchasing policy. Because of this gap the purchased inventory items were being exposed to quality problems. There was also lack of sharing information/networked activity/ between purchasing and warehouse departments about the inventory on hand; because of these purchasing is being done without checking the exact stock balance and this leads to make wrong decision on what to order, when to order and how much to order.

The other gap found in this study was lack of computerized inventory controlling system. This gap made the organization especially the warehouse department not to exactly know how much inventory on hand, how much to be purchased and how much to be disposed. Because of this much of the warehouse spaces were held by obsolete inventory items and active inventory items are kept outside the store and exposed to damage and theft. This problem leads the organization to unnecessary carrying cost of obsolete inventory items and unnecessary handling cost of active materials. Reid & Sanders (2007) noted that the benefits of a computerized inventory control system can be derived, when an organization integrates its inventory control system with the

other systems such as accounting and purchasing, that helps in better control of inventory levels. In practice, when the inventory level reaches to its minimum point, the system automatically generates a purchase order, which is sent to the supplier electronically as well as what and how much items left on hand.

The other gap identified in this study was lack of effective handling and disposal policy. Due to this gap, the organization was exposed to incur unnecessary cost of holding obsolete inventory items and keeping active inventory items outside the store and exposing them to damage and theft. Department of Army Field Manual (1958) stated that when the material is clearly become obsolete, excess or surplus to needs, it should be disposed of to conserve ware-house space and reduce operating costs. According to Drury (2004) obsolescence cost is one of the main inventory carrying costs that highly affect an organizations financial performance.

The final gap found in this study was lack of training programs. Some of the employees especially in warehouse department are working only with experience and the others also need to be capable of up-to-date knowledge and skill. All the indicated gaps highly affect logistics performance in relation to customer satisfaction and delivery performance because the main objective of logistics is to deliver the right product with the right quality with the right quantity at the right time to the right customer. As explained by Jie & Roger (2005), training programs not only develops employees but also help an organization to make best use of their human resources in favor of gaining competitive advantage.

According to the correlation and the regression model results, there was a strong positive relationship between inventory management practices and logistics performance and these variables have a high positive effect on logistics performance. The model outputs indicates that unless the selected inventory management practices performed in the proper way, the organization under the study could be affected due to weak logistics performance especially in relation to customer satisfaction and delivery performance.

5.4 Recommendation

Based on the conclusion drawn in the above, the following recommendations were forwarded by the researcher in relation to the research objectives:

- ✓ Ethiopian Defense Force Logistics Main Department should adopt competition based purchasing policy and give a chance to all possible suppliers to offer better quality with better price. The legality of purchasing activity plays a significant role on inventory management effectiveness. Formal advertising should be the law of the organization in order to establish real transparency and accountability in relation to overall purchasing performance as well as to assure maximum competition (Department of Army Field Manual 1958).
- ✓ There should be information sharing/networked activity/ between purchasing and warehouse departments by using automated inventory controlling system in order to create common understanding about what is going on in the inventory controlling activity and make a triangulated decision on what to order when to order and how much to order. The main objective of inventory management is identifying the effects of cost that having items in stock and not having items in stock and compute the cost of holding and ordering the inventory. In order to attain a balance between inventory availability and cost, it must be addressed the main target of inventory management is the volume that how much to order and when to order Therefore, since inventory is a key to any organization, inventory management must pay attention on decision making. (Porter, 2011).
- ✓ The organization should implement computerized inventory management system in order to control inventory items effectively and efficiently by making the right decision on what and how much inventory should be kept on hand as well as what and how much to purchase. Reid & Sanders (2007) noted that the benefits of a computerized inventory control system can be derived, when organization integrates its inventory control system with the other systems such as accounting, purchasing and warehousing that helps in better control of inventory levels. In practice, when the inventory level reaches to its minimum point, the system automatically generates a purchase order, which is sent to the supplier electronically. The primary objective of an inventory control is to minimize idle time caused by shortage of inventory and non-availability of inventories as per requirement and to keep down capital

investment in inventories, inventory carrying cost and obsolescence losses as well as avoiding human errors.

- ✓ The organization should adopt a serious policy to solve the existing problems on handling and disposal of obsolete inventory items. Inventory items which are out of use due to design change and being outdated need to be disposed in accordance to their importance to other organizations and individuals. Department of Army Field Manual (1958) stated that when the material is clearly become obsolete, excess or surplus to needs, it should be disposed of to conserve ware-house space and reduce operating costs. According to Drury (2004) obsolescence cost is one of the main inventory carrying costs that highly affect an organizational performance. An automated warehousing system provides less effort, more efficient, and reliable results compared to manual handled system.
- ✓ The organization should adopt on job and of job training programs in order to upgrade the existing knowledge and skill of employees in relation to inventory management practice. Training programs not only develops employees but also help an organization to make best use of their humane resources in favor of gaining competitive advantage. Therefore, it seems mandatory for any organization to plan for training programs for its employees to enhance their abilities and competencies that are needed at the workplace (Jie and Roger, 2005).
- ✓ In general, the organization should perform on the selected inventory management practices (purchasing, controlling and handling & disposal) in a better way since the gaps identified in these practices highly affected logistics performance especially in relation to customer satisfaction and delivery performance.

5.5 Direction for Further Research

Inventory management can be studied from different perspectives in Ethiopian Defense force Logistics department. This study concerned only in assessing the effect of inventory management practice on logistics performance. Inventory management practice can be studied from other perspectives such as its effect on financial performance as well as overall organizational performance. The researcher suggests fort those researchers who are interested to conduct further research on similar topics to assess inventory management practice from the indicated perspectives.

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APPENDIX

Appendix A: Questionnaire



School of Commerce

Questionnaire for Purchasing, warehouse and Finance Departments

Dear Respondents

This questionnaire was prepared only for the aim of assessing “The effect on inventory management practice on Logistics performance” in Ethiopian Defense Force Logistics main Department. Your honest response helps the researcher to find out the real problems in study. So, I kindly request you to give us your true response for the questions that we are going to ask you. The study does not have any other purpose rather than assessing the current inventory management process and help the concerning body to set the appropriate solution for the problems to be found. I confirm you that all the information gathered will be held confidential. The study aims to measure the performance of each inventory management practice, assess the relationship between each determinants of inventory management practice and logistics performance and assess the effect of inventory management practice on logistics performance. In case of any concern, you may call by telephone number 09-13-56-07-65 Liul

Dear respondents

- ✓ You don't need to write your name on the question paper
- ✓ Please answer all questions
- ✓ Please do not discuss with other respondents to give your answer
- ✓ Put (x) sign in the box provided to give your answer

Respondents' Background

1. Job status (JST)

Clerk supervisor head of section head of department

2. Work experience (WEXP)

1-5 years 6-10 years 11-15 years above 15 years

3. Level of education (LEDU)

o Below 10th grade 10th and 12th complete certificate diploma
 degree masters and above

Section I: Instruments for measuring the Extent of Inventory Management Practice

Performance

Based on the instruments of inventory management practice in your department, please give your response by putting (X) symbol for five point likert scale items below with 5 = strongly agree, 4 = agree, 3 = undecided, 2 = disagree and 1 = strongly disagree

1. Purchasing Inventory Items (PII)						
No	Question	Response				
		5	4	3	2	1
1	The human resource power working in my department is full of the required skill and knowledge with the necessary formal education in purchasing profession.					
2	There is a mechanism for knowing the level of inventory items to determine annual demand of the organization					
3	My department applies competitive purchasing method to buy inventory items					
4	My department invites all possible suppliers in purchasing inventory items.					
5	My department has a mechanism for assessing the overall performance of selected suppliers of inventory items.					
6	My department facilitates fair and legal competition between all possible suppliers in purchasing inventory items					
7	Purchasing of inventory items is not timely done to maintain the level of inventory items.					
8	There is a dalliance of finance department in the processes of preparing the payment of suppliers					
9	Dalliance of central store is affecting purchasing works in timely receiving the delivery of purchased items.					
10	Purchasing department takes feedback from the army members about the quality of inventory items before purchasing.					
11	All inventory items are being delivered according to pre-stated specifications.					

12	There is serious inspection of purchased inventory items in relation to quality before storage.					
13	My organization's financial flow is being affected due by excess inventory items.					
14	Finance department has a systematic mechanism to get up-to-date information about inventory items.					
15	Finance department has a systematic mechanism to reconcile the total balance of the stock catalogue with the balance of stock ledger account.					
16	Organization's financial flow is being affected by obsolete inventory items.					
17	My organization is incurring storage and other costs due to obsolete inventory items.					

Any other

2. Controlling Inventory Items (CII)

No	Question	Response				
		5	4	3	2	1
1	The human resource power working in my department is full of the required skill and knowledge with the necessary formal education in controlling inventory items.					
2	Warehouse department always sends the necessary document of purchased items to your warehouse for processing the receiving activity.					
3	Warehouse department faces a problem of dalliance of inspection to processes the receiving activity of purchased items					
4	Defective inventory materials are being seen frequently in receiving process of warehouse department.					
5	Warehouse department always purchases similar items with sample received items					
6	Too much warehouse space is occupied by idle and obsolete inventory items					
7	All inventory items are categorized by ABC classification.					
8	Computerized inventory controlling system is applicable in the warehouse.					
9	There is networked computerized system between warehouse, purchasing and finance departments.					
10	Obsolete items are kept separately from active inventory items for best handling system					
11	There are inventory items outside the store without shelter for long time					
12	Warehouse department applies a scientific method to control over and under stock inventory items					

13	There is a mechanism for reconciliation of actual inventory items with registration document.					
14	There is a scientific mechanism to determine reorder point in warehouse.					
15	There is scheduled inventory counting mechanism in warehouse.					
16	There is timely ordering of inventory items to maintain or replenish the inventory items					

17	The current inventory management system in Ethiopian Defense Force Logistics Main Department is well organized to manage inventory items to keep safely and good handling?					
Any other						

No	3. Handling and Disposal of Inventory Items (HDII)	Response				
		5	4	3	2	1
1	There are obsolete inventory items in the store which cannot be used due to change in technology, design or color.					
2	There is well organized disposal system for obsolete inventory items.					
3	Warehouse spaces are being utilized properly without the effect of obsolete inventory items.					
4	All actively needed inventory items are kept in the store with proper safety.					
5	The organization is free from caring costs of obsolete inventory items.					
6	The stock materials which were kept out side of the stores for a long time are exposed to damage as well as theft					
7	There are sufficient spaces to handle active inventory items properly in warehouse					
8	Obsolete inventory items are kept separately from active inventory items for the best handling system					
9	The current inventory management system in Ethiopian Defense Force Logistics Main Department is well organized to manage inventory items in safe and good handling					
Any other						

Section II: Instruments for measuring Logistics Performance

Based on the instruments of inventory management practice in your department, please give your response by putting (X) symbol for five point likert scale items below with 5 = strongly agree, 4 = agree, 3 = undecided, 2 = disagree and 1 = strongly disagree

1. Customer satisfaction (CS)						
No	Questions	Responses				
		5	3	4	2	1
1	To what extent inventory items are being purchased based on customers' quality requirements?					
2	To what extent customer satisfaction survey is being applied to measure customer satisfaction level?					
3	What is the extent of Customer satisfaction level in terms of delivering the right product with the right quality and quantity at the right time?					
4	What is the extent of Customer satisfaction level in terms of product quality?					

2. Delivery Performance (DP)						
No	Questions	Responses				
		5	4	3	2	1
1	To what extent the logistics department perform delivery of the right product with the right amount with the right quality to the right customer at the right time?					
2	To what extent the inventory items are available whenever they are needed to perform timely delivery to the end users?					
3	To what extent military missions failed due to poor delivery performance?					

Appendix B: Interview

Part V Interview Questions

To the Head of Purchasing Department

1. What purchasing method do you apply to purchase inventory items?
2. Do you give equal opportunity to all possible suppliers to compete in purchasing activity?
3. How do you control the quality of purchased items?
4. What mechanism do you apply to know the level of inventory items in order to determine what to order, when to order and how much to order?
5. Do you take a feedback from you end users about the quality of inventory items being purchased?
6. How effective is the purchasing department in timely purchasing the needed inventory items?
7. Do you have a mechanism to assess the production performance of your suppliers?.

To the Head of Warehouse

1. To what extent the purchased items pass through serious inspection in relation to quality and quantity before storage?
2. What mechanisms are being used to control inventory items?
3. How do you determine when to order, what to order and how much to order?
4. How obsolete inventory items are affecting warehouse space utilization?
5. Do you have any disposal policy for obsolete inventory items?
6. What are the major obsolete inventory items holding a wide warehouse space?

To the Head of Finance Department

1. What mechanisms do you apply to assure the legality of purchasing activity?
2. How obsolete inventory items are affecting the financial performance of logistics main department?

To the Head of Logistics main Department

1. What problems is the organization facing in inventory management practice?
2. Do you apply computerized inventory management system?
3. Is there a training program to upgrade the skill and knowledge of employees in relation to inventory management?

