

ST.MARY'S UNIVERSITY

BUSINESS FACULTY

DEPARTMENT OF MANAGEMENT

AN ASSESSMENT OF INVENTORY MANAGEMENT

THE CASE OF RIES ENGINEERING

BY

AMANUEL DEREJE

JUNE, 2014
SMU
ADDIS ABABA

AN ASSESSMENT OF INVENTORY MANAGEMENT

THE CASE OF RIES ENGINEERING

A SENIOR ESSAY SUBMITTED TO THE DEPARTMENT OF

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APPROVED BY COMMITTEE OF EXAMINERS

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The fear of GOD is the beginning of wisdom Oh God! What can we say about you? Our beginning and our end is in your hand. Thanks GOD.

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CHAPTER ONE

INTRODUCTION

1.1. Background of the study

Material Management can be said to be that process of management which coordinates, supervises and executes the tasks associated with the flow of materials to, through and out of an organization in an integrated fashion, (DATTA 2003,2-5).

The function of inventory control is to balance the set-up costs of procurement with inventory carrying costs in order to see that cost is kept minimum, while, at the same time, holding of optimum inventory is possible, (DATTA 2003,3-6).

Inventory control is defined as “a science-based art of controlling the amount of inventory a business needs to economically meet the demands placed upon that business. It is also the application of best practices and common sense procedures used to control the inventory management process.” (Caterpillar Manual 2010,6-10)

Inventory represents three elements depending on the nature of the firm's nature. These are raw material, semi processed and finished goods. Therefore, one's firm finished goods can be raw material for the other inventory management and production\ maintenance\ is interdependent in achieving production targets because production schedules cannot meet and be achieved without timely supply of inventory, (DATTA 2003,193-195)

Ries Engineering was founded as an independent company in 1965. It is the Caterpillar dealer representative to Ethiopia. Prior to that, it was operating as an engineering department of Paul Ries & Sons (ETH) Ltd since 1961, when its founders, the Ries family, acquired the Caterpillar dealership to Ethiopia, ([Http://www.RESCO\home.com](http://www.RESCO\home.com))

RESCO has established with capabilities that enabled it provide full support to its customers. There have been substantial developments in the company since its initial start-up through modernization and establishment of facilities essential for supporting its customers and

upgrading the number, qualification, skill and knowledge of its technical personnel,([Http://www.RESCO/aboutus.com](http://www.RESCO/aboutus.com))

Ries Engineering S. Co. (RESCO) represents, besides Caterpillar, a number of world renowned manufacturers of agricultural and construction machinery and equipment as these includes Massey Ferguson, Perkins, Ford, Marini, Triman Group, Berthoud and others. RESCO is the sole distributor in Ethiopia of the products of these manufacturers and gives full pre and after-sales support to its customers using its well established and equipped facilities and qualified and experienced personnel, ([Http://www.RESCO/products.com](http://www.RESCO/products.com))

Massey Ferguson (MF) is a brand of AGCO Corporation, one of the world leaders in the design, development and manufacture of agricultural machinery and equipment. Perkins has led the field in the design and manufacture of high performance diesel engines for 75 years. Ford Motor Company is a global automotive industry leader based in Dearborn, USA, which manufactures and distributes different brands of automobiles all over the world. TRIMAN Group is located in the northern part of Spain and is one of the leading companies in the design, manufacture, assembly and after-sales support. Marini, which is a member of the French FAYAT GROUP, has over 60 years of experience in the manufacture of asphalt plants and advanced solutions for recycling. BERTHOUD has been innovating over 100 years to provide its customers with accurate, reliable and high performance crop sprayers,([Http://www.Resco/home.com](http://www.Resco/home.com))

Services Provided: Parts Operation, Engine parts, Drive Train, Filters, Ground Engaging Tolls (GET), Batteries, Hardware, Hydraulics and Undercarriage. ([Http://www.Resco.com](http://www.Resco.com))

1.2.Statement of the Problem

Inventory is carried out for many reasons, but the main reason is that operational risks require holding of inventory to guard against breakdown and production losses. Secondly, delivery cannot be exactly matched to daily usage. Sufficient inventory ensures that production is continuous and at an economic level,(DATTA (2003:136)

With this regard, the researcher has investigate the inventory management and control of Ries Engineering SCo for its supplying the maintenance\service department, the right parts at right time so that machineries can have little breakdown time. As per the information the researcher

finds from service department personnel, higher breakdown time arising from inventory control results in higher breakdown time. This resulted in decline of sales and customer dissatisfaction. This leads to customer's shift to other competitors for parts and service need.

Just in-time system (JIT):-JIT is defined as philosophy of manufacturing based on planned elimination of all waste and continuous improvement of productivity.JIT is an approach that to eliminate all source of waste in production activities by providing the right part at the right place at the right time. JIT encompasses the successful execution of all manufacturing activities required to produced a final product, from design to delivery and including all stage of conversation from raw materials onward, Shridhara K:2003

1.3.Research Questions

Based on the above discussion the researcher tried to address the following basic questions.

- How the company manages its inventory especially Caterpillar parts
- What the major limitations of the existing inventory management and control system are in supplying inventory to maintenance department
- What kind of inventory handling tools does RIES engineering SC Co use during the operation process?
- How optimal is the inventory system in its ordering and carrying costs

1.4.Objective of the study

1.4.1. General Objective

The general objective, of this research is to assess the Inventory management and Control system of the Ries Engineering S.co.

1.4.2. Specific Objective

In line with the above general objective the researcher addressed the following specific objectives:-

- How the company manages its inventory especially spareparts.

- What the major limitations of the existing inventory system were in supplying inventory the service department requires?
- The methods used in ordering, follow-up, receiving and delivery of parts and to compare this method with the theory.
- How optimal are the Carrying and Ordering Costs

1.5.Delimitation of the Study

The subject of inventory is vast in its nature and Ries Engineering S.c.o has large line items of parts \ CATERPILLAR(CAT),Perkins, MassiFergson and Others/ in its inventory. Yet the researcher focused on caterpillar product and its parts due to the familiarity with the products. And also the researcher analyzed the system of two years (year 2011-2013) for the generalization of the inventory management system.

1.6.Significance of the Study

The researcher believes that the study will help in highlighting the major advantages and limitation of the existing inventory management control system of the company. The study is carried bearing out in mind that the company should remain competitive in the industry where other companies are improving their systems. Therefore, the company is expected to be benefited from the suggestions and recommendations of the study. Besides, it will be used as additional reference and documentation for other researchers who wish to study the inventory management and control of any company.

1.7.Research Design and Methodology

1.7.1. Research Design

The researcher used descriptive type of research Design. This research design method allowed the researcher to describe the population characteristics using frequency and percentage .These

methods are used to describe how the existing inventory management and control system functions.

1.7.2. Population, Sample Size and Sampling Technique

The population for this research is the management and staff of the warehouse, part sales, finance and General Service Department. The total population of the study is 138. The sample size taken is 30% of the population that is 42 samples was taken.

The sample is taken based on stratified sampling technique. Since departments have not show the same characteristics, they differ in activity and objectives they are considered as strata.

Furthermore, random sampling will be used in selecting the sample respondents and this gives equal chance to every one in each strata.

Table:1.1 sample respondents selection table

| Name of Department | No. of workers | Sample size taken | %age of the population |
|---------------------------|-----------------------|--------------------------|-------------------------------|
| Warehouse | 15 | 5 | 30% |
| Administrative Finance | 8 | 2 | 30% |
| Parts sales | 5 | 2 | 30% |
| Service and mentenance | 110 | 33 | 30% |
| Total | 138 | 42 | 30% |

1.7.3. Type of Data Used

The study will use both primary and secondary data. The primary data will be collected from the sample respondents and secondary data will be gathered through the companys document and reports.

1.7.4. Data Collection Method

Primary data will be collected by distributing questionnaires to employees and by interviewing to the managers. Interview will be conducted to get indepth understanding of the organizations working principles, procedures and methods. And to check the data found by the questionnaire are in line with the employee responses. Furthermore data will be gathered documents and reports through reviewing them .

1.7.5. Methods of Data Analysis

After collecting of both primary and secondary data, the researcher classified, processed analyzed and interpreted data thoroughly. Before going through analysis, the student researcher edited, coded, classified and made data in tabulation form for analysis part student researcher used descriptive analysis techniques.

1.8.Organization of the Study

The research paper contains four chapters. In the first chapter, it is comprised of the background of the study, statement of the problem, objective of the study, significance of the study, scope of the study and data collection and analysis method. The second chapter deals with literature review of the study and the third chapter deals with data presentation, analysis and interpretation and the final chapter the summarizes the study of findings and gives recommendations and suggestions

CHAPTER TWO

2. REVIEW OF RELATED LITERATURE

Past research works and suggestions of different scholars are of enormous importance in any study. Even though research relating to this study has become difficult to find by the student researcher, it is believed that the theoretical background is great help to support the whole material. In this chapter the theoretical and empirical bases of inventory control management will be reviewed.

2.1 The main concepts & definitions of inventory and inventory control

2.1.1 Inventory, Inventory Control and Inventory Management

Inventory is one of the most significant items for many manufacturing and merchandize enterprise. It can be defined as a tangible asset that is intended for sale in the ordinary course of business or being produced for sale or used currently in the production of goods to be sold. Inventory is reported on the balance sheet as current asset because it will be converted to cash (sold) or consumed (used in production) within one year or the operating cycle, whichever is longer (Lanny, 1998:147).

Inventories are substantial part of the cost of day to day business. Inventories are assets held for daily business. It includes raw materials, work in process, and finished goods supplies. For various reasons, management is interested in inventory planning and control. An accurate accounting system with up to date records is essential. If unsalable items are accumulated in the inventory, a potential loss exists. Sales and customers may be lost if products ordered by customer are not available in the desired style, quality and quantity. Also business must monitor inventory levels carefully to limit the financing cost of large inventories (Keiso, 1998:394).

Inventory control is the technique of maintaining stock keeping items at desired levels. Generally, product oriented manufacturing organizations experience more tangible inventory situations than do labor-intense, service oriented organizations. In manufacturing, since the focus is on a physical product, emphasis is on materials control, in the service sector, the focus is on service and there is very little emphasis on material or stocks. In many cases, services are consumed as they are generated rather than stocked for later consumption. Inventory control involves ensuring that just enough inventory (stock) is held by the organization to meet both its internal and external demand commitments economically. These can be disadvantages involving either too much or too little inventory. Therefore, inventory control is primarily concerned with obtaining the correct balance or compromise between these two extremes (Colin Lewis, 1975:5).

Inventory Management is a problem common to all business firms. Basically, inventory is idle resource for the present but useful for the future. "If it is for future, then why store it now physically? Why not procure it only when it is needed?" These questions address two functions mutually disinfected school of thought in inventory theory. The traditional school adopts just by controllability and accessibility is assured and the adverse effect of risk; and uncertainties are reduced by storing now rather than procuring later. The other school confront the problem of uncertainty, accessibility and promote a philosophy where by material are produced or procured in time for use." (IEBM; 1996: Vol. 3:23 79).

Management of the firm takes care of inventory management and control because there are costs involved; the cost of caring the inventory. The higher the inventory level the more cost is incurred in carrying the physical inventory and the lower the opportunity cost associated shortage. The conflicting nature of those two types of costs bring into being a decision problem of what to order? How much to order? And when to order? It is the physical good purchased by an organization in anticipation of being sold to a customer that has not yet been sold; it includes the value that is added through laborer processing. An item purchased at retail by consumer will have been part of many inventories, at number of firms as it was produced, packaged, distributed & finally sold (ibid).

Inventory management encompasses the planning, organizing and control of activities that focus on the flow of materials and inventory into and from the organization. Inventory for many small business owners is one of the more visible and tangible aspects of doing business. Each type of inventory represents many tied up until inventory is sold. It represents a large portion of the business investment to be well managed in order to maximize profit. In fact, many small businesses cannot absorb the type of losses arising from poor inventory management. It should be remembered that inventory is basically an idle resource which lacks capital of the enterprise. Frequently, money is borrowed from banks or financial institutions and interest is to be paid for the idle resources. In order to maintain inventory, the organization has to incur various types of costs. It requires storage space and staff for various types of office work. Usually the goods stock is insured to which premium has to be paid. The most serious consequence of overstocking is the absence of the various items in store. Many items which are overstocked for a long period cannot be used due to technological change and other reasons. They have to be disposed off as scrap material causing a huge waste of national resources (Mustafi; 1989:204).

Where effective inventory control exists to execute management policy, there is a definite relationship between the amount of inventory carried and the service result. The lower the inventory, the more back orders and stock outs, the higher the inventory and the better the service. A good and effective management is necessary for any organization because many divisions fall under the inventory management umbrella (Duncan Williamson, 1996:135).

There is a need for installation of a proper inventory control technique in any business organization. According to Kotler (2000), inventory management refers to all the activities involved in developing and managing the inventory levels of raw materials, semi-finished materials and finished goods so that adequate supplies are available and the costs of over or under stocks are low. Rosenblatt, 1977 says: "The cost of maintaining inventory is included in the final price paid by the consumer. Good inventory represents a cost to their owner. The manufacturer has the expense of materials and labor. The wholesaler also has funds tied up".

Therefore, the basic goal of the researcher is to maintain a level of inventory that will provide optimum stock at lowest cost.

Morris (1995) stressed that inventory management in its broadest perspective is to keep the most economical amount of one kind of asset in order to facilitate an increase in the total value of all assets of the organization – human and material resources.

Keth et al. (1994) in their text also stated that the major objective of inventory management and control is to inform managers how much of a good to re-order, when to re-order the good, how frequently orders should be placed and what the appropriate safety stock is, for minimizing stock outs. Thus, the overall goal of inventory is to have what is needed, and to minimize the number of times one is out of stock.

Drury (1996) defined inventory as a stock of goods that is maintained by a business in anticipation of some future demand. This definition was also supported by Schroeder (2000) who stressed that inventory management has an impact on all business functions, particularly operations, marketing, accounting, and finance. He established that there are three motives for holding inventories, which are transaction, precautionary and speculative motives. The transaction motive occurs when there is a need to hold stock to meet production and sales requirements.

2.1.2 FUNCTIONS OF INVENTORIES

Organizations hold inventories for a variety of reasons. According to Stevenson (1989) among the most important reasons, some of them are the following : -

- i.** To meet anticipated demand: when standard products are involved, organizations keep inventories in order to respond quickly to customer demand.
- ii.** To be able to buy or produce in ‘economic’ lot sizes: organizations typically buy more than is currently needed because there are usually certain economies involved.

- iii. To separate various stages of operations: unexpected variations in supply or demand rates, equipment breakdowns and human error can create confusion with unless a certain amount of 'buffer' stock is maintained between stages.
- iv. To maintain flexibility in scheduling: costs and complexities related to scheduling personnel and equipment sometimes make it desirable to produce on time and in quantities that do not directly correspond to current demand.
- v. To safeguard against stock out: in many instances, demand rates and delivery times are subject to variability.
- vi. To display items: most retail establishments benefit from displaying their goods because this allows customers to examine and compare the items.
- vii. To allow for pipe line goods: after goods are produced, they are usually stored at least temporarily before being loaded on to trucks or trains for shipment to distributor, store, and so on. These goods in-transit are one form of inventory (Stevenson, 1989).

2.1.3 Objectives of Inventory Management

In general, the objective of inventory management is to minimize possible shortages and the total cost of carrying, restocking and purchasing inventories. More often, these costs are computed for one year. Thus, the goal is to minimize total annual cost, where:

$$\begin{array}{rcccccc}
 \text{Total} & & \text{Annual} & & \text{Annual} & & \text{Annual} & & \text{Annual} \\
 \text{Annual} & = & \text{Holding} & + & \text{replenishment} & + & \text{Purchase} & + & \text{Shortage} \\
 \text{Cost} & & \text{Cost} & & \text{Cost} & & \text{Cost} & & \text{Cost}
 \end{array}$$

As it turns out, not all of these costs pertain to every situation. In fact, as a general rule, usually only two/three of these costs are involved. This stems from a variety of reasons.

For example, if quantity discounts are not a factor, purchase price is independent of order size, and order size decisions need not involve unit price. Likewise, shortages may be avoidable in certain cases, making it unnecessary to include that component in the decision. At other times, management will opt for a specified customer service level, thereby avoiding the issue of directly including the shortage cost in an analysis (William & Stevenson; 1989:493).

2.1.4 TYPES OF INVENTORIES AND MODEL

Inventory represents the largest single investment in asset for most manufactures, wholesalers and retailers. There are typically four categories of inventory. These include raw materials and semi finished item inventory, work in process & finished goods inventory, maintenance, repair and operating supplies inventory. As much as we identify the various functions in material management with the flow of goods ,we can identify the different types of inventories or stocks of material maintained in manufacturing plant.

All plants use the same general classification of inventories including raw material. Purchased part work in process founded goods and supplies (Harold and Amrine 1975:219).

2.1.4.1 Raw Material and Semi Finished Item Inventory

A raw material inventory includes all the items purchased from suppliers, or produced internally to directly support production requirements. A raw material includes those items purchased in bulk or unfinished condition. Bulk quantity of chemicals (a sticky substance that comes from plants or manufactured) or petroleum are examples of purchased raw materials. Semi finished inventory includes those items and components used as input during the final production process. All are definitely (firmly) on the same level of inventory (Raw materials) to support final production requirements. This type of inventory is primarily managed by purchasing. Raw material inventory includes all items that after being received at the plant require additional processing before becoming unidentifiable part of finished products. It is obvious that the finished product of one plant such as role, bar and sheet steel, may be the raw material for next industrial purchases. By holding stock of raw material, one

organization decouples its primary production section or process from the raw material manufacture and stock (Colin Lewis, 1975:99).

This allows primary production to be initiated in a short period of time than the raw material supplier's delivery time, a facilitator ways required for urgent item some of which tend to crop up in most production programs. Where the price of a raw material fluctuate considerably such as in the case of compare, as speculative purchasing policy can, to a limited extent resulted an organization from those price changes. The holding of raw material stock also allows bulk purchases to be made and consequent discount obtained (Colin Lewis 1975:99).

2.1.4.2 Work in Process (WIP Inventory)

This type of inventory is a function of the amount of production value currently in process. At any given point in time, WIP is the sum total of inventory that exists within and among all processing centers located throughout the manufacturing system. This includes materials that are:

- Waiting to be moved to other processes;
- Being worked on at a work center;
- Quelling up at a processing center due to capacity bottle neck & machine break down;

This holding of both raw material stock and finished goods is generally a planned activity, in so far such stocks, however, are likely to exist in any manufacturing organization weather they are planned for or not. This is because the decoupling function provided by this category of inventory is to buffer the demand of later stage and this deceiving is essential for any production process (Colin Lewis 1975:100).

2.1.4.3 Finished Goods Inventory

This includes completed items or products that are available for shipment of future customer order. A firm that produces item in anticipation of future customer order should monitor the

levels of finished goods inventory closely. A higher than anticipated level finished good means that a decrease in customer demand is occurring. A lower than anticipated finished goods inventory level indicates that customer demand is increasing. Either condition may also indicate that forecasts of anticipated customer demand do not current production level. The stock of finished goods provides a buffer between the customer demand and the manufacturers' supply. In many cases, because the size of orders required by customer is much smaller than those supplied by manufacturer, wholesaler can it as intermediacy between manufacturer, wholesale or stocks (as retailer or distributor) can get as intermediary between the two, and in this case a large proportion of finished goods may be held by the wholesale then by manufactures (Harold and Amrine, 1995:220).

2.1.4.4 Economic Order Quantity (EOQ) Model

There are different methods of inventory management, the EOQ model was used to determine the optimum inventory level per year. Undoubtedly, the best-known and most fundamental inventory decision model is the Economic Order Quantity Model. The purpose of using the EOQ model in this research is to find out the particular quantity, which minimizes a total inventory cost that is the total ordering and carrying costs.

EOQ Assumptions

The EOQ has been previously defined by Dervitsiotis (1981), Monks (1996), Lucey (1992), and Schroeder (2000) as the ordering quantity which minimizes the balance of cost between inventory holding and re-order costs. Lucey (1992) stressed further that to be able to calculate a basic EOQ, certain assumptions are necessary:

- (i) That there is a known, constant, stock holding costs;
- (ii) That there is a known, constant ordering costs;
- (iii) That the rates of demand are known
- (iv) That there is a known constant price per unit
- (v) That replenishment is made instantaneously the whole batch is delivered at once.

(vi) No stock-outs are allowed.

It would be apparent that the above assumptions are somewhat sweeping and that they are a good reason for treating an EOQ calculation with caution. Also, the rationale of EOQ ignores buffer stocks, which are maintained to cater for variations in lead-time and demand. The above assumptions are wide ranging and it is unlikely that all could be observed in practice. Nevertheless, the EOQ calculation is a useful starting point in establishing an appropriate reorder quantity.

The EOQ formula is given below; it's derivation and graphical presentation.

$$\text{EOQ} = \frac{2CoD}{Cc} \dots\dots\dots (1)$$

Where :- Co = ordering costs,
 Cc = carrying cost and
 D = annual demand.

Note also that

$$\text{Annual stock} = Q/2,$$

$$\text{Total annual carrying cost} = CcQ/2,$$

$$\text{Number of orders per annum} = D/Q,$$

$$\text{Annual ordering costs} = CoD/Q \text{ and}$$

$$\text{Total cost} = CcQ/2 + CoD/Q \dots\dots\dots(2)$$

In the above formula, Q is defined as the result of the calculated EOQ.

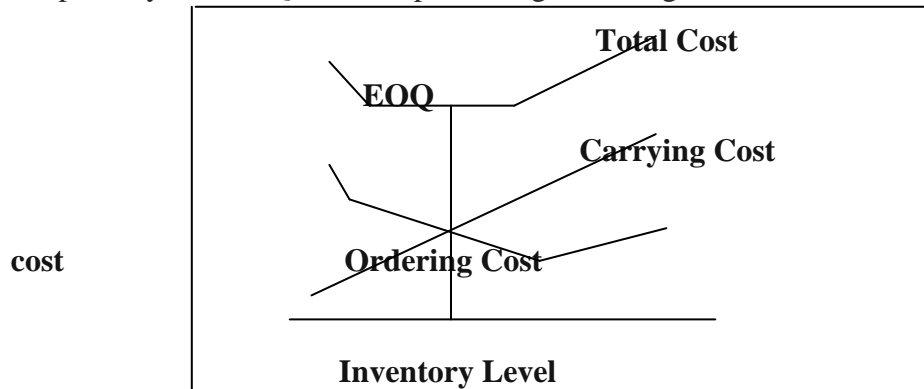
The order quantity, which makes the total cost (TC) at a minimum, is obtained by differentiating with respect to Q and equating the derivative to zero the above total cost equation 2. Thus, $dTc/dQ = Cc/2 - CoD/Q^2$ and when $dTc/dQ = 0$ cost is at minimum.

$$DCo/Q^2 = Cc/2, \quad Q^2 = 2DCo / Cc \text{ and } Q \text{ which represent the EOQ formula would now be}$$

The EOQ formula is given below; it's derivation and graphical presentation.

$$EOQ = \frac{2CoD}{Cc}$$

Graphically, the EOQ can be representing in the Figure 2.1.



Source: Lueey T 1992 Quantitative Techniques, 4th Edition

The Economic Order Quantity (EOQ) decision model calculates the optimal quantity inventory to order. It is a mathematical tool for determining the order quantity that minimizes the costs ordering and holding inventory. In inventory and production control analysis, it is usually convenient and practical to steady together those items which fall into natural groups; these groups may be made up of part processed by common manufacturing equipment, purchased item handled by the same buyer or material ordered from the same vendor. This is particularly true in determining the sizes of the lots in which materials are procured, cost capital requirement space needs operating conditions and other factors which must be considered in setting large size are most meaningful when families of related part are considered (Possl, 1967:65).

There are two approaches to use:

1. **Tabular Approach** – the total annual cost of ordering and holding inventory is calculated as follows:-

$$\text{Number of order} = \frac{\text{Annual requirement}}{\text{Quantity per order}}$$

$$\text{Annual Ordering Cost} = \text{Number of order} * \text{cost/order}$$

$$\text{Average quantity inventory} = \frac{\text{Quantity/order}}{2}$$

Annual holding cost = (Average Quantity inventory) (Annual carrying Cost) per annual.

Total annual cost of inventory policy = ordering cost + holding inventory

2. **Equation Approach:** The total annual cost of ordering and holding inventory is given by the following equation:

$$\text{Total annual cost} = \frac{\text{Annual requirement (cost order)} + \text{ordering quantity}}{\text{Order quantity}}$$

2.1.5 INVENTORY CONTROL SYSTEMS AND RECORDING

2.1.5.1 INVENTORY CONTROL SYSTEMS

In most of the realistic inventory situations certainty does not exist. Both usage (demand or requirement) and acquisition lead time usually fluctuate and cannot be completely predictable. In a situation where these two factors are relatively constant and known the earlier inventory models will provide us an optimal solution.

The assumptions regarding the economic order quantity are not applicable to all inventory situations. Demand or usage of items can be greater or lesser than anticipated due to external and internal factors. Also, the acquisition lead time can vary from favorable to unfavorable due to the supplier and/or transshipment difficulties.

If there is no inventory of items when required due to any reasons, a stock out occurs. This situation can lead to a decrease in profits and sometimes even losses. As a result, a class of

inventory systems has been developed to cope up with the situations where the demand or the lead time or both fluctuations.

1. Perpetual Inventory systems

Under the perpetual inventory systems, the reorder quantity is fixed at the EOQ level but the frequency of ordering varies depending upon the fluctuations in consumption. Whenever the inventory reaches a minimum level known as the reorder point, an order for a fixed quantity (EOQ) is placed. The perpetual inventory system is also known by other names such as fixed order quantity system or reorder point inventory system.

2. Periodic Inventory System

Periodic inventory system is based on the determination of a fixed period at which the inventory is received. Depending upon the type or usage of items, the periodicity of review may be a week, fortnight, a month, a quarter or a year. The optimal period is determined by $Q/u = t_o$. Usually, some items have shorter review periods than others. At each review period, an order is placed for an amount equal to the difference between a fixed replenishment level and the actual inventory level. Thus, the order quantity is variable in size. This inventory is also known as fixed period or replenishment inventory system or p-system.

In the periodic review system, which requires more inventories on hand, for a given frequency of shortages, as compared to the perpetual inventory system. On the other hand, since the perpetual inventory system requires perpetual auditing of the system, and many companies are resorting to perpetual inventory system (Colin Lewis 1975:100).

2.1.5.2 COST OF INVENTORY

Cost to be considered in determining how much inventory to hold. Ordering and carrying physical inventory result in a number of costs. In theory, if a specific cost is expected to contribute to the production of revenue, that cost should be associated with the goods acquired. Thus, a theoretical justification exists for adding the indirect costs of ordering

freight in handling and storing to the net invoice cost to determine the total cost of goods acquired.

However, the work involved in the allocation of these costs to inventories often exceeds the benefits derived from the increased accuracy in the valuation of inventories. Although the assignment to inventories of all costs incurred in the preparation of goods for sale is durable, unrealistic allocation of indirect costs should be avoided to prevent a false impression of precision in the measurement of inventory costs. When costs are incurred that are necessary for the acquisition or production of goods but are not expected to produce future benefits or are not material in amount, the costs usually are not included in inventories. Instead, such costs are considered period cost to be deducted from current revenue.

- a. **Unit cost:** is the most basic and inventory cost to quantity and track
- b. **Ordering or acquisition cost:** costs related to acquisition of purchased items are those of getting an item into company's inventory or stores. Ordering costs incurred on each time an order is placed with the supplier start with purchase requisition. Other costs include are issuing of purchase order, follow-up actions, receiving the goods, inspection for quality control, placing them into store and paying vendors etc.
- c. **Carrying Costs/Holding Costs**

Carrying or holding costs of inventory are those incurred because the firm has decided to maintain inventories. Of course, a firm cannot operate without certain amount of process and movement of inventories.

These costs may include interest on money invested in inventory, insurance premium paid on inventory, storage cost, which include warehouse space cost, cost incurred on heating, lighting or refrigeration and obsolescence and depreciation (Shenoy, 1991:198).

2.1.5.3 Internal Control over Inventory

The purpose of a system of internal control is to assure that assets belong to the business enterprise are received when purchased, are protected while in the custody of the enterprise, and are used only for authorized business purpose such a system, consist of administrative and accounting control. The system of internal controls frequently may be improved by physical safeguard. It is not designed primarily to detect errors but rather to reduce the opportunity for errors or dishonesty to occur.

Internal control over inventory is important because successful companies take greater care to protect their inventory. Elements of good internal control over inventory include:

- Physically counting inventory at least once a year,
- Strong inventory to protect it against theft, damage and delay,
- Giving access to inventory only to people that does not have access to the accounting records,
- Keeping enough inventory on hand to prevent shortage situation,
- Not keeping too large inventory stock piled,
- Thus avoiding the expenses of typing up money in amended item
- Purchasing inventory in economic quantities (Mosich 1998:294).

2.1.7. Empirical Studies

- (Brad,2007:254) :-It knows that cash is the blood of any organization which consists of different elements. From this element inventory is white blood cell of the firm that protects it from financial disease
- Hin murray (April:2008):- from the assets of manufacturing companies most of them are inventories, most of costs are incurred for inventory in manufacturing company mean that to know at least 50% of the overall operation of the firm.
- Therefore as we can see from the above expressions, to know about inventory control system of an organization is the very essential issue for the operation of organization.

CHAPTER THREE

3. DATA PRESENTATION, ANALYSIS AND INTERPRETATION

OVERVIEW

This chapter deals with presentation, analysis and interpretation of data obtained from respondents through questionnaire and interview to explore the inventory management practices of Ries Engineering. .

42 questionnaires were distributed to the selected sample respondents, all of them were properly filled and returned. The interview was conducted with the store manager. Accordingly, all the data gathered are presented, analyzed and interpreted in the forthcoming subsequent pages.

Table 3.1: General characteristics of respondent

| No | | Item | Respondents in | |
|----|------------------------|-----------------------|----------------|------------|
| | | | Number | Percentage |
| 1 | Gender | Male | 30 | 72 |
| | | Female | 12 | 28 |
| | | Total | 42 | 100 |
| 2 | Age | 18-30 | 8 | 19 |
| | | 31-40 | 30 | 71 |
| | | 41-50 | 4 | 10 |
| | | <50 | 0 | 0 |
| | | Total | 42 | 100 |
| 3 | Educational Background | Above Master's Degree | 0 | |
| | | Master's Degree | 6 | 14 |
| | | Degree | 20 | 48 |
| | | Diploma | 16 | 38 |
| | | Below Diploma | | |
| | | Other | 0 | |
| | | Total | 42 | 100 |

Source : primary data

As it can be seen from the above table, out of 42 respondents 30(72%) are males and the rest 12(28%) are females. With regard to their age 8(19%) are between the age range of 18-30, 30(72%) are between 31-40 and the rest 4(10%) fall under the age range of 41-50. This shows that the majority of them are males and, in fact, age wise they found in their productive age, if they are well managed and motivated

Concerning to their level of education 6(14%) are masters, 20 (48%) are first degree holders and the rest 16 (38%) are diploma holders. So one can say that the respondent's level of education is promising and they can contribute more to the organization in achieving its goals and objective if they are guided properly.

Table 3.2 Inventory type

| Ser No. | Characteristics | Respondents | |
|---------|--------------------------|-------------|------|
| | | Number | In % |
| 1 | Inventory Control System | | |
| a | Perpetual | 42 | 100% |
| b | Periodic | 0 | 0 |

Source : primary data

The respondents were asked about the frequency of inventory controlling in the organization, accordingly all respondents that is 42(100%) replied that the company is exercising perpetual inventory controlling. This is due to the nature of parts as most of the parts are fast moving items and can be taken out by individuals easily. So this continuous checking of the parts will minimize misappropriation of parts and also helps to know the available stock in order to replenish the parts early.

Table 3.3 Inventory method.

| Ser No. | Characteristics | Respondents | |
|---------|--------------------------|-------------|------|
| | | Number | In % |
| 2 | Type of Inventory Method | | |
| a | FIFO | 35 | 83 |
| b | LIFO | 7 | 17 |
| c | Weighted average | 0 | 0 |

Source : primary data

The respondents were also asked no out the method of inventory management adopted by the company, 35(83%) replied First Out (FIFO), the rest that is 7(17%) said Last In First Out (LIFO). From this one can understand that the company's inventory method is to sell out parts according to their entry order. This method seems appropriate for the company as it makes easy to access parts as well as it is useful to exercise control over the parts.

Table 3.4: Physical Verification of items

| No | | Yes | % | No | % |
|----|---|-----|----|----|----|
| 1. | Physical Verifications of items is undertaken in your company | 33 | 78 | 9 | 12 |

Source : primary data

Another question posed to the respondents was the physical counting of the parts to ensure that the recorded items are physically existing to this end, 33(78%) respondents responded 'yes 'and 9(12%) responded no. As the majority witnessed that the stock records regularly reconciled against actual physical existence for parts to see if there is any deviation between the number of items on the record and on the shelf. This can help the company to minimize the mismatch between the recorded and shelf items. In addition to this, it assists to detect the missing items as early as possible and take on appropriate action timely.

Table 3.5 Orderly Storage

| Item | Response | Frequency | percentage |
|---|--------------|-----------|-------------|
| Parts are properly numbered for identification | Yes | 39 | 92% |
| | No | 3 | 8% |
| The proper procedure to ensure that only authorized employee may have permitted to take out parts from the stock. | yes | 21 | 50% |
| | No | 21 | 50% |
| Damages, returns, and scrap are reported to management. | Yes | 42 | 100% |
| | No | | - |
| | Total | 42 | 100% |

Source : primary data

Respondents were also asked whether parts are properly tagged for identification for this question 39(92%) confirmed the proper numbering and labeling of parts for easy access and identification, where as 3 (8%) replied that there is no proper labeling of parts. As it was witnessed by the majority parts are tagged with proper identification to make easy for controlling. So this is a good practice by the company in order to minimize the time taken to look for the items.

Storage Another question was presented to respondents to know if unauthorized individuals may access to enter in to the star age area. For this question 21(50%) said yes and another half that is 21(50%) 'No'. As it can be seen from the table, half of the respondents witnessed that unauthorized individuals have an access to enter in to the storage, so this is somehow risky as it may encourage theft and misappropriation of parts.

Whether damages, returns, and scrap are reported to management was another question inquired to the respondents, to this end, respondents unanimously said yes. So the reporting of damages scraps will help managers to make informed decision as to how to discard them.

Table 3.6.Forecasting methods

| Ser No. | Response | Respondents | |
|---------|--|-------------|------|
| | | In No. | In % |
| 12 | What methods of demand forecasting are used by the company | | |
| a | Judgmental | 32 | 76% |
| b | Trend analysis | 10 | 24% |
| c | statical | 0 | 0 |

Source : primary data

As it can be seen from the above table, respondents reflected on the methods used by the company to forecast demand for spare parts. Accordingly, 32(76%) replied judgmental, whereas 10(24%) said historical or trend analysis. As it was witnessed by the respondents the company inventory forecasting method is judgmental. This kind of forecasting is not accurate that it may lead to shortage or surplus inventory. In this case the company may not be able to

serve its customers due to shortage of stock or it may tie up its capital due to surplus stock which increases the cost of inventory.

Table 3.7. Keeping adequate stock

| Ser No. | Response | Respondents | |
|----------|---|------------------|--------------------|
| | | In No. | In % |
| | The company keep adequate stock of all types of spare parts | | |
| a | Yes | 18 | 43% |
| b | No | 24 | 57% |
| | Total | <u>42</u> | <u>100%</u> |

Source : primary data

The company's ability of keeping adequate stock of parts was posed to customers. For this 18(43%) replied 'yes' and 24(57%) said no. As it was discussed above, the company used judgmental forecasting, so it is hard to determine the exact demand for the parts. Thus, the company is unable to keep adequate number and type of spare parts; as a result this situation may disappoint customers.

Table 3.8. On Shelf Parts

| Ser No. | Response | Respondents | |
|----------|--|------------------|--------------------|
| | | In No. | In % |
| | Are there parts that stay for long time on shelf | | |
| a | Yes | 25 | 60% |
| b | No | 17 | 40% |
| | Total | <u>42</u> | <u>100%</u> |

Source : primary data

Respondents also were asked if there are parts that stay long on shelf or parts that have a very low demand. With this regard, 25(60%) said 'yes' and the rest 17(40%) replied 'no'. This shows that the company **storing** slow moving parts. Keeping parts having low demand has dual disadvantage, first, it ties up capital that could generate profit if invested in fast moving parts; second, this practice increase the cost of inventory.

Table 3.9 Respondent responses safety of storage

| Ser. No. | Description | Response | Respondents | |
|----------|--------------------------------|----------|-------------|-----|
| | | | In No. | % |
| 1 | Adequate fire outbreak alarms | Yes | 38 | 90% |
| | | No | 4 | 10% |
| 2 | Adequate insurance coverage | Yes | 35 | 83% |
| | | No | 7 | 17% |
| 3 | Appropriator storage condition | Yes | 40 | 95% |
| | | No | 2 | 5% |

With regard to the safety of the store, the presence of fire outbreak alarm is witnessed by 38(90%).on the other hand, adequate insurance coverage is confirmed by 35(83%) respondents and appropriate storage condition exist as it was assured by 40(95%) respondents. So, one can say that the safety and risk management of the company seems promising.

CHAPTER FOUR

4. SUMMARY, CONCLUSION AND RECOMMENDATION

This chapter deals with the presentation summary of finding, description of the conclusion draw based on the finding and the presentation of the recommendation forward based on conclusion draw from major finding

4.1. SUMMARY

Under this section major finding obtained from the research has been summarized

- All respondents that is 42(100%) witnessed that the organization adopted a perpetual inventory system
- The majority of respondents that is 35 (83%) replied that the company inventory method is first in first out (FIFO)
- Most of the respondents that is 33 (78%) confirmed that the organization conduct periodical physical counting of inventory to reconcile with the record
- 21 (50%) of the respondents witnessed that unauthorized saffs have and entering to the inventory storage area
- All responders believe that damages, scraps and returns are reported to management
- The majority of respondents that is 32(76%) replied that the company use judgmental forecasting methods for its inventory
- Majority of respondents 22 (53) confirmed that company does not keep adequate stock regularly.
- Most of the responds that is 25 (60%) witnessed that the company keep pats that are sty on shelf
- 38(90%) of the respondents replied that the company inventory area has adequate fire protection
- Majority 35(83%) witnessed that the company's inventory are insured

- Most of the respondents that 40 (95%) witnessed the existence of appropriate storage for parts in the company.

4.2. CONCLUSION

The company use perpetual inventory management for management for spare parts. This approach is very appropriate for the company as spare parts can be misappropriate by people. The approach enables the company to check the inventory regularly and to take appropriate measure if sprats are may be missing.

The method for inventory management mostly used by the company is First- First-out (LIFO). This is also applicable to the company's business at it help to manage price variations. Since parts are sold out in their entry order, their price can be quoted easily.

The company administers the physical counting of the inventory by independent body to ensure parts listed in the record are physically existed. This kind or cross check is very important for companies doing such business as goods may appear in record may not exist physically on shelf.

So this physical counting helps the company to detect these parts that are recorded but not exist physically.

It is also identified that company's spare parts are properly numbered and tagged for easy identification and accessibility. This will simplify the activity of selling and issuing parts to the customer as it enable to locate parts easy.

However the company's store can be accessed by unauthorized staffs which may increase the risk of misappropriations of parts.

The company's forecasting system for inventory is found to be judgmental. To this end, the inventory furcating is based on management's personal assumption and notion without having a valid data for forecasting. This kind of forecasting will lead to shortage or surplus in inventory as simply a guess work.

Due to lack of proper forecasting as it has been discussed above to company enables to keep adequate stock of parts. This situation may dissatisfy customers and make them to look to get

another suppliers, thus, the company will lose its potential customers. Moreover, due to the judgmental forecasting the company also keeps parts that are not moving fast, that means some spare parts are stay on shelf for long time as they have low demand. This also led to tie-up capital and infarct it will affect the company's overall performance.

The company has adequate fire protection, insurance and appropriate storage for parts. This situation helps the company to minimize the risks on the business

4.3. RECOMMENDATION

The company needs to have a restriction for unauthorized staff entering in to spare parts storage areas. This can be done by ruled out the restriction by the company's higher authority .

The companies advised to adopt trend based forecasting technique in order to improve the inventory management practice. In this case the company needs to have a restriction e the company should forecast on based on past sales data, which increase the likely hood of keeping the right type and amount of spare parts through tracking customer's information.

It is also recommended the company to keep adequate stock of spare parts in order to satisfy its customers. The shortage of stock may due to the judgmental inventory forecasting as it is only a speculation. To this end if the company's adopted the trend analysis it will more easier to track the customer, spare parts type and magnitude they wanted.

The company advised to avoid keeping these spare parts that are sty long time on shelve due to low demand. This situation is will tide-up the capital or create an idle capital that would a value if invested in some other business activity. In other words the company better keep fast moving parts which increase the company's sales turn over which turn improve profitability.

Biography

Colin D. Lewis (1975): *Demand Analysis and Inventory Control*, London: Ashford Color Press.

Dervitsiotis KN (1981). *Operations Management*. USA: McGraw-Hill series in Industrial Engineering and Management Science.

Drury C(1996). *Management and Cost Accounting*. London: International Housan Business Press

Duncan W.(1996): *Cost and Management Accounting Practice*, Hall Europe.

Gov Shenoy(1986): *Operation Research for Management*,2ed willey Eastern Limited

Harold and T.Amrine (1979): *Manufacturing Organization and Management* 3rd ed, prentice Hall,Inc.

IEBM 0415-07401-9(volume3): *International Encyclopedia of Business and Management* 1996.

Keiso (1998): *Financial Accounting*,9th ed. Wiley Eastern Limited

Keth L,A Mulemen, J Oakland (1994). *Production and Operations Management*. Loandon: Pitman Publisher.

Kotler P (2000). *Marketing Management.2nd Edition*. The Millennium Edition.New Delhi: Prentice Hill of India

Lanny G.Chesteen (1998): *Intermediate Accounting*, 3rd, prentice Hall Inc.

Morris C (1995). *Quantitative Approach in Business Studies*: London: Pirman Publisher. Negeria Bottling Company.2004. Annual Report.

Mosich (1989), *Intermediate Accounting*, 6th ed. New Delhi: Prentic Hill of India

Mustafi C.K(1993): *Operation Research Methods and Practice*,2nd ed, Wiley Eastern Limited.

Rosenblatt B.S (1997). *Modern Business-A Systems Approach*. 2nd Edition, Boston: Houghton Mifflin co.

Schroeder RG (2000). *Operations Management-Contemporary Concepts and Cases*. USA: International Edition.

William J.S (1989). *Introduction to Management Science*: 2nd ed. Materials Management and integrated approach, USA: International Edition.

Shridhara K.(2003) *Production and Materials Management* India, Himalaya Publishing House

Appendices

Appendix-A

St.Mary's University Management Department Questionnaire Employees

The questionnaire is prepared by the student of St.Mary's University as requirement for partial fulfillment of the Bachelor of Arts degree in Management. Therefore, the data for enquiring will be used to prepare a senior essay on inventory Management and control System, which is applied in Ries Engineering S.co. the researcher would very much appreciate you genuine responses.

Personal Profile of Respondents

1. Gender Male Female
2. Educational Background Masters and Above Degree
 Diploma High School graduate
3. Years of service in the organization
 More than 10 years 6-10 years
 1-5 years less than a year
4. Inventory Control System of the company
Perpetual
Periodic
5. Type of inventory method used by the company
FIFO
LIFO
6. Physical verifications of items is under taken in your company
Yes

No

7. Parts are properly numbered for identification

Yes

No

8. The proper procedure to ensure that only authorized employee may have permitted to take out parts from the stock

Yes

No

9. Damages, returns, and scrap are reported to management

Yes

No

10. What methods of demand forecasting used by the company

Judgmental

Trend analysis

Statics tools

11. The Company keep adequate stock of all types of spare parts

Yes

No

12. Are there parts that are stay long time on shelf

Yes

No

13. Adequate fire outbreak alarms

Yes

No

14. Adequate insurance coverage

Yes

No

15. Appropriator storage condition

Yes

No

Appendix-B

St.Mary's University
Business Facility
Department of Management
Interview guide line for management

This interview guideline is prepared by St'Mary's University undergraduate student. The main objective of this interview is to identify the inventory practiced of the RISE Company

Thank you for wonderful cooperation

1. Does the company has a policy concerning to its inventory management?
2. What type of inventory used by the company?
3. What methods of inventory management used by the company?
4. Is there physical counting of parts in the organization?
5. How safe are the parts in the company?
6. How effective is the inventory management system?

Declaration

I the undersigned,declare that this senior essay is my original work,prepared under the guidance of Advsiar Habte Zeberga,all source of materials used for the manuscript have been duly acknowledged

Name: _____

Signature: _____

Place of Submission: _____

Date of Submission: _____

Advisors Declaration

The paper has been submitted for examination with my approval as the university Advisor

Name: _____

Signature: _____

Date: _____