

**“A STUDY ON THE EFFECTIVENESS OF INVENTORY
MANAGEMENT WITH REFERENCE TO KEL, MAMALA”**

Dissertation

Submitted by

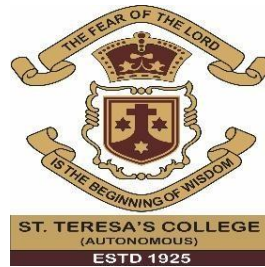
ARYA S (SM19COM007)

Under the guidance of

Ms. AKHILA P A

In partial fulfilment of requirements for award of the degree of

MASTER OF COMMERCE



ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM

COLLEGE WITH POTENTIAL FOR EXCELLENCE

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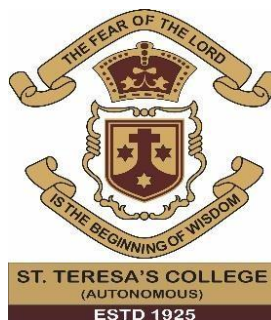
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CERTIFICATE

This is to certify that the project report titled ‘**A STUDY ON THE EFFECTIVENESS OF INVENTORY MANAGEMENT WITH REFERENCE TO KEL, MAMALA**’ submitted to **MAHATMA GANDHI UNIVERSITY** in partial fulfillment of the requirement for the award of the degree of **MASTER OF COMMERCE** is a record of bonafide work carried out by **ARYA S** under the supervision and guidance of **Ms.AKHILA P A** during the academic year 2019-2021.

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DECLARATION

I **Arya S** student of Department of commerce(SF) St. Teresa's College(Autonomous) do hereby declare that this project titled,"**A Study on the Effectiveness of Inventory Management with Reference to KEL, Mamala**" is a bonafide record of work done under the supervision and guidance of **Ms.Akhila P A** Assistant Professor of Department of Commerce(SF) ,St Teresa's College(Autonomous). I also declare that this dissertation has not been submitted by me fully or partly for the award of any Degree, Diploma, Title or Recognition before.

Arya S

Place: Ernakulam

Date:



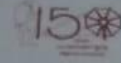
KERALA ELECTRICAL & ALLIED ENGINEERING CO. LTD.

(A GOVERNMENT OF KERALA UNDERTAKING)

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CHAPTER -1
INTRODUCTION

1.1 INTRODUCTION

In any business organization, all functions are interlinked and are often overlapping. Some key aspects like supply chain management, logistics and inventory form the backbone of the business delivery function. Therefore, these functions are extremely important to marketing managers as well as finance controllers. Inventory management is a very important function that determines the health of the supply chain as well as impacts the financial health of the balance sheet. Every organization constantly strives to maintain optimum inventory to be able to meet its requirements and avoid over and under inventory that can impact the financial figures.

Inventory is always dynamic. Inventory management requires constant and careful evaluation of external and internal factors and control through planning and review. Most of the organizations have a separate department or job function called inventory planners who continuously monitor, control and review inventory and interface with production, procurement and finance departments. Inventory management is a collection of interdisciplinary processes that include a full circle from supply chain management to demand forecasting, through inventory control and includes reverse logistics.

1.2 STATEMENT OF PROBLEM

The purpose of the study is to understand the effectiveness of inventory management of KEL, Mamala by analysing the financial statements of five years (2012-2017) with the help of various tools of analysis like ratios, correlation, trend and percentages. The problems faced by the company under the purview of the present study are excessive investment in inventory, negative working capital, non-fixation of stock levels, unsystematic purchasing policies, absence of inventory management software and higher inventory holding period.

1.3 SCOPE OF THE STUDY

The scope of the study concerns with the quantity of materials which can be purchased at minimum cost, the size of investment in inventory, and the relationship of inventory with sales and working capital. So an attempt has been made to study the extent to which Kerala electrical allied and engineering limited has efficiently carried out inventory management practices to minimize the investment in inventory.

1.4 SIGNIFICANCE OF STUDY

The study is focusing on identifying the present potential of the company's inventory methods and techniques. It helps us to identify the best set of inventory management to be carried out to improve its inventory policy. The purpose of this study is to derive meaningful application of the theory of inventory management for its actual implementation.

1.5 OBJECTIVES OF STUDY

Following are the objectives of the study;

- To study the percentage of investment in inventory.
- To study the correlation of inventory between sales and working capital
- To study the impact of inventory management on the performance of the firm with the help of ratios.

1.7 RESEARCH METHODOLOGY

1.7.1 TYPE OF RESEARCH

The analytical model of research is adopted for the study. Facts and information already available are analyzed to make critical evaluation of the performance.

1.7.2 DATA COLLECTION

- **Primary data**

Primary data is collected through unstructured personal interview with the employees of the material management department.

- **Secondary data**

The necessary data is collected from annual reports, books, journals, and websites.

1.7.3 TOOLS FOR DATA COLLECTION AND ANALYSIS

The following tools have been applied in the present study.

1. Percentage
2. Graphs
3. Correlation
4. Ratios
5. Trend Analysis

1.8 HYPOTHESIS OF STUDY

- 1) H₀: There is no significant relation between sales and Inventory
- 2) H₀: There is no significant difference between Inventory and working capital

1.9 LIMITATIONS OF THE STUDY

- The study is mainly conducted with secondary data and figures drawn from accounting records. The reliability of these records are doubtful.
- Lack of co-operation from the employees due to their busy work.
- Qualitative factors are not considered in the study.
- Limited scope for deep study due to lack of access to internal financial documents.
- Complete data regarding the various inventory items of the company was not available.

CHAPTER- II
REVIEW OF LITERATURE
&
THEORETICAL FRAMEWORK

REVIEW OF LITERATURE

Inventory management is considered as major concerns of every organization. So a number of studies have been done in the field of inventory management by various researchers. Some of them are given below;

1. **Edwin Sitienei and Florence Memba(2015)** Conducted a study on “ Effect of Inventory Management on profitability of Cement Manufacturing Companies in Kenya”. The study concluded that Gross profit margin is negatively correlated with the inventory conversion period, Increase in sales, which denotes the firm size enriches the firm’s inventory levels, which pushes profits upwards due to optimal inventory levels. It is also noted that firms inventory systems must maintain an appropriate inventory levels to enhance profitability and reduce the inventory costs associated with holding excessive stock in warehouses.
2. **Cheng (2014)** Their research concentrate relationship among inventory management with business performance of smallscale enterprises (SSEs), in Kisii Municipality, Kisii County,Kenya. They used a cross-sectional survey study based on a small sample size of 79 SSEs. The study inferred that inventory comprised the maximum portion of working capital, and improper management of working capital was one of the major reasons of SSE failures.
3. **Srinivas Rao Kasisomayajula(2014)** His research title based on the” Inventory Management in Commercial Vehicle Industry In India”. There were five sample firms had preferred for study. The study concluded that all the units in the commercial vehicle industry have significant relationship between Inventory and Sales. Proper management of inventory is important to maintain and improve the health of an organization. Efficient management of inventories will improve the profitability of the organization.
4. **Panigrahi (2013)** According to his analysis inventory management practices used by Indian cement firms and their effects must be on working fund efficiency. The

study also investigated the relationship between profitability and inventory conversion days. The study, using a sample of the top five cement companies of India over a period of 10 years from 2001 to 2010, concluded there must be exist inverse relationship among conversion period of inventory and profit margin

5. **Asfaque Ahmed (2012)** He said that most of the manufacturing company vendors have planning and scheduling product which assume either infinite production capacity for calculating quantities of row material and work in progress (WIP) requirements or infinite quantities of raw material and WIP materials for calculating production capacity. There are many problems with this approach and how to avoid these by making sure that the product you are buying indeed takes into account finite quantities of required materials as well as finite capacities of work centres in your manufacturing facilities.

6. **Soni (2012)** Made an in depth study of practices followed in regard to inventory management in the engineering goods industry in Punjab. The analysis used a sample of 11 companies for a period five years, that is, 2004–2009 and was done using panel data set. The adequate and timely flow of inventory determines the success of an industry. She concluded that size of inventory enhanced marginally over the period as compared to a hike in current assets and net working capital. Inventories constituted half of the working capital which was due to overstocking of inventory as a result of low inventory turnover especially for finished goods and raw materials. Rise in sales and favourable market conditions lead to a rise in inventory levels. It was also inferred that sales increased more as compared to inventory.

7. **Lwiki et al (2013)** A survey conducted on all the eight (8) sugar manufacturing firms in Kenya established that there is generally positive correlation between each of inventory management practices. Specific performance indicators were proved to depend on the level of inventory management practices. They established that Return on Equity had a strong correlation with lean inventory system and strategic supplier partnerships. As such, they concluded that the performance of sugar firms could therefore be stated as being a function of their inventory management practices.

8. **Zabala (2011)** investigates whether decisions considered as common in new product development literature are also valid in a region characterized by traditional industries. The author aims to link the theoretical and empirical fields in the context of new product development and product innovation management

9. **Bern at de William (2008)** This study tells that the main focus of inventory management is on transportation and warehousing. The decision taken by management depends on the traditional method of inventory control models. The traditional method of inventory management is how much useful in these days the author tell about it. He is also saying that the traditional method is not a cost reducing, it is so much expensive. But the managing the inventory is most important work for any manufacturing unit.

10. **Delaunay C, Sahin E (2007)** A lots of work has been done but now if we want to go ahead we must have good visibility upon this field of research. That is why we are focused on frame work for an exhaustive review on the problem of supply chain management with inventory inaccuracies. The author said that their aim in this work is also to present the most important criterion that allow a distinction between the different types of managing the inventory

11. **Charles Atkinson (2006)** A the study by Mr. Charles Atkinson, he explained the inventory management and assessment of inventory levels. As per this study inventory management need to address two issue Part I. How to optimize average inventory levels. Part II. How to assess (evaluate) inventory levels. This study tells about what the manager should do and not to do, and how much amount should be order in one placed orders. Average inventory can be calculated by simplistic method.
$$\text{Average inventory} = \frac{\text{beginning inventory} + \text{end inv.}}{2}$$

12. **Wolf Bagby, Managing inventory (2004)** In this study Mr. W.Bagby explains that by managing the inventory it becomes easier for the organization to meet the profit goals, shorter the cash cycle, avoid inventory shortage, avoid excessive carrying

costs for unused inventory, and improve profitability by decreasing cash conversion and adopt JIT system. According to this study companies need to get smart about inventory. Boosting financial performance is another benefit that comes from better inventory management. Infact large number of manufacturers enjoy savings and better performance by choosing the approach of inventory reduction. For this company needs to maximize the cash flow and profitability and this includes keeping a watchful discerning eye on charge in supply and demand

13. **D.Hoopman (2003)** He said that inventory optimization recognize that different industry have different inventory profiles and requirements. Research has indicated that solutions are priced in a large range from tens of thousands of dollars to millions of dollars. In this niche market sector price is definitely not an indicator of the quality of solution, ROI and usability are paramount.
14. **Silver, Edward (2002)** this context of a population of items for which the assumption underlying the EOQ derivation holds reasonably well. However as is frequently the cash in practices there is an aggregate constraint that applies to the population as a whole.
15. **Dave Piasecki (2001)** He focused on various model of inventory to calculating optimum purchase quantity which used the EOQ method. He points out that many companies are not using EOQ model because of poor results resulted from inaccurate data input. He says that EOQ is an accounting formula which determines point at which combination of ordering costs and stock inventory costs are the least. He highlights that EOQ method would not conflict with the JIT approach. He further elaborates the EOQ model formula that includes parameters like yearly usage on unit, order cost and carrying cost. Finally, he proposes several steps to follow in implementing the EOQ model. Now this literature limitation is as it does not elaborate further association among EOQ and JIT. It does not associate stock turns with EOQ so fails for mention profit gain with associated stock is calculated

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THEORETICAL FRAMEWORK

MEANING OF INVENTORY

Inventory is defined as a list of goods and materials which are available in stock for business. It refers to the goods and materials that a business holds for the ultimate goal of resale/repair. It is the stock file of all the products that the organization has made for sale and the components that make the product. Every organization requires inventory for the smooth running of its activities. Inventory act as a link between the production and purchase departments. Firms usually maintain a large size of inventory so as to facilitate smooth production. This means that a huge amount of money will be tied up with the inventory until it leaves the firm as purchased finished goods. Therefore, it is imperative to manage the inventories efficiently and effectively in order to ignore unnecessary wastage of funds. In accounting, inventory is considered as an asset.

Inventories constitute the principal item in the working capital of the majority of trading and industrial companies. To maintain a continuity in the operations of the business enterprise, a minimum stock of inventory is required. The physical control of inventory is the operating responsibility of stores superintendent and financial personnel. The term inventories include raw materials, work in progress, finished goods and other accessories.

TYPES OF INVENTORY

Inventories play a vital role in business. Depending upon the nature of business, inventories maybe classified as follows;

I. Raw materials

It refers to those materials and components which are required for making a product. Raw materials are those inventories which have been acquired and reserved for future production. These basic inputs are later converted into finished products through manufacturing.

II. Work in progress

It refers to those materials and components that have started their conversion into finished goods. Materials issued to the shop floor which have not yet been transformed

into finished products are called as value added materials to the extent of labor cost incurred.

III. Finished goods

It refers to the completed part that is ready for sale as per customer order. These goods have been inspected. From this point, the finished goods can be sold to the retailers, wholesalers and ultimate consumers as per their order.

PURPOSE OF HOLDING INVENTORY

1. Transaction motive:

Every firm has to preserve some level of inventory to meet the day-to-day transactions of sales and production. The finished goods as well as raw materials are kept as inventory/ stock for the smooth operations of business.

2. Precautionary motive:

A firm should keep some of its inventory for unexpected circumstances like loss due to natural calamities in a specific area, strikes, etc. that may occur in the future.

3. Speculative motive:

The firm may keep some inventory in order to capitalize an opportunity to make profit due to price fluctuations.

Factors affecting the size of investment in inventory:

i. Level of safety stock

If a firm maintains a high level of safety stock because of relatively larger degree of uncertainty associated with sales and production, the size of investment in inventory will also be higher.

ii. Carrying cost

If the cost of holding inventory is lower, the firm tends to keep larger stock of inventories.

iii. Economy in purchase

If a firm is likely to receive certain benefits in the form of cash discounts for the purchases made currently, the size of investment in inventory is also likely to be higher due to larger quantity of purchases.

iv. Possibility of price rise

If the price of materials is likely to rise in future, the firm makes larger quantities of purchase at present.

v. Cost and availability of funds

If the cost of funds to be invested in inventories is relatively cheaper and are conveniently available, the firm shall make larger quantity of purchase.

vi. Possibility of rise in demand

If the firm has anticipated an increase in the demand of its products in future, it maintains larger stock of inventory at present.

vii. Length of production cycle

If the length of production cycle is relatively longer, the firm has to maintain inventory for longer duration of time. As a result of which the size of investment in inventory increases.

viii. Availability of material

If certain kind of material is available only for a particular season, the firm has to increase its investment in inventory in order to maintain larger stock in that season.

ix. Nature of business

A firm that deals with mostly perishable goods tend to keep lower stock of inventory thus reducing the size of investment.

x. Size of business

For a firm with relatively larger size and wider market coverage the investment is larger.

INVENTORY MANAGEMENT

Inventory management refers to the process of evaluating and controlling the flow of inventory or stock level of the company. It is the active control program that enables the

management to do correct and timely provision of raw materials required for the final product.

Inventory management is a collection of tools, techniques, and strategies for storing, tracking, delivering, and ordering inventory or stock. It is about specifying the size and the placement of stocked inventory. A large amount of capital, if not the majority of a company's capital is wrapped up in their inventory. For that reason, it is incredibly important to control the coming and going of inventory in the best possible manner so as to minimize losses and maximize profit.

It is very important to maintain the desired level of stock so as to perform the production and sales activities effectively. The scope of inventory management also covers the fine lines between replenishment lead time, carrying cost of inventory, asset management, inventory valuation, quality management and demand forecast.

Inventory management deals with:

- Active control program related with the management of sales and purchase department.
- Understanding of inventory and the capacity to control financial cost.
- Control over operating cost.
- Identifying the requirement of inventory, stock up techniques, actual and projected inventory status.

OBJECTIVES OF INVENTORY MANAGEMENT

- a) To have stocks available as and when required.
- b) To utilize available storage space efficiently thereby preventing stock levels from exceeding space availability.
- c) To decide the items to be stocked and procured on demand.
- d) To keep all the expenditure related to inventory within the budget.
- e) To ensure an adequate supply of materials, stores, spares, minimum stock-outs and storage thereby avoiding costly interruptions in operations.
- f) To provide perpetual inventory value and a consistent and reliable basis for the preparation of financial statements.
- g) To facilitate economies in purchase.
- h) To keep down investment in inventories, inventory carrying and obsolescence losses to the minimum.
- i) To meet a high percentage of demand without creating excess stock levels.

- j) To provide a check against loss of materials through carelessness.
- k) To improve the profitability of the business.
- l) To maintain adequate accountability of inventory assets.
- m) To provide desired level of customer service.
- n) To allow cost efficient operations.

We have not heard about any companies which have become successful while mismanaging its inventory. There are plenty of mammoth companies that mismanaged their inventories and lost billions after becoming successful. Walmart losing \$3 billion because of out of stocks is a prime example of inventory mismanagement. If they want to remain profitable, competitive and continue being successful, they will have to implement better inventory management techniques.

INVENTORY MANAGEMENT TECHNIQUES

Following is a list of some of the most popular and effective inventory management techniques used by business firms;

- **ECONOMIC ORDER QUANTITY**

Economic order quantity is the lowest amount of inventory to be ordered to meet peak customer demand without going out of stock and without producing obsolete inventory. Its purpose is to reduce inventory as much as possible to keep the cost of inventory as low as possible. Economic order quantity uses three variables; demand, relevant ordering cost, and relevant carrying cost.

Demand: The demand, in units, for the product for a specific time period.

Relevant ordering cost: Ordering cost per purchase order. Ordering cost is the cost of placing an order with the supplier.

Relevant carrying cost: Carrying cost for one unit. Assume the unit is in stock for the time period used for demand. Carrying cost is the cost of carrying or storing the material in store till they are used in production.

The economic order quantity can be ascertained from the following formula.

$$EOQ = \sqrt{2AO/C}$$

Where, EOQ – economic order quantity

A – Annual consumption in units

C – Carrying cost of one unit per annum

- **ABC ANALYSIS**

ABC analysis is a method of sorting the inventory into three categories according to how well they sell and how much they cost to hold:

A - Items – best selling items that don't take up all the warehouse space or cost.

B - Items – mid- range items that sell regularly but may cost more than A- items to hold.

C - Items – the rest of the inventory that makes up the bulk of the inventory costs while contributing the least to the bottom line.

ABC analysis of inventory helps to keep working capital costs low because it identifies which items should be reordered more frequently and which items need not be stocked often thereby reducing obsolete inventory and optimizing the rate of inventory turnover.

- **JUST IN TIME INVENTORY MANAGEMENT**

It is simply making available what is needed, when its needed, in the amount needed. JIT attempts to establish a 'zero inventory system' by manufacturing goods to order; it operates on a pull system whereby an order comes through and initiates a cascade response throughout the entire supply chain- signaling the staff that they need to order inventory or begin producing the required item. Some of the benefits of JIT is as follows;

- ✦ Minimize costs such as rent and insurance by reducing inventory.
- ✦ Less obsolete, outdated and spoiled inventory.
- ✦ Reduce waste and increase efficiency by minimizing or eliminating warehousing and stockpiling, while maximizing inventory turnover.
- ✦ Maintain healthy cash flow by ordering stock only when it is necessary.
- ✦ Production errors can be identified and fixed faster since, production happens on a smaller, more focused level, allowing easier adjustments or maintenance on capital equipment.

- **SAFETY STOCK INVENTORY**

Safety stock inventory is a small, surplus amount of inventory kept in hand to guard against variability in market demand and lead times. Safety stock plays an integral role in the smooth operations of the supply chain in various ways.

- ✦ Protection against unexpected spikes in demand.
- ✦ Prevention of stock outs.
- ✦ Compensation for inaccurate market forecasts.
- ✦ A buffer for longer than expected lead time.

The benefits of safety stock are all tied to mitigating problems that could seriously harm the business. Therefore, without safety stock inventory the business would experience loss of revenue, lost customers and a loss in the market share.

$$\text{Safety stock inventory} = (\text{Max. daily sales} \times \text{Max. lead time in days}) - (\text{Average daily sales} \times \text{Average lead time in days})$$

- **FIFO and LIFO**

FIFO and LIFO are accounting methods used to value inventory and report profitability.

FIFO (first in, first out) is an inventory accounting method that says the first items in the inventory are the first ones that leave- meaning the old inventory is get rid of first. This method assumes that materials are issued to production in the order in which they are purchased. Whereas, LIFO (last in, first out) is an accounting method that says the last items in the inventory are the first ones to leave- meaning the newest inventory is get rid of first. This method assumes that materials are issued to production in the reverse order of purchases. That means materials are first issued from the last lot, then from the just previous lot and so on.

FIFO method is suitable for business dealing in perishable goods and LIFO method is suitable for businesses that deal in non-perishable homogeneous goods.

- **INVENTORY TURNOVER RATIO**

Inventory turnover ratio also known as stock turnover ratio is a ratio showing the number of times a company's inventory is sold or replaced over a given period. A higher inventory turnover ratio implies strong sales and ensures that the company does not overspend by buying and storing too much inventory and waste resources. A lower ratio implies poor sales and therefore excess inventory.

$$\text{Inventory Turnover Ratio} = \frac{\text{Cost of Goods Sold}}{\text{Average Inventory}}$$

Cost of Goods Sold is the accumulated total of all costs used to create a product or service which has been sold. It is also referred to as the Cost of Sales. It excludes indirect expenses. It is calculated by adding opening stock and purchases and subtracting closing stock. Average inventory is the median value of an inventory throughout a certain time period. It is calculated by adding both opening and closing inventory and dividing it by two. Average inventory is used for the purpose of accuracy. The ratio establishes the relationship between cost of goods sold and average inventory. Higher the ratio, higher will be the profitability. A lower inventory turnover ratio indicates lower profitability position of the firm.

- **PERCENTAGE OF INVENTORY TO CURRENT ASSET**

The quality of current assets has been viewed in terms of liquidity of current assets therefore the high ratio of cash to current assets indicates qualitative current assets and high ratio of inventory to current assets indicates less qualitative current assets. The higher ratio of inventory to current assets would indicate a large volume of inventory holding. Therefore, higher percentage of inventory to current assets can be taken as a poor sign of inventory management. Generally, lower the percentage of this ratio is considered better for the company.

$$\text{Percentage of Inventory to Current asset} = \frac{\text{Value of Inventory}}{\text{Current asset}} * 100$$

- **INVENTORY TO WORKING CAPITAL RATIO**

Inventory to working capital ratio is defined as a method to show what portion of a company's inventory is financed from its available cash. This is essential to those companies which hold inventory and survive on cash supplies. In general, lower the ratio higher is the liquidity of the company. Analyzing a company's inventory to its net working capital is best done over a number of periods to accurately identify the trends in the use of a firm's working capital. Such trends can reveal any problems in the regular operations of a company, including the rising ratio values associated with heavy quantities of outdated stock, inferior purchasing control and inefficient sales forecasts. The formula to determine working capital is the company's current assets minus its current liabilities.

$$\text{Inventory to Working capital ratio} = \frac{\text{Inventory}}{\text{Working capital}}$$

- **CORRELATION BETWEEN INVENTORY AND WORKING CAPITAL**

Two variables are said to be correlated if the change in one variable results in a corresponding change in other variable. That is when two variables move together, we say they are correlated. Here the level of inventory rises, the working capital also rise on the other hands, if level of inventory falls working capital also falls.so both variables move together and they move in sympathy. Hence inventory and working capital are correlated. The equation for calculating correlation.

$$\text{CORRELATION} = \frac{n\sum xy - (\sum x) * (\sum y)}{\sqrt{n\sum x^2 - (\sum x)^2} \sqrt{n\sum y^2 - (\sum y)^2}}$$

- **INVENTORY CONVERSION PERIOD**

Inventory conversion ratio is used to calculate the time taken to clear stocks. It is calculated by dividing days in a year with inventory turnover ratio.

$$\text{Inventory Conversion Ratio} = \frac{365}{\text{Inventory turnover ratio}}$$

With the help of this ratio, inventory policy can be reviewed. Overstocking leads to locking up of working capital and there are chances of loss due to passage of time. Understocking

may lead to inability to meet demands. Hence, it is a test of efficient inventory management. No standard ratio can be suggested. It depends upon the nature and type of business, manufacturing or procurement time, etc. A low ratio indicates inefficiency in inventory management or over investment in stock. Similarly, a very high ratio does not mean efficiency but implies insufficient stock and shortage.

- **SALES TO INVENTORY RATIO**

Sales to inventory ratio is one of the effective tool by which inventory can be managed smoothly. This ratio establishes the financial relationship that exists between inventory and sales. Higher the ratio, better is the efficiency. Comparing this ratio against the company's own historical records allow managers and executives to understand the trend changes. Comparison of the same helps in knowing whether the company's inventory management is good or bad. The formula for calculating sales to inventory ratio is as follows;

$$\text{Sales to Inventory Ratio} = \frac{\text{Net Sales}}{\text{Inventory at the end}}$$

- **INVENTORY TO TOTAL ASSET RATIO**

One ratio used to assess operational management and inventory turnover is inventory to total assets ratio. In general, a low inventory to total assets ratio is indicative of good performance and profitability. The percentage of inventory to total assets is known as Inventory to assets ratio. It shows the Percentage of the assets tied up in the form of inventory. Generally, the lower percentage value of this ratio is considered better for the company. The higher the percentage of inventory to the total assets, the lower the profitability of the firm as the Companies with high inventory turnover generally will have a low percentage of inventories to total assets. By looking at the inventory to total assets ratio over time, one can determine inventory levels for the company. If the ratio is rising, inventory levels are increasing, which may be a sign of low demand and oversupply of the inventoried asset.

$$\text{Inventory to Total asset} = \frac{\text{Inventory}}{\text{Total asset}}$$

- **TREND ANALYSIS**

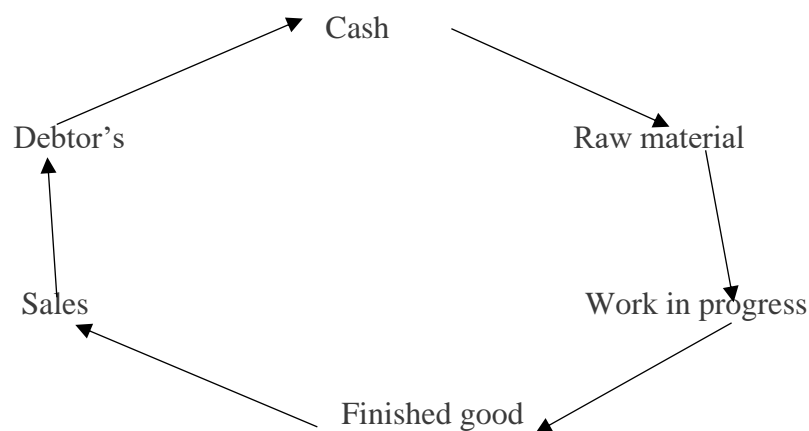
It is a type of horizontal analysis. A trend Statement shows the percentage of an item for a number of years taking a base year. An analysis made on trend percentage is called trend analysis. When Calculating trend, the first year is taken as base year. The figure of base year taken as 100 and trend percentages for other years are calculated by using formula.

$$\text{Trend} = \frac{\text{Amount of a particular year}}{\text{Amount of Base year}} * 100$$

OPERATING CYCLE OF INVENTORY MANAGEMENT

Operating cycle is the number of days a company takes in realizing its inventories in cash. It equals the time taken in selling inventories plus the time taken in recovering cash from trade receivables. Operating cycle is a measure of the operating efficiency and working capital management of a company. The operating cycle is the average period of time required for a business to make an initial outlay of cash to produce goods, sell the goods, and receive cash from customers in exchange for the goods.

The operation cycle can be said to be the heart of the working capital. The need for working capital or current assets cannot be over emphasized as already observed. The main motive of many business firms is to achieve maximum profits, which can be earned depending upon the magnitude of the sales among other things. However, sales do not convert in to cash instantly. There is invariable time lag between sale of goods and receipts of cash. Therefore, sufficient working capital is required for sustaining sales activity.



The operating cycle of a manufacturing company has three phases namely;

- Acquisition of resources
- Manufacturing products
- Sale of product

INVENTORY CONTROL

Material control/ inventory control is a part of inventory management.

Material is the first and most important element of cost of a product. In some cases, the cost of raw material ranges from 40% to 70% of the total cost. The quality of finished goods is also governed by the quality of raw material which is used in production process. Hence, control over material is necessary to assure a steady supply of each item of material.

Essentials of Inventory Control

The important requirements of inventory control are;

- A firm needs inventory control system to effectively manage its inventory.
- Proper classification of materials with codes, material standardization and simplification.
- The operation of proper internal check system ensures that all transactions involving material and equipment are properly checked by authorized and independent persons.
- The operation of perpetual inventory system helps to determine at any time the amount and value of each kind of material in stock.
- A suitable method of valuation of material is essential because it affects the cost of jobs and the value of closing stock of materials.

Advantages of Inventory Control

- 1) Eliminates wastage in use of material
- 2) It reduces the risk of loss from fraud and theft.
- 3) It helps by the keeping perpetual inventory and records to facilitate the preparation of accurate material report management.
- 4) It reduces the capital tied up in inventories.
- 5) It reduces cost of storage.

TYPES OF INVENTORY COST

There are three types of costs that must be considered in setting inventory levels:

1. Holding/Carryingcost

They are expenses such as storage, handling, insurance, taxes, obsolescence, theft, and interest on funds financing the goods. These charges increase as inventory levels rise. To minimize carrying costs, management makes frequent orders of small quantities. Holding costs are commonly assessed as a percentage of unit value, rather than attempting to derive monetary value for each of these costs individually. This practice is a reflection of the difficulty inherent in deriving a specific per unit cost, for example, obsolescence or theft.

2. Ordering costs

ordering costs are those fees associated with placing an order, including expenses related to personnel in purchasing department, communications, and the handling of related paper work. Lowering these costs would be accomplished by placing small number of orders, each for a large quantity. Unlike carrying costs, ordering expenses are generally expressed as a monetary value per order.

3. Stock-out costs

They include sales that are lost, both short and long term, when a desired item is not available; the costs associated with back ordering the missing item; or expenses related to stopping the production line because a component part has not arrived. These charges are probably the most difficult to compute, but arguably the most important because they represent the costs incurred by customers when an inventory policy falters. Failing to understand these expenses can lead management to maintain higher inventory levels than customer requirements may justify.

INVENTORY TRANSACTIONS

- Normal stock receipt- from previously issued purchase orders and transfers
- Unexpected stock receipts-the stuff that just shows up on receiving stock
- Requisitions- a request for material to be consumed within company
- Emergency requisitions
- Sales
 - Orders to be delivered
 - Orders to be picked up
 - Cash sales
- Transfers to other warehouses or facilities
- Assembly orders
- Bin to bin transfers within warehouse
- Returns of stock material
- Returns of non-stock material
- Returns of damaged material
- Returns to supplier
- Scrapping and writing-off stock.

OPERATIONAL CHALLENGES IN INVENTORY MANAGEMENT

- a) **Low Product Turnover** - Failure to track demand can lead to a lower than expected product turnover due to low demand. Low turnover results in excess inventory that ends up wasting space in your warehouse and tying up capital, which is costly for business.
- b) **Excess Inventory** - Excess inventory occurs when a business inaccurately orders inventory and is left with more than needed. This leads to storage problems and prevents you from offering better products that could lead to higher revenue.
- c) **Failure to Keep Track of Stock** - Infrequent inventory checks and using manual processes to track inventory is not enough to manage your supply chain. Failing to keep close track of stock movement in and out of your business causes accounting errors, resulting in added costs for your business.
- d) **Poor Service Levels** - A company's number one goal should be supporting the highest possible service levels for customers. Improved service levels lead to higher profits; customer satisfaction is the most important asset a business can have, and poor service

levels will negatively impact customer perception of your brand. However, delivery and lead times will vary depending on the product which makes management complicated for businesses without inventory optimisation software.

- e) **Difficulty in identifying demand patterns** - Changing demand can be one of the biggest challenges for SMBs, especially with ever-increasing and changing product portfolios. For example, within the electronic industry, there are shorter product life cycles and high demand which increases uncertainty. Tracking and analysing demand changes and trends help companies accurately forecast for future orders.
- f) **Lack of Visibility** - The complexity of the supply chain network has increased with globalisation; accurate inventory has become a critical factor for success. Having complete visibility and insight into your inventory from supplier to customer is essential for establishing effectively managing a global supply chain network.

MODERN TECHNIQUES OF INVENTORY MANAGEMENT

The importance of effective and efficient inventory management is recognized by every modern organization today especially the big players in supply chain management such as Wal-Mart. With the advent of technology and use of information technology in every aspect of our lives, inventory management is not untouched by the IT revolution. Today various supply chain companies and manufacturing industries use modern inventory management techniques incorporating the use of highly advanced technology and software.

Let us look at some of these modern techniques of inventory control:

1. Just in Time (JIT)

Originally used by the Japanese automobile giant Toyota for optimizing their production process while reducing inventory, JIT is one of the most popularly practiced approach used by many organizations. It involves having an exact amount of materials which are needed at present thus ensuring almost zero inventory with minimum lead time.

2. Barcode Scanning

Tracking of inventory is another major area of overall inventory control and management. Traditionally there was no fool proof method to keep an exact track of inventory items. Now-a-days, barcodes are extensively used on products in supply chain or production processes which can be scanned by bar code readers which then sends the data to central control unit regarding the product details and updating various details about the product.

3. Material Requirement Planning

Material Requirement Planning or popularly called as MRP is the widely used approach in manufacturing plants to systematically plan the various requirements of production in future, either monthly, quarterly half yearly or yearly depending upon the size of organization.

4. Use of RFID

Radio Frequency Identification Technology is the advanced technology to increase equipment, inventory and business process visibility. It helps to accurately track the location and exact count of materials and store them in a central database which provides bird's eye view on the inventory levels in the organization hence empowering the users to make informed decisions based on facts.

5. Vendor Managed Inventory

VMI or Vendor Managed Inventory is the technique where the inventory storage is the responsibility of the vendor or supplier of goods for optimizing the inventory held by distributor or user of goods. This is done with the help of communication link over the internet that provides vendor with the necessary data to plan inventory and place orders. This can result into better inventory accuracy, forecasting and service.

PROCESS OF INVENTORY MANAGEMENT AND CONTROL

1) Determination of optimum inventory levels and procedures for review and adjustment.

It is a significant step but a difficult one. Too much inventory results in locking up of working capital accompanied by increased carrying cost (but reduced ordering cost). Too less of inventory releases working capital for alternative uses and reduces carrying cost and increase ordering cost. But there is risk of stock out costs. So the actual level of inventory improves your production and reduces losses.

2) Determination of the degree of control that is required for the best results.

The second aspect of inventory management is to decide just how much control is needed to realize the objectives of the inventory management. The difficulty is best overcome by categorization of inventory on the basis of value, popularly called the ABC Categorization; this approach is useful in deciding the degree of control. 'A' class items are high in value but 'low' in quantity, 'C' class inventories are the opposite of 'A' class items. 'C' Class items are high in quantity and low in value. In between are the 'B' group stocks which are more or less equal in quantity and value proportion to the total inventory. Tight control is exercised on 'A' category items through accurate records of receipts and issues and by coordination of incoming shipments with production management.

3) Planning and design of the inventory control system

An inventory system provides the organizational structure and the operating policies for maintaining and controlling goods to be inventoried. The system is responsible for ordering and receipt of goods, timing the order placement, and keeping track of what has been ordered, how much from whom.

Functions of materials management department in an organization;

- Procurement of the required quality and quantity of materials at the best price for the purpose of production.
- Maintaining continuity of supply to ensure production schedule at minimum investment i.e. Inventory handling.
- Avoiding duplication of materials which otherwise may lead to wastage of materials and equipment.
- Creation and maintenance of goodwill of the company through dealings with the suppliers.

INDUSTRY AND COMPANY PROFILE

INDUSTRIAL PROFILE

Energy can neither be created nor destroyed, but it can be converted from one form to another. The generation of electrical energy is nothing but conversion of various forms of energy into electrical energy. The various energy sources which are used to generate electrical energy on a large scale includes oil, natural gas, water stored in dams, diesel oil, nuclear power, steam obtained by burning coal and other non-conventional energy sources.

Electrical power is generated in bulk at the generating stations also known as power stations. Depending upon the source of energy used, these stations are called thermal power stations, hydro-electric power stations, diesel power station, nuclear power station, etc. This generated electrical energy is demanded by the customers. Hence there is a need to supply the generated electric power to the customers. The electrical power industry provides services related with the production and delivery of electrical power (electrical energy) often known as power/ electricity in sufficient quantities to areas that need electricity through a grid. Both households and business need access to electricity, the demand being more in developed and developing countries.

Demand for electricity is derived from the requirement for electricity in order to operate domestic appliances, office equipment, industrial machinery, domestic and commercial lighting, heating, cooking and industrial processes. Because of these aspects of the industry, it is viewed as a public utility infrastructure.

The electric power industry covers the generation, transmission, distribution and sale of electric power to the general public and industry. The commercial distribution of electric power started in 1882 when electricity was produced for electric lighting. In the 1880s and 1890s, growing economic and safety concerns lead to the regulation of the industry. Once an expensive novelty limited to the most densely populated areas, reliable and economical electric power has now become an essential aspect for normal operations of all the elements of developed economies. By the middle of the 20th century, electricity was seen as a “natural monopoly”, only efficient if a restricted number of organizations participated in the market; in some areas, vertically-integrated companies provide all stages from generation to retail, and only governmental supervision regulated the rate of return and cost structure.

Since 1990s, many regions have opened up the generation and distribution of electric power to provide a more competitive electricity market. While such markets can be abusively manipulated with consequent adverse price and reliability impact to consumers, generally competitive production of electrical energy leads to worthwhile improvements in efficiency. However, transmission and distribution are harder problems since returns on investment are not as easy to find.

State scenario

The first public sector electrical equipment industry set up in Kerala was the Metropolitan Engineering Company limited in Trivandrum in the year 1945. It was followed by the starting of Electrical and Allied Industries Pvt. Ltd. (EAIT) at Kundara in the year 1946.

EAIT was taken over by the Government in the year 1964, which was then registered as a Government of Kerala Undertaking. At present there are five public sector electrical equipment industries working in Kerala. They are as follows:

No.	Company Name	Products
1	Metropolitan Engineering Co. Ltd.	Isolators, Fuses, Switches
2	United Electrical Ltd.	Meters, Motors, Capacitors
3	Traco Cables	Telephone & PVC cables
4	Kerala Electrical and Allied Co. Ltd.	Alternators, Transformers
5	Kerala State Electronics Development Co. Ltd.	Capacitors, Resistors, Television

Electrical industry on growth path

After being in the doldrums towards the end of the 1990s, the Indian electrical equipment industry is seeing a revival in the last couple of years with the growth rate averaging 7 per cent per annum. There is no doubt that a major cause of this upsurge is the reforms that have led to unbundling of monolithic, state-owned power utilities and the corporatization of the transmission and distribution sectors. The pressure on these two enterprises to be commercially viable has led to the implementation of practices for reducing power losses (technical as well as due to theft) in the pipeline and effect better recovery of dues. This, in turn, has led to investment in new equipment and systems which have boosted the fortunes of the equipment manufacturing industry.

Heavy electrical industry covers units manufacturing large plants and machinery requires for power generation, transmission, distribution and utilization. These include turbo-generators, boilers, and various types of turbines, transformers, motors and switch gears. The major areas where the heavy electrical equipment are used are the large projects for power generation including nuclear power stations, petro chemical complexes, chemical plants, integrated steel plants, non-ferrous metal units etc. The share of the domestic equipment is about 66% of the country's generation capacity.

The industry has also established a strong manufacturing base to the requirement for the equipment for nuclear power plants in the country. The domestic heavy electric equipment manufacturers are making use of the developments in the global market with respect to the product designs and upgrading of manufacturing and testing facilities. The industry is also competitive in the field of design and engineering as the skill sets available in the country are relatively less expensive.

COMPANY PROFILE

Established in 1964 in the state of Kerala, India, the Kerala Electrical & Allied Engineering Co. Ltd. (KEL) is a multifaceted company fully owned by the State government. Through its five production facilities, located in various districts of the State, this ISO 9001:2000 compliant company provides basic engineering services / products besides executing projects of national significance for high profile clients like the various defense establishments.

The company manufactures and markets products like general purpose brushless alternators, brushless alternators for lighting and air-conditioning of rail coaches, medium power and distribution transformers as well as Structural Steel fabrications.

The product category for defense applications include high frequency alternators, frequency convertors, special alternators and power packs for missile projects. The power packs designed and supplied by the company for missile projects like Falcon, Prithvi, Thrishul and Akash have been pioneering efforts. The company has also supplied special alternators to the Army (Military Power Cars) and Air Force (Radar Applications).

The company's all- India marketing network with regional offices in all metro cities cater to major institutional clients like the State Electricity Boards, Indian Railways and various defense establishments besides the general market clients.

KEL's products are marketed through an all-India network of marketing and after-sales service offices located in all metro cities (New Delhi, Bombay, Madras, Calcutta, Kanpur, Bhopal, Hyderabad, Bangalore, Coimbatore and Trivandrum.). These offices provide all support services to the sales and marketing team to guarantee complete customer satisfaction. Also there are Sales / Liaison Officers at Coimbatore and Trivandrum.

KEL is one among the largest, most vibrant and productive Public Sector Undertaking, and is fully owned by the Government of Kerala. A multi- product engineering company, consistently catering to an envious client base, ranging from the Army and Air- Force of India to world renowned space research organizations, highly competent engineering companies to mammoth institutions like the Indian Railways. The company with four state-of-the-art manufacturing units spread across Kerala has a pan India presence with the marketing offices in major metros and selected cities.

Vision

To be a globally recognized enterprise committed to enhancing stakeholder value by providing world class engineering and power system solutions.

Mission

To achieve our vision by:

- Apply state-of-the-art technology, processes and innovative solutions.
- Building long-term relationship with the stakeholders in an environment of fair business ethics and values.
- Creating value through highly motivated and empowered team

Core Values

- Fairness, transparency, integrity
- Trust and mutual respect
- Passion for professional and operational excellence
- Corporate and social responsibility
- Responsive and courteous service

The KEL Product Range

1) Transformer Division @ Mamala Unit

- Distribution transformers of ratings up to 5000 kVA, 33 k V classes- of types such as oil-filled and resin impregnated dry type, on load tap changing with automatic voltage regulation.
- Future-ready product range: resin cast dry type, special application transformers such as EMU, LOCO, dynamic reactive power compensation and furnace transformers.

2) Structural Engineering Division @ Mamala Unit

- Design, fabrication and commissioning of hydraulic gates and hoists and their controlling equipment
- Design and construction of steel bridge, factory buildings, storage tanks, fabrication of pressure vessels and other industrial steel structures.

- Fabrication and manufacture of bogie frames, bogie bolster, head stocks for railway and wagons.

3) Train Lighting Alternator Division @ Kundara Unit

- Inductor type brushless alternator for train lighting and air-conditioning – 1k W to 40k W, with RRU/ERRU.
- 12k W alternators specially designed for powering Janashatabdi Express Trains of Indian Railways.
- Inductor type brushless alternator for automobiles and for charging systems in diesel engines-12V, 24V, up to 50A.
- High frequency alternator-400Hz, up to 100 k VA.
- Ground power units for starting Avro and Dornier aircrafts and for powering Boeing aircrafts.
- Ground support units with dual voltage system for starting fighter aircrafts.
- DC, AC power frequency and high frequency power pack for missile firing auxiliary power support.
- BLDC fan

4) LT Switchgear Division @ Olavakkod Unit

- Fuse Switches
- Changeover Switches
- Porcelain Fuse Units and Cutouts
- Distribution fuse boards and industrial type switch boards
- Distribution Boards (SPN & TPN 2 to 16 ways).

Divisions

1. KEL Train Lighting Alternator Division

This ISO certified unit was initially started in the year 1964 imbibing technical know-how from EVR of France for the purpose of manufacturing Stat dyne brushless alternators used for lighting and air-conditioning of Railway coaches.

There are two divisions in this unit, namely Stat Dyne Alternator Division (Train Lighting Alternator Division) and Foundry Division.

Stat dyne Alternator Division has an Installed capacity of 3000 numbers of alternators per annum. There are more than 40,000 alternators in service with the Indian Railways alone. Foundry Division has a capacity of 1500 MT per annum and manufactures Spheroid Graphite Iron & Grey Iron Castings. This unit has fully mechanized molding lines with sophisticated testing equipment to ensure quality castings. The unit also has 2 x 3t capacity Induction Furnaces.

Indian Railways, BHEL, Crompton Greaves Ltd., BEML, R & DE (Engineers), Pune, BDL Hyderabad are some of the top customers of this unit.

Quality System

To achieve customer satisfaction by providing the right product and service at the right time, every time as per customer's requirement.

USP

- Induction Alternator- Brushless excitation without winding on the rotor, with both field and armature windings embedded in stator slots. Hence unlimited working speed and ideal for variable speed applications like Train, Automobile, Windmill, etc.
- Totally enclosed fan cooled version available for dusty humid / corrosive environments.

2. KEL Transformer Division

The Transformer Division of KEL at Mamala, Ernakulam, was established in 1969, with the technical assistance of 'BHEL', to manufacture supreme quality transformers, for various State Electricity Boards, Government Departments, Public and Private Sector Companies.

This division, ISO 9001 certified by TUV, boasts of a long sustained list of extremely satisfied clients, many of whom who have stood by KED, for decades. A fitting testimony to the trustworthy performer- the robust energy efficient transformers of KEL. Over the years, relying on the unmatched quality of KEL transformers, electricity boards across India perfectly maintain a healthy power distribution supply system.

The transformer division with an annual production capacity of 6,00,000k VA soon after its inception, emerged as a major player in designing and manufacturing Distribution Transformers of ratings up to 5,000 k V Class. Manufacturing custom-build transformers, for specific requirements, is yet another specialty of KEL.

The KEL transformer factory is one of the first few transformer factories in India, to get ISO 9001 Certification. KEL transformers, approved by the national test house, various state electricity boards and power corporations in the country, are type tested at Central Power Research Institute, Bangalore.

Designed to excel

Through in- house R&D efforts, KEL transformers were customized to suit stringent requirements and trends innovations continue as an on-going process to deliver specific transformer types and designs of various ratings. In the pursuit of excellence, the resourceful design department of KEL uses state-of-the-art software to design world-class transformers, optimized for maximum reliability, durability, and energy efficiency, compatible to the standards set by the Bureau of Energy Efficiency (BEE).

Promising new horizons

Banking on its inherent strength, in technological excellence, and an uncompromising commitment to quality, the Transformer division of KEL, all set for substantial growth. By forgoing new alliances. By exploring new vistas.

Quality System

ISO 9001 Quality Management System for design, procurement, manufacturing, testing, erection, commissioning and servicing of transformers. Certified by TUV.

Product Range

Distribution Transformers of ratings up to 5000 kVA, 33kV class- of types such as oil- filled and resin impregnated dry type; on load tap changing with Automatic Voltage Regulation.

Future- ready Product Range

KEL has successfully ventured into the manufacturing of Resin Cast Dry Type, Special Application Transformers such as EMU, LOCO, Dynamic Reactive Power Compensation and Furnace Transformers.

3. KEL Structural Engineering Division

The Structural Division of KEL in its Mamala Unit specializes in the design, fabrication and commissioning of hydraulic gates and hoists and their controlling equipment used in dams

for power and irrigation projects. Many such projects have been successfully executed, by this division on a turnkey basis, all over India.

The KEL structural division, with a capacity of 1200 MT per annum undertakes the design and construction of steel bridges, factory buildings, storage tanks, fabrication of pressure vessels and other industrial steel structures, as per customer specification. For the Railways, KEL undertakes the fabrication and manufacture of bogie frames, bogie bolster, head stocks for railway coaches and wagons.

Product Range

Hydraulic gates, hoists and controlling equipment. Fabrication of structural steel. Railway bogies, Suspension bridges.

Major Projects Undertaken

- Gerusoppa Dam, Karnataka for Karnataka Power Corp. Ltd.
Hydro-mechanical works- Penstock, stop log gate, gantry crane, hoist
- Upper Tunga, Karnataka for Karnataka Neeravari Nigam Ltd.
Radial gates, rope drum hoists, stop log gate, gantry crane
- Mansi Wakal, Udaipur, Rajasthan for ITD Cemetation India Ltd.
Radial gates, vertical gates, stop log gate, hoists
- Narmada Project for J P Associates
Slide gates
- Bogie frames for BFAT Wagons for BEML
- Bogie frames for EMU Coaches for ICF

4. KEL LT Switchgear Division

Started in 1977 with technical know- how from UNELEC of France this manufactures Isolators/Changeovers, Switch fuses, Fuse units/ Cutouts, Distribution fuse boards/ Panels and casting used for Industrial, Commercial and Domestic applications through their LT Switchgear Division.

KSEB (Re- wire Fuse Units), other Units of KEL (Al/Bronze Castings) and general market are all customers of this unit.

Product range

- Fuse Switches
- Changeover Switches
- Porcelain Fuse Units and Cutouts
- Distribution fuse boards and industrial type switch boards
- Distribution Boards (SPN & TPN 2 to 16 ways).

CHAPTER-IV
DATA ANALYSIS AND INTERPRETATIONS

1. PERCENTAGE OF INVESTMENT IN INVENTORY

The value of investment in inventory of KEL, Mamala is as follows.

Table no.4.1 Showing the investment in inventory of KEL, Mamala.

Particulars	Year				
	(₹) 2014-15	(₹) 2015-16	(₹) 2016-17	(₹) 2017-18	(₹) 2018-19
Raw Materials	5,09,85,368	6,18,48,257	6,11,47,711	6,17,85,705	8,00,41,287
Work-in-progress	2,29,97,028	2,01,93,112	3,53,63,513	4,92,85,558	8,05,09,722
Finished goods	10,37,98,423	6,18,15,884	2,44,03,928	3,58,31,998	4,39,42,585
Stores and spares	41,44,133	41,99,591	13,71,732	14,80,064	13,14,837
Loose Tools	13,04,452	11,26,835	9,76,953	9,69,135	9,24,907
Stationary	4,01,774	4,24,656	1,41,026	1,54,017	5,76,613
Scrap	24,00,015	75,69,954	1,30,82,367	72,28,889	41,32,762
Material with fabricators	19,58,828	9,59,321	-	-	-
Total	18,79,90,021	15,81,37,610	13,64,87,230	15,67,35,346	21,14,42,713

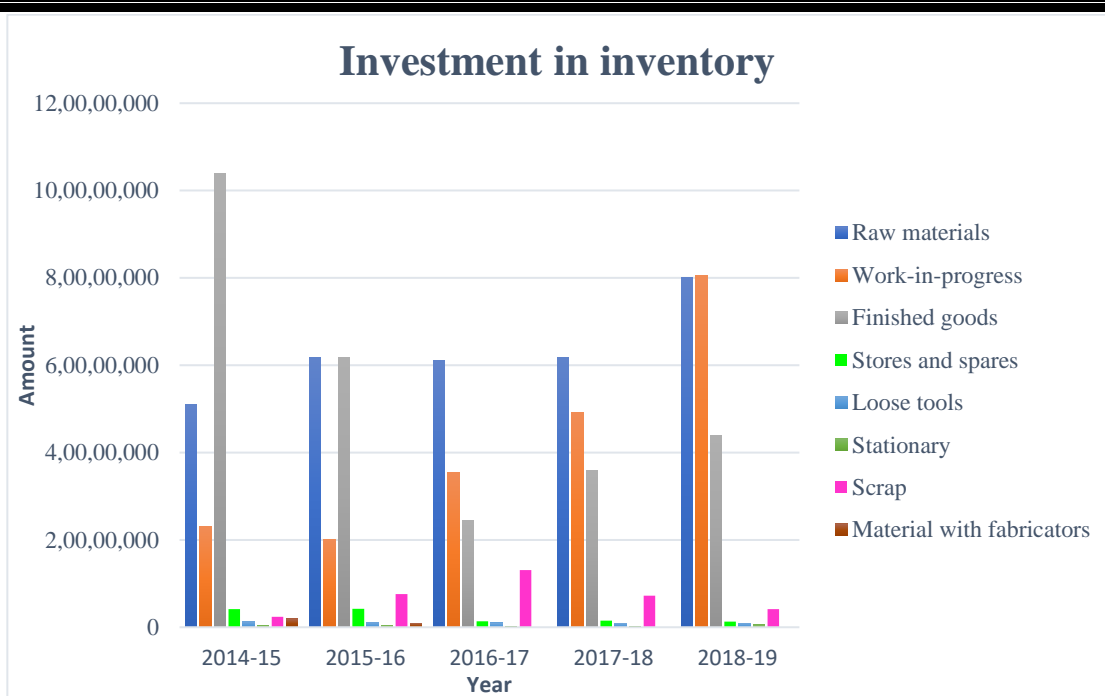


Chart 4.1 Showing investment in inventory of KEL, Mamala

INTERPRETATION

- The amount spent on raw materials is showing a steady increase. It was at the highest during the year 2018-19.
- The amount spend on work-in-progress is also showing a steady increment. During the final year under study, the statistics almost doubled.
- The amount of finished goods is showing a decreasing trend, with the year 2016-17 having the lower value. Thereon, it started increasing.
- The spending on stores and spares was the highest during first two years under study. It showed a drastic decline in the third year when the amount went down by more than 50%.
- The amount spent on loose tools were highest during the year 2016-17 and is decreasing gradually.
- The spending on stationary is irregular. It displayed a slight increase in the second year when compared to the first year, followed by a rapid decline in the third year by 33%. It shot up by more than three times in the final year.
- The amount spend on scrap was steadily increasing during the first three years, whereas it came down in the last two years under study.

- Amount spend on material with fabricators was the highest during the first year, it became half during the second year. Thereon, the presence of material with fabricators was not visible in the total inventory of KEL, Mamala.

Table No. 4.2 Showing the percentage of investment in inventories of KEL, Mamala.

Particulars	Year				
	2014-15 (%)	2015-16 (%)	2016-17 (%)	2017-18 (%)	2018-19 (%)
Raw Materials	27	39	45	39	38
Work-in-progress	12	13	26	31	38
Finished goods	55	39	18	23	21
Stores and spares	2	3	1	1	1
Loose Tools	1	1	1	1	0
Stationary	0	0	0	0	0
Scrap	2	5	9	5	2
Material with fabricators	1	0	-	-	-
Total	100	100	100	100	100

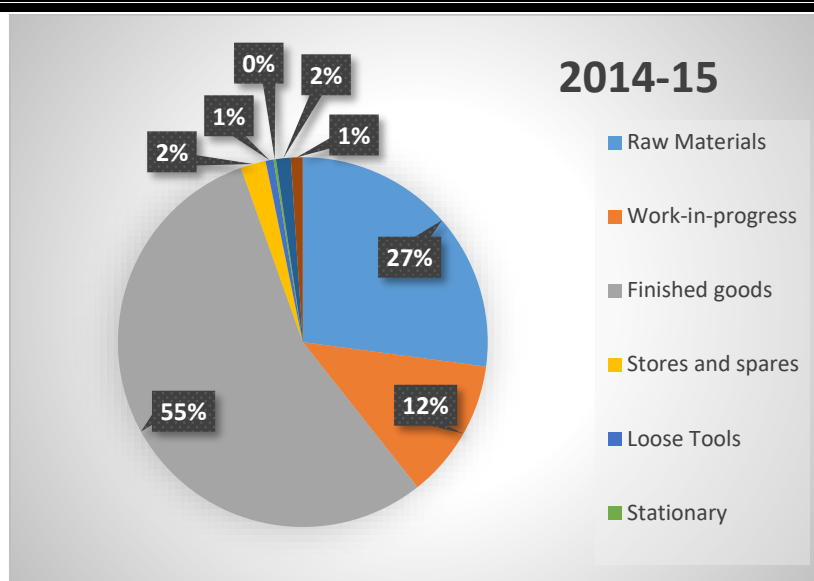


Chart No.4.2 Showing the percentage of investment in inventory of KEL, Mamala.

INTERPRETATION

During the year 2014-15, finished goods constitute the greater share of inventory with 55%, followed by raw materials of 27% and work-in-progress of 12%. All other components like scrap, stores and spares, etc. constitute only a minor share of the inventory.

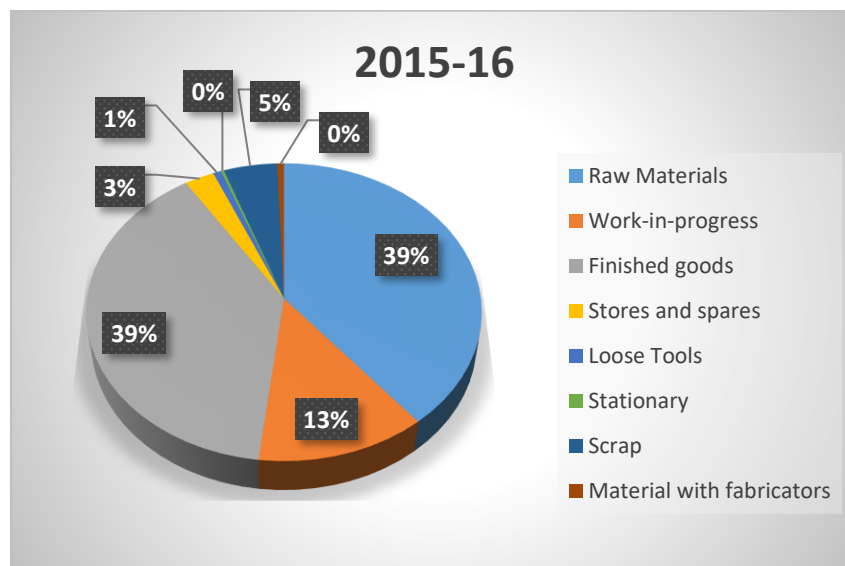


Chart No.4.3 Showing percentage of investment in inventory of KEL, Mamala.

INTERPRETATION

In the year 2015-16, the major portion of inventory was consumed by raw materials and finished goods each amounting to 39% of total inventory. This is followed by work-in-

progress of 13%, scrap 5%, stores and spares 3% and loose tools 1%. Material with fabricators were present, but only a meagre amount.

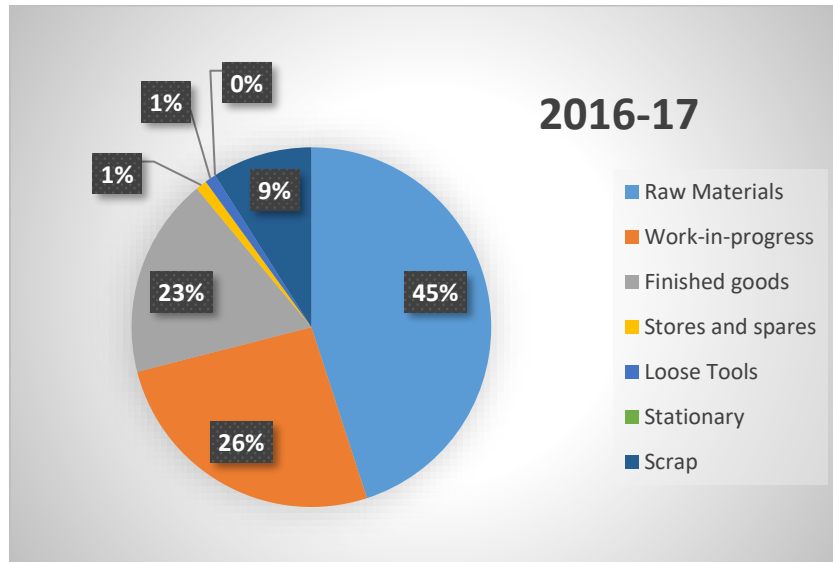


Chart No.4.4 Showing percentage of investment in inventory of KEL, Mamala

INTERPRETATION

The major portion of inventory for the year 2016-17 is consumed by raw materials with 45% followed by work-in-progress 26%, finished goods 23% and scrap 9%. Stores and spares, loose tools and stationary constitute only a minor share.

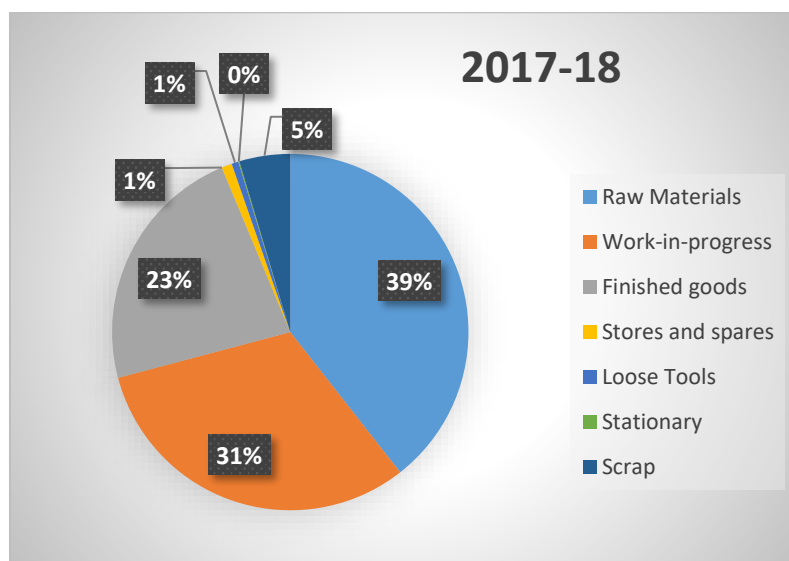


Chart No.4.5 Showing percentage of investment in inventory of KEL, Mamala

INTERPRETATION

During the 2017-18 , 39% of the total inventory consisted of raw materials while 31% accounted for work-in-progress. Finished goods constituted 23% and scrap 5%. Stores and spares and loose tools added up to only 1% of the total inventory.

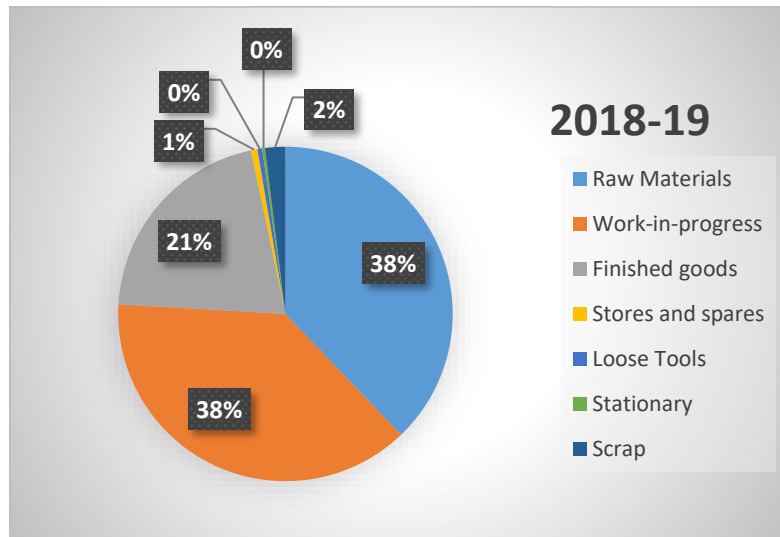


Chart No.4.6 Showing percentage of investment in inventory of KEL, Mamala

INTERPRETATION

The chart shows an almost equal proportion of raw materials and work-in-progress for the year 2018-19 which is 38% each of the total inventory. Finished goods amounted to 21%, scrap to 2%, stores and spares to 1% of the total inventory. Stationary and loose tools were present only at a meagre rate.

2. INVENTORY TURNOVER RATIO

$$\text{Inventory Turnover Ratio} = \frac{\text{Cost of Goods Sold}}{\text{Average Inventory}}$$

Table No.4.3 Showing Inventory Turnover Ratio

Year	Cost of Goods Sold (₹)	Average Inventory (₹)	Inventory Turnover ratio(times)
2014-15	11,80,840	18,63,38,503	0.006
2015-16	5,63,34,543	17,33,63,815	0.32
2016-17	4,14,69,405	14,76,12,420	0.28
2017-18	66,38,381	14,66,11,288	0.04
2018-19	15,86,112	18,40,89,029	0.008

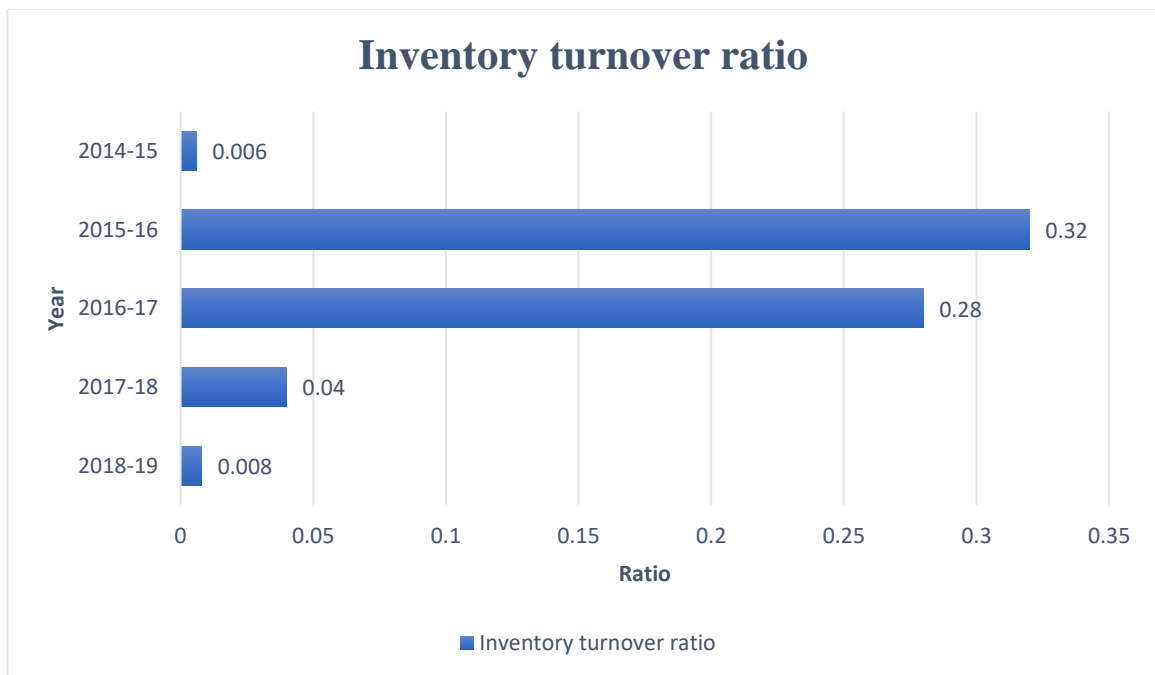


Chart No.4.7 Showing Inventory Turnover Ratio

INTERPRETATION

The inventory turnover ratio was the lowest during the first year under study. It increased tremendously during the year 2015-16 and this continued for the next year as well. But during the year 2017-18, the ratio showed a huge decrease and this decreasing trend continued till the end of the study.

3. INVENTORY TO TOTAL ASSET RATIO

$$\text{Inventory to Total asset} = \frac{\text{Inventory}}{\text{Total asset}}$$

TableNo.4.4 Showing Inventory to Total asset ratio

Year	Inventory (₹)	Total asset (₹)	Ratio	Percentage
2014-2015	18,79,90,021	96,57,31,257	0.19	19.47
2015-2016	15,81,37,610	92,51,64,072	0.17	17.09
2016-2017	13,64,87,230	88,61,44,217	0.15	15.40
2017-2018	15,67,35,346	95,18,18,946	0.16	16.47
2018-2019	21,14,42,713	92,95,93,193	0.23	22.75

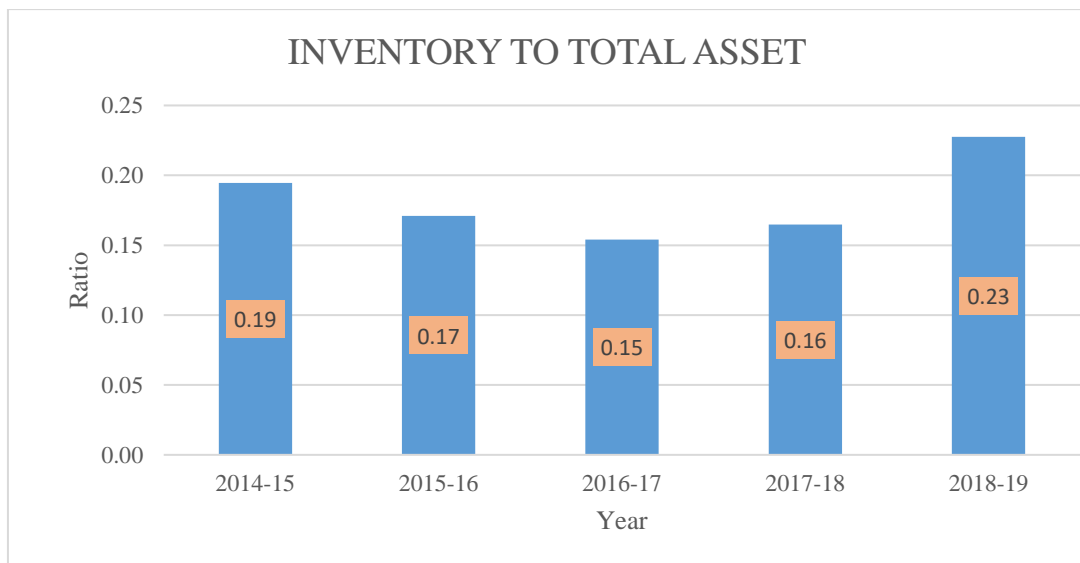


Chart No.4.8 Showing Inventory to Total Asset Ratio

INTERPRETATION

The ratios of inventory to total assets in the company during the study period were between 0.15 and 0.23. The ratio was best in the year 2016-2017 as it decreased to 0.15 and lower percentage value of this ratio indicates better inventory performance and profitability of the firm. The ratio was worst in the year 2018-2019 as it increased to 0.23 and higher percentage value of this ratio indicates lower profitability of the firm as opportunity cost will be loosened.

4. INVENTORY TO WORKING CAPITAL RATIO

Inventory to Working capital ratio = $\frac{\text{Inventory}}{\text{Working capital}}$

Table no.4.5 Showing Inventory to Working capital ratio

Year	Inventory (₹)	Working Capital (₹)	Inventory to working capital (times)
2014-2015	187,990,021	8,973,836	20.94
2015-2016	158,137,610	- (60,508,413)	-(2.61)
2016-2017	136,487,230	- (63,680,020)	-(2.14)
2017-2018	156,735,346	- (169,948,591)	-(0.92)
2018-2019	211,442,713	- (406,858,815)	-(0.51)

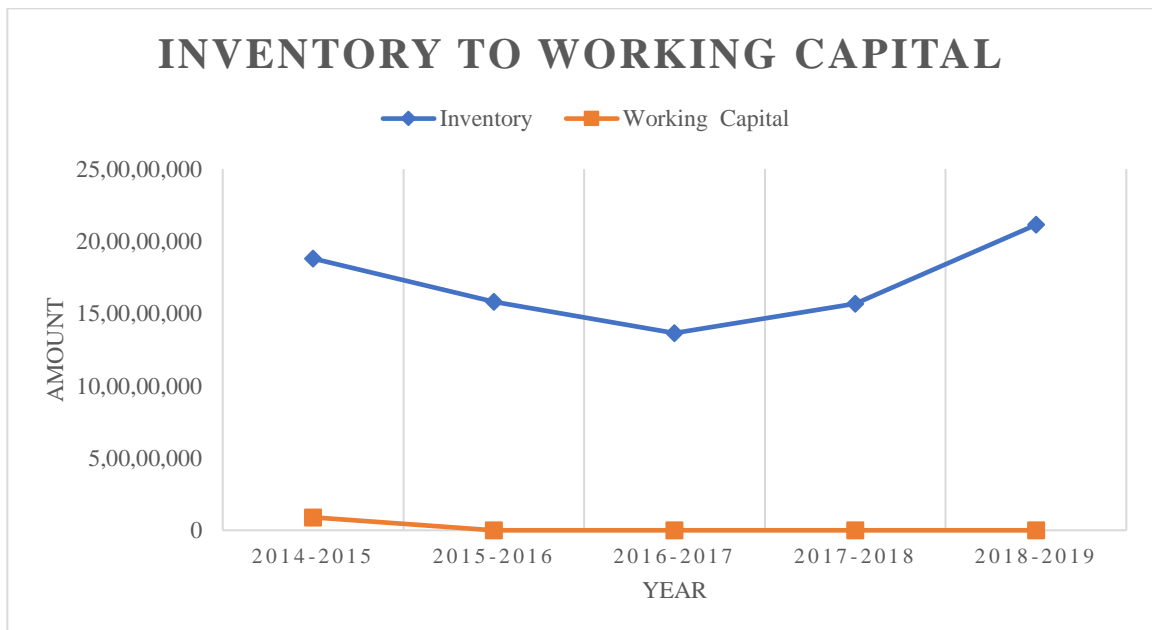


Chart No. 4.9 Showing Inventory to Working capital

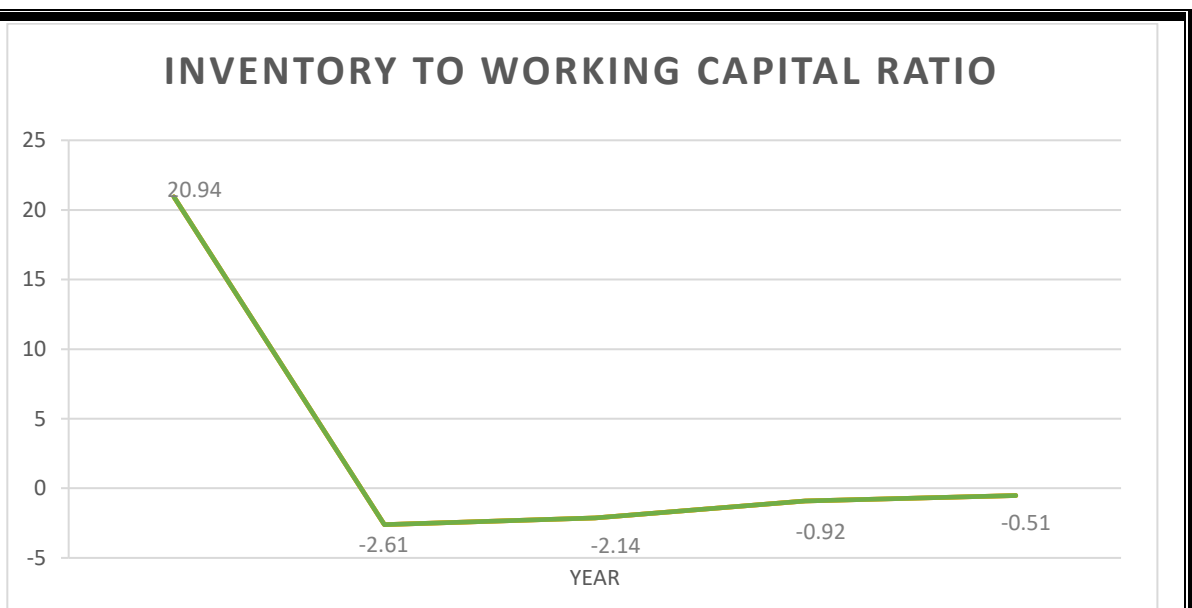


Chart No.4.10 showing Inventory to Working capital ratio

INTERPRETATION

Inventory to working capital shows an increasing trend from the year 2015-18. In the year 2018 the ratio was the worst as it increased to -0.51, which indicates the liquidity of the company has reduced. It also shows a negative trend during the years 2015-2018 because of the company having more current liabilities than current assets. Increasing rate of current liabilities leads to negative working capital. Company does not have much working capital to meet its daily requirement.

5. PERCENTAGE OF INVENTORY TO CURRENT ASSET

$$\text{Percentage of Inventory to Current asset} = \frac{\text{Value of Inventory}}{\text{Current asset}} * 100$$

Table No 4.6 Showing percentage of inventory to current asset

Year	Inventory	Current Assets	Ratio	Percentage
2014-2015	187,990,021	866,743,883	0.21	21.68%
2015-2016	158,137,610	811,853,403	0.194	19.47%
2016-2017	136,487,230	714,519,554	0.191	19.10%
2017-2018	156,735,346	736,423,182	0.21	21.28%
2018-2019	211,442,713	712,157,452	0.29	29.69%

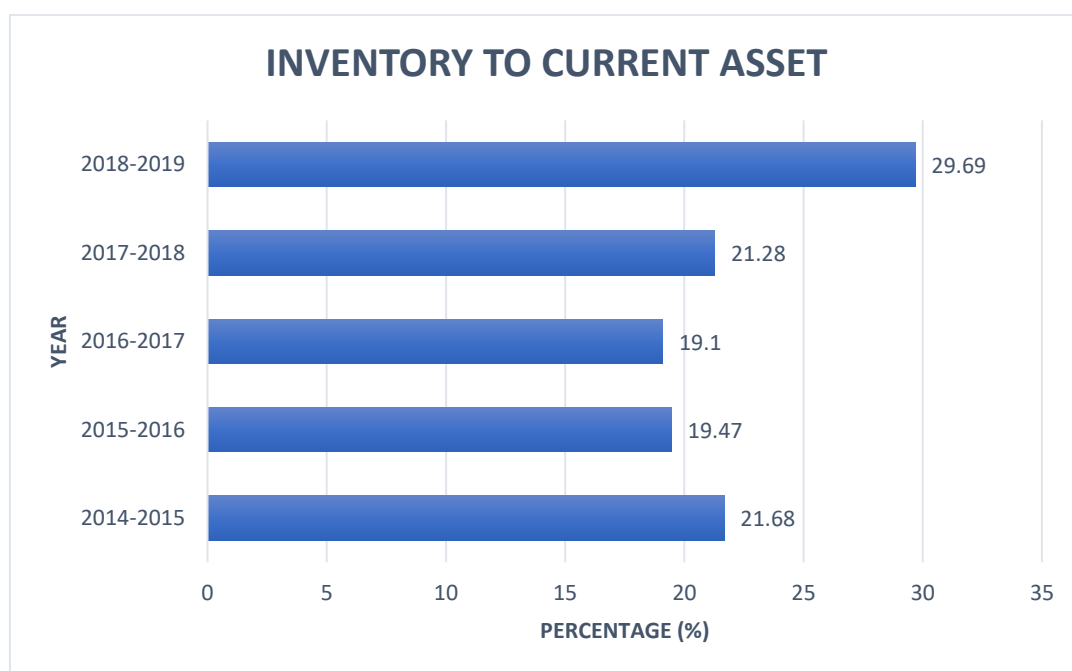


Chart No. 4.11 Showing percentage of inventory to current asset

INTERPRETATION

The Inventory to current asset ratio of the company is showing a downward trend from 2015-16 till 2017-18, but it increased 0.29 during the year 2018-2019. The ratio was best in the year 2015-16 as it decreased to 0.19. A lower ratio indicates better inventory performance.

6. SALES TO INVENTORY RATIO

$$\text{Sales to Inventory Ratio} = \frac{\text{Net Sales}}{\text{Inventory at the end}}$$

Table No.4.7 Showing Sales to Inventory Ratio

YEAR	NET SALES (₹)	INVENTORY (₹)	SALES TO INVENTORY RATIO
2014-15	64,21,27,681	18,79,90,021	3.41
2015-16	93,36,80,381	15,81,37,610	5.90
2016-17	94,67,26,204	13,64,87,230	6.93
2017-18	10,51,67,115	15,67,35,346	6.71
2018-19	1,15,95,00,253	21,14,42,713	5.48

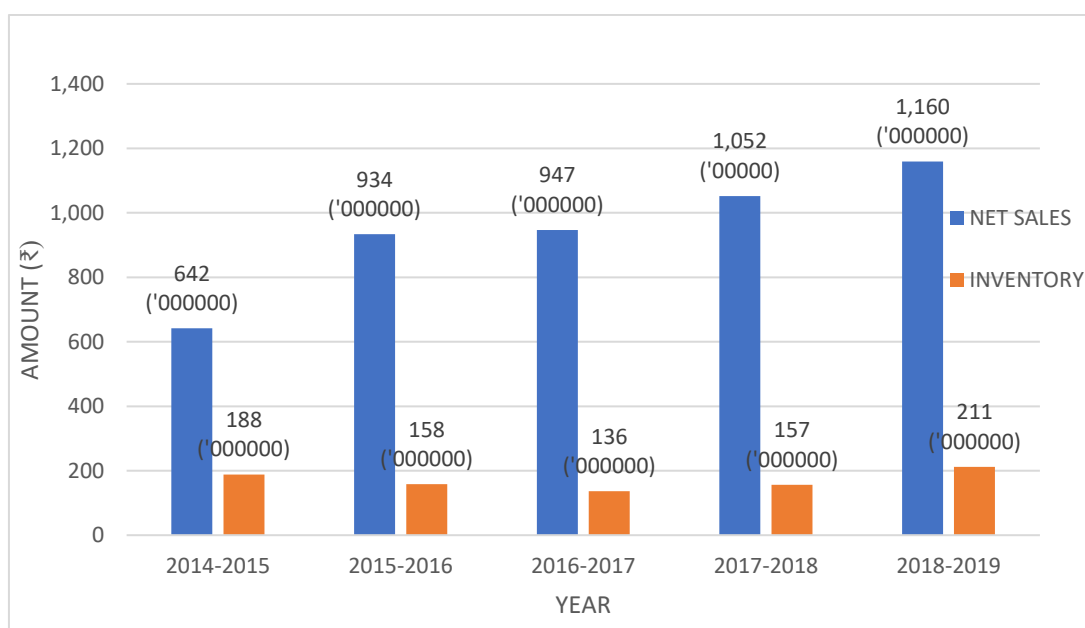


Chart No.4.12 Showing the Volume of Net Sales and Inventory of KEL, Mamala

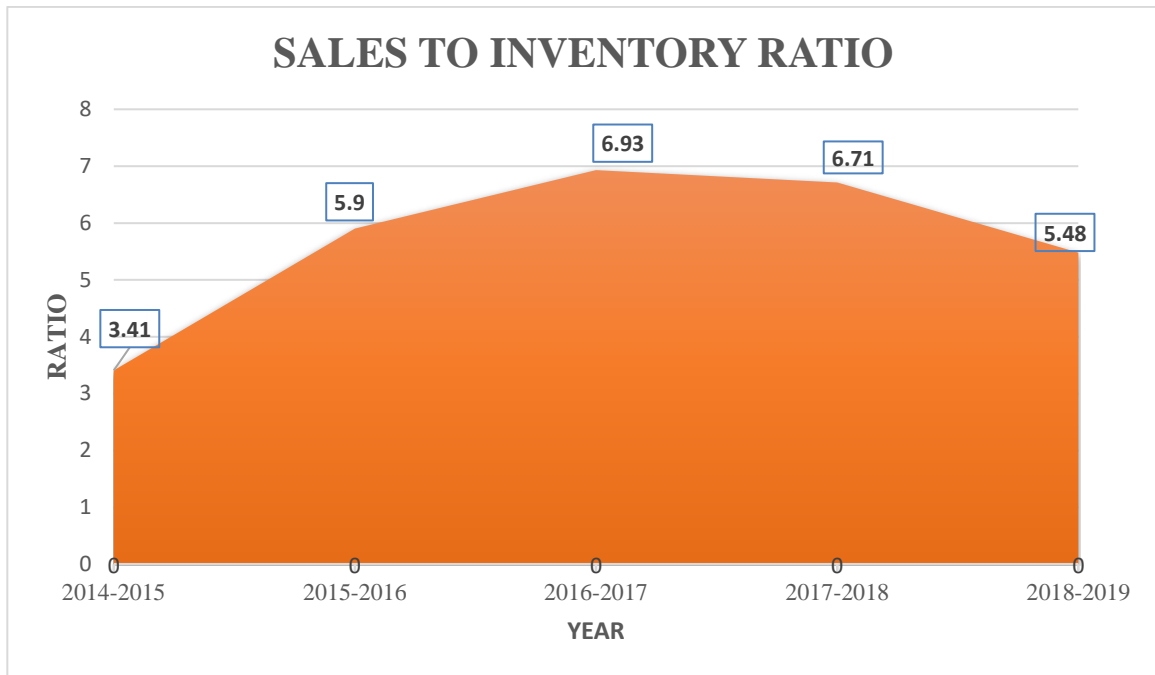


Chart No.4.13 Showing Sales to Inventory Ratio

INTERPRETATION

Sales to inventory ratio was 3.41 in the year 2014-15. It showed an increasing trend till 2016-17, with the highest ratio of 6.93 in the year 2015-16. There on, the ratio showed a tremendous fall from 6.71 to 5.48. This showcases the inefficiency of the company in the management of inventory and we could say that the financial relationship that exist between the sales and inventory is not satisfactory.

7. CORRELATION BETWEEN INVENTORY AND WORKING CAPITAL

H0: There is no correlation between inventory and working capital

$$\text{CORRELATION} = \frac{n\sum xy - (\sum x) * (\sum y)}{\sqrt{n\sum x^2 - (\sum x)^2} \sqrt{n\sum y^2 - (\sum y)^2}}$$

Table No.4.8 Showing Correlation between Inventory and Working capital.

Year	x (₹) (‘000000)	y (₹) (‘000000)	xy	x ²	y ²
2014-15	187.99	89.73	16,868.3427	35,340.2401	8051.4729
2015-16	158.13	-60.5	-9566.865	25,005.0969	3660.25
2016-17	136.48	-63.68	-8691.0464	18,626.7904	4055.1424
2017-18	156.73	-169.9	-2662.8427	245642.929	28866.01
2018-19	211.44	-406.8	-8601.3792	44706.8736	165486.24
TOTAL	850.77	-611.2	-114031.7877	148243.294	210119.1153

x=Inventory

y=Working Capital

n=number of years

$$\begin{aligned} \text{Correlation (r)} &= \frac{5*(-114031.7877) - 850.77 * (-611.2)}{\sqrt{5*148243.294 - (850.77)^2} \sqrt{5*210119.1153 - (-611.2)^2}} \\ &= \underline{\underline{-0.46}} \end{aligned}$$

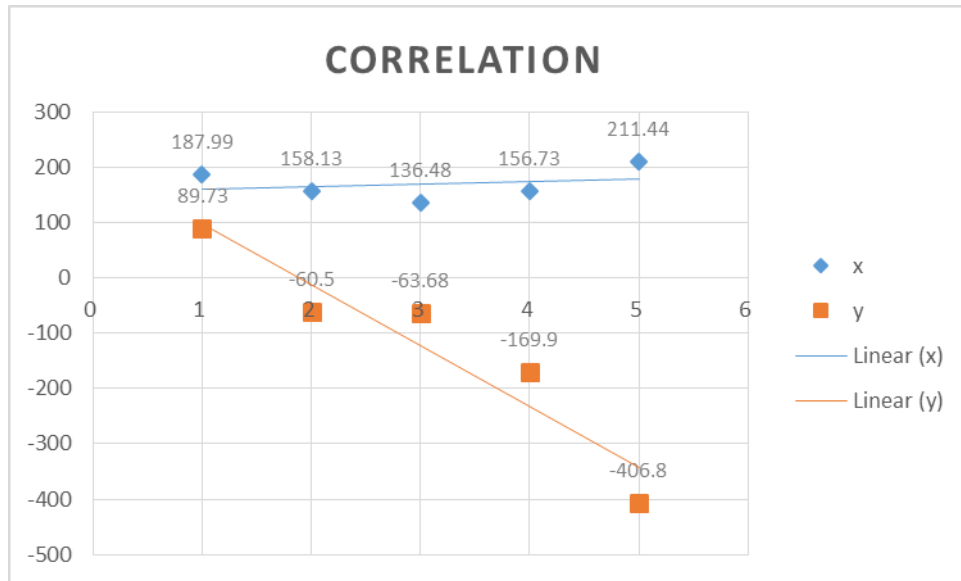


Chart No.4.14 Showing Correlation between Inventory and working capital

INTERPRETATION

The above table shows the correlation between inventory and working capital. Coefficient of Correlation (r) is equal to -0.46 which signifies negative relationship between each other. When Inventory increased from the year 2017-18 and 2018-19 the working capital decreased, which is due to tremendous increase in current liabilities.

Testing Hypothesis:

As P value is less than 0.05, we reject the null hypothesis and accept the alternative hypothesis. Therefore, we conclude that there is correlation between inventory and working capital.

8. CORRELATION BETWEEN SALES AND INVENTORY

H0: There is no correlation between sales and inventory

$$\text{CORRELATION} = \frac{n\sum xy - (\sum x) * (\sum y)}{\sqrt{n\sum x^2 - (\sum x)^2} \sqrt{n\sum y^2 - (\sum y)^2}}$$

TableNo.4.9 Showing Correlation between Sales and Inventory.

Year	(‘000000) X (₹)	(‘000000) Y (₹)	xy	x ²	y ²
2014-2015	642.12	187.99	120712.1388	412318.0944	35340.2401
2015-2016	933.68	158.13	147642.8184	871758.3424	25005.0969
2016-2017	946.72	136.48	129208.3456	896278.7584	18626.7904
2017-2018	1051.67	156.73	164828.2391	1106009.7889	24564.2929
2018-2019	1159.50	211.44	245164.68	1344440.25	44706.8736
TOTAL	4733.69	850.77	807556.2219	4630805.2341	148243.2939

X-Sales

Y-Inventory

$$\begin{aligned} \text{Correlation (r)} &= \frac{5*(807556.2219) - 4733.69 * (850.77)}{\sqrt{5*4630805.2341 - (4733.69)^2} \sqrt{5*148243.2939 - (850.77)^2}} \\ &= \underline{\underline{0.09}} \end{aligned}$$

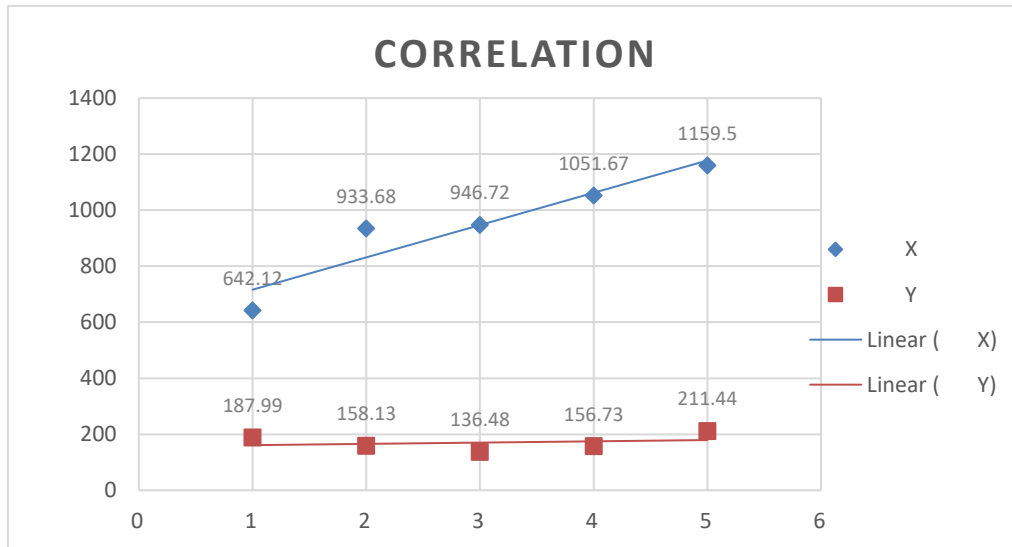


Chart No.4.15 Showing Correlation between Sales and Inventory

INTERPRETATION

The above table shows the relationship between the sales and inventory during the five-year period. Coefficient of correlation of sales and inventory in Kerala Electrical Allied Engineering Limited was 0.09 which signifies positive relationship. In other words, 9% variation in inventory was due to sales. Theoretically, the correlation between sales and inventory should be negative but in our calculation for the Kerala Electrical Allied and Engineering Limited it was positive which indicates less effectiveness of the inventory management in this industry.

Testing Hypothesis:

As P value is more than 0.05, we failed to reject the null hypothesis. Therefore, we conclude that there is correlation between sales and inventory.

9. ECONOMIC ORDER QUANTITY (EOQ)

$$\text{Economic Order Quantity (EOQ)} = \sqrt{\frac{2AO}{C}}$$

Where, A=Annual Consumption

O=Ordering Cost

C=Carrying cost

Table No.4.10 Showing basic details of Economic Order Quantity.

Particulars	2014-15	2015-16	2016-17	2017-18	2018-19
(‘00000)					
Annual usage	4814.98	5373.24	5942.55	7396.09	5315.32
Ordering Cost	27.37	200.93	99.95	30.34	49
Carrying Cost	27%	20%	22%	18%	25%
Purchase Price	680	600	650	590	700

TableNo.4.11 Showing Calculation of Economic Order Quantity

Year	Calculation of EOQ = $\sqrt{\frac{2AO}{C}}$	EOQ (units)
2014-15	$\sqrt{\frac{2 * 4814.98 * 27.37}{183.6}}$	37.88
2015-16	$\sqrt{\frac{2 * 5373.24 * 200.93}{120}}$	134.14
2016-17	$\sqrt{\frac{2 * 5942.55 * 99.95}{143}}$	91.14
2017-18	$\sqrt{\frac{2 * 7396.09 * 30.34}{106.2}}$	65.007
2018-19	$\sqrt{\frac{2 * 5315.32 * 49}{175}}$	54.56

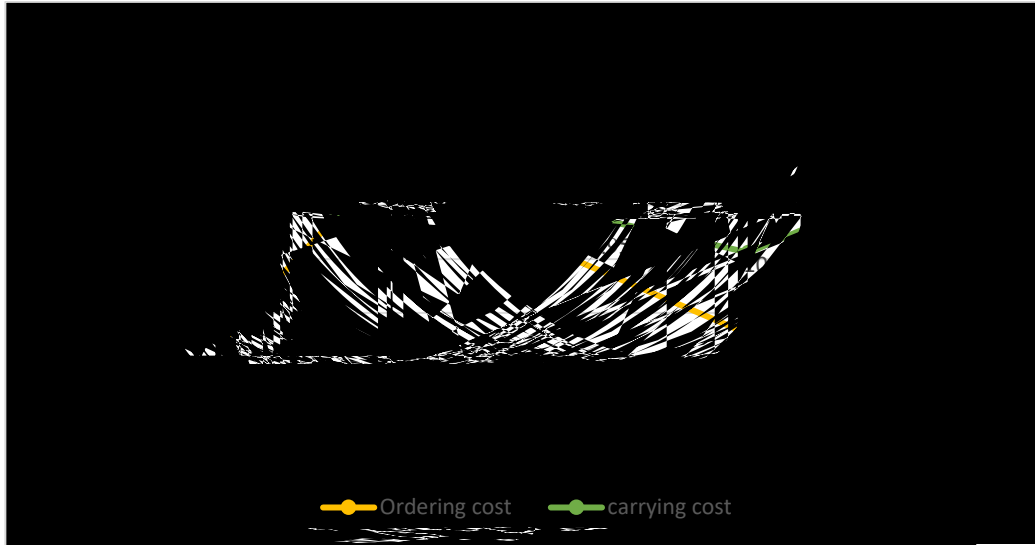


Chart No.4.16 Showing Ordering and carrying costs.



Chart No.4.17 Showing Economic Order Quantity

INTERPRETATION

Using the required formula, we arrive at the actual economic order quantity for the five years under study. For the first year 2014-15, the economic order quantity was 37.88 units. In the following years the rate of EOQ showed a tremendous increase. In 2015-16 it was 134.14 units, in 2016-17 it came down to 91.14. In the years 2017-18 and 2018-19 it drops down to 65.007 and 54.56 units respectively.

10.TREND ANALYSIS

$$\text{TREND} = \frac{\text{Amount of a particular year}}{\text{Amount of Base year}} * 100$$

Table No.4.12 Showing Trend Percentage of Sales, stock and profit before Tax

Years	Sales(₹) (‘0,00,000)		Stock(₹) (‘0,00,000)		Profit before tax (‘0,00,000)	
	Amount	Trend%	Amount	Trend%	Amount	Trend%
2014-15	642.12	100.00	187.99	100.00	(649.3)	100.00
2015-16	933.68	145.4	158.13	84.11	(37.98)	58.49
2016-17	946.72	147.43	136.48	72.59	(165.59)	255.02
2017-18	1051.67	163.78	156.73	83.37	(172.58)	265.79
2018-19	1159.50	180.57	211.25	112.37	(170.27)	262.23

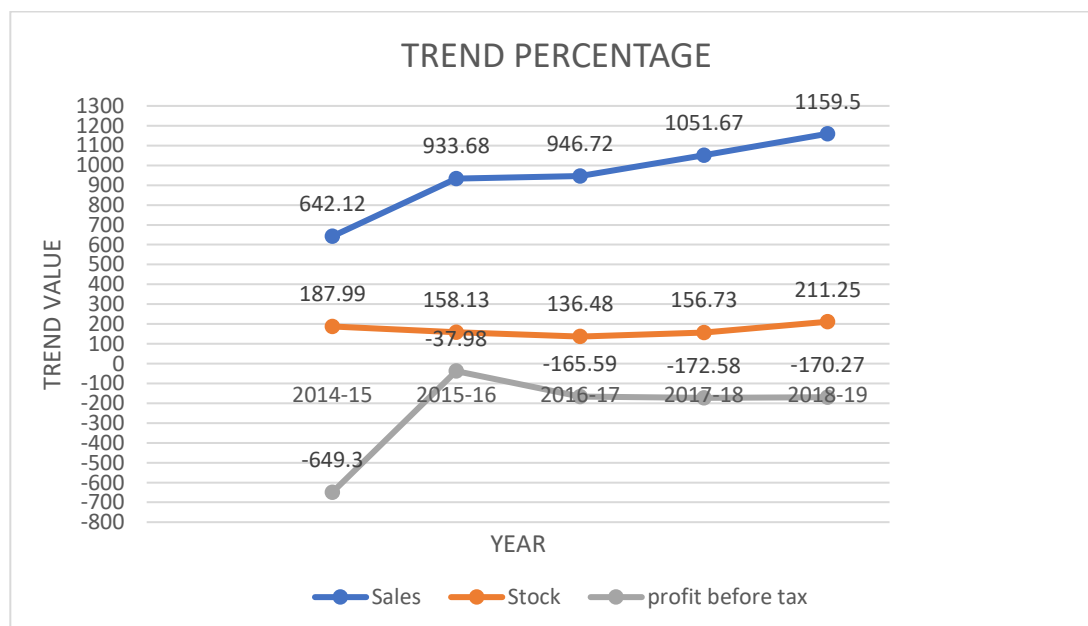


Chart No.4.18 Showing Trend Percentage of Sales, Stock and Profit before Tax.

INTERPRETATION

The sales of the company show an increasing trend during the period of study. Loss incurred showed a tremendous increase in 2015-16 and it remained nearly constant throughout the period of study. Inventory shows a fluctuating trend and in the year 2018-19 there was a tremendous increase in stock as compared to all other years.

CHAPTER-V

**FINDINGS, SUGGETSIONS AND
CONCLUSION**

FINDINGS

- The percentage of investment in various items of inventory arranged in descending order are as follows,
Raw materials (37.6%), Finished goods (31.2%), Work-in-progress (24%), Scrap (4.6%), Stores and spares (1.6%), Loose tools (0.8%), Material with fabricators (0.2%), Stationary (0%).
- Inventory turnover ratio was the lowest during the first year under study. It increased tremendously during the year 2015-16 and this continued for the next year as well. But during the year 2017-18, the ratio showed a huge decrease which continued till the end of the study.
- Inventory to total asset ratio shows a decreasing trend from the year 2015 to 2017. Lower ratio indicates good performance of the firm. But during the year 2017-18 and 2018-2019 the ratio shows a rising trend.
- Inventory to working capital ratio shows an increasing trend from the year 2015 to 2018. Higher the ratio, lower the liquidity. Thus, it is found that the liquidity of the firm has been reduced over the years.
- Inventory to current asset ratio shows a decreasing trend during the years 2015-16 and 2016-17. A low ratio is a good sign of inventory management. But during the years 2017-18 and 2018-19 the ratio is showing an increasing trend.
- Sales to inventory ratio shows an increasing trend during 2017 and 2018. It shows better efficiency of the company. Gradually, it is found to decrease due to inefficiency of inventory management.
- Correlation between inventory and working capital shows a negative relationship between each other. When inventory increased from the year 2017-18 and 2018-19 the working capital decreased. The negative working capital may be due to abnormal loss in inventory and excess of current liabilities.
- Theoretically, the correlation between sales and inventory should be negative. But it is found to be positive under the study which indicates lower efficiency of inventory management.

- The carrying cost of the company is fluctuating over the years. In the year 2018 the carrying cost of the company increased. The average economic order quantity for the period under study is found to be 76.54 units.
- Trend analysis between sales, inventory and profit showed that the sales of the company gradually increased until 2018, but there was no corresponding increase in the profit of the company. Along with the increase in sales, the inventory also showed a continuous increment which may have resulted in the less than proportionate share of profit. Further, it was found that the inventory tremendously increased in 2018 which was a result of reduced sales.

SUGGESTIONS

- The problem of excessive investment in inventory can be tackled through effective purchase policies, procedures, methods, inventory control and stores management.
- The rate of growth of inventory is very high which can be tackled by fixing stock levels for different categories of items by taking into account consumption pattern, lead time, storage space, market trends, carrying cost, ordering cost etc.
- The company should adopt a suitable inventory management software which will act as a central hub to find out information about inventory of a company. This is useful for public enterprises to decide how much additional inventory they have to purchase.
- The working capital of the company can be improved by proper management of inventory, making sure that finished goods are sold as soon possible and are not idling away in the warehouse.
- The inventory holdings can be reduced by adopting an integrated system of material management and by appointing trained and qualified inventory managers.
- Modern techniques of inventory management have to be adopted in order to improve the performance of the firm.

CONCLUSION

Inventory management is a vital function that helps and ensures the success of every manufacturing company. A better inventory management will surely help the company in solving the problems that it is facing with respect to inventory and will pave way for reducing huge investment or blocking up of money in idle inventory. The purpose of the project was to study the '**effectiveness of inventory management**' with reference to KEL, Mamala. In every manufacturing company, inventory plays a major role in the overall performance of the concern and in ensuring its success. With the help of ratios, it has been noticed that the profitability of the company has not shown a significant positive change. The inventory has been accumulating due to improper purchase planning and reduced sales. If KEL wants to achieve incremental growth and to earn profit in future, it has to give more emphasis to effective inventory management practices and use its resources optimally. The company has to adopt new trends in inventory management like just in time inventory, material requirement planning and periodically review its inventory to avoid production loss. Hence, it can be understood that an efficient inventory management can take the company to new heights and an inefficient inventory management can ruin the company.

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