Impact Of Cost Of Holding Inventory On The Profits & Sales Of The BHEL With The Help Of ABC Analysis & EOQ- A Study

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Shruti Aggarwal, Research Scholar, Department of Commerce, Bangalore University, Bangalore

ABSTRACT
This research paper focusses on the issue of inventory management and the part thereof, basically the cost of holding inventory and its impact on the profits and sales of the company with the help of inventory management tools, ABC analysis and the EOQ (Economic order quantity). The purpose is to find out the ways of managing the inventory properly, so that there would be a little impact on the profits and sales of the company. To carry out the research, the researcher have taken BHEL, as the target company, the study is Descriptive in nature, and the time horizon is cross sectional. The hypothesis is tested by ANOVA and the statistical tools are Regression, Correlation. To support the study the Ratio Analysis, ABC analysis and EOQ model is prepared. The sole purpose is to find out:
1. How important the inventory management is for the company?
2. What is the economic order quantity, time of ordering inventory and how one can calculate it?
3. What can be the adverse impact on the profits and sales of the company, if one does not hold inventory properly, donot reorder it on time?
4. How one can manage the inventory properly?

Keywords:
Cost of holding inventory: it includes carriage cost, storage cost, any duty paid etc
ABC Analysis: dividing the inventory into three categories A, B, C according to their priority
EOQ: Economic order quantity is the amount of reordering the inventory after a fixed interval keeping in mind the safety stock.
ANOVA: a statistical tool to test the hypothesis in accordance to analysing the variances among variables.
Regression: regression analysis is a statistical technique for estimating the relationships among variables.
Correlation: It is a statistical technique to measure the cause and effect relationship among the variables

1. COMPANY PROFILE

B.B.E.L. A CORPORATE GIANT
BHEL is India's largest engineering company and one of its kinds in this part of the hemisphere. It manufactures a wide range of state of the art power generation equipment and systems besides equipment for industry, transmission, defence, telecommunication and oil business. The first plant of BHEL was set up in Bhopal in 1956, which signaled the dawn of the heavy electrical industry in India. In the early 60's three more major plants were set up in Haridwar, Hyderabad and Tiruchirapalli. The company now has 14 manufacturing divisions, 10 services centers and power sectors regional centers besides project sites spread all over India and also abroad to provide prompt and effective service to customers. BHEL's business broadly covers conversions, transmission, utilizations and conservation of energy in core sectors of economy that fulfill vital infrastructure needs of the country. Its product have established an enviable reputation of high quality and reliability, which is largely due to emphasizes placed all along on contemporary some of the best technologies of the world from the leading companies in U.S.A., EUROPE, and JAPAN together with technologies from its own R&D centers technologies B.H.E.L.has consistently upgraded its design and manufacturing facilities to international standards by acquiring and assimilating.

The Central Foundary Forge Plant (CFFP) located in Haridwar is one of the major manufacturing plants of BHEL. The construction of Central Foundary Forge Plant commenced in Oct."1963"after indo- soviet technical co-operation agreement in Sept."1959"The first product to roll out from the plant was an electric motor in January 1967. The core business of CFFP includes design and manufacture of large steam and gas turbines, turbo generators, hydro turbines and generators, hydro turbines and generators, large AC/DC motors and so on.
2. PROBLEM STATEMENT

“IMPACT OF COST OF HOLDING INVENTORY ON THE PROFITS AND SALES OF THE BHEL WITH THE HELP OF ABC ANALYSIS AND EOQ- A STUDY”

The researcher is prone to find out the impact of the cost of holding inventory – carriage, storage, transportation etc., on the profits and sales of the company with the help of ABC analysis – “dividing the materials into three categories A, B, C according to their priority”, and EOQ (Economic order quantity) – “How much is to be ordered every time after a fixed duration, keeping in mind the safety stock?” in order to maintain the inventory properly with minimum cost and maximum profits. Ratio Analysis is done for keeping a glance at the current regime of debtors, creditors, assets, gross profit and sales of the company which would help the researcher in getting the more accurate results.

MOTIVE OF RESEARCH
“Maximum Profits at Minimum Cost”

3. OBJECTIVES OF THE STUDY
• To understand the effects of cost of holding Inventory on the profitability & sales.
• To study the effect of EOQ model on profitability & sales.
• To study the effect of ABC model on profitability & sales.
• To study the effect of RE-ORDER LEVEL on profitability & sales.
• To study the financial health of the company.
• To determine the changes in the inventory position of the company
• To study the workings of the inventory department in the organization.
• To study the environment of the corporate world.
• To give pragmatic suggestions for the improvement of existing system so that it could be implemented effectively with minimum cost and time.

4. THEORETICAL FRAMEWORK
Construct of the study
“Impact of the cost of holding inventory on sales and profitability”

Independent variable
➢ Cost of holding Inventory

Dependent variables
➢ sales
➢ Profitability

5. LITERATURE REVIEW
The first study analyzed a decision maker having the capability to buy from two different suppliers and using the “periodic-review inventory model” Fox, Metters & Semple, 2006, p.389). The first supplier was defined by high variable cost and insignificant fixed cost. The second supplier had low variable cost and high fixed cost. When using different suppliers, there were tradeoffs between variable and fixed cost. Other components were considered such as to “make or buy, order routing, temporary labor, and consumer store preference” (p. 390).

Donald and Lamarlee (P.350-351) says “No matter how diligently a store keeper performs the custodial job or how carefully an inventory control clerk maintains records (computerized or manually), some discrepancies between the actual and the balance of inventories is bound to occur. The system is operated by people, and people occasionally make mistakes.

Glautier 1980, P.123 said “an inventory control is to provide means of exercising a closed control over the flow of materials or goods into inventory and the flow of inventory into production or sales, thereby only preventing loss but also ensuring that adequate inventory levels are maintained. The purpose of this is to focus on the procedures applied to the control of inventory on daily basis.

6. RESEARCH DESIGN
6.1 Purpose of study:
The purpose of my study is descriptive. A descriptive study is undertaken in order to ascertain the nature of causal relationship between the two or more factors in the situation.

6.2 Types of investigation:
1. Casual relationship
2. Correlation
3. Group differences, ranks etc.

Type of investigation in my study will be correlation. Because my main motive is to check whether there is significant relationship between change in the sales and profit of the two
companies. So investigation type will be correlation type

6.3 Extent of researcher interference in study:
1. Minimal: studying events as they normally occurs
2. Manipulation and/or control and/or simulation

The extent of research interference in my study will be **minimal**. I’ve to just collect and analyze the data for findings. There will be no need for simulation tests etc.

6.4 Study setting:
1. Contrived
2. Non-contrived

This includes field study, field study and lab experiment. My study is using the same natural environment/data.

6.5 Units of analysis (population to be studied)
1. Individuals
2. Dyads
3. Groups
4. Organization
5. Machines etc.
The units of analysis or the population that will be studied in my research will be the balance sheet, P&L account, cash flow statements, etc.

Sampling design: It is a definite plan for obtaining a sample from sampling frame. It is determined before collection of data.
Sampling size for my study will be the data of last four years i.e from 2005 to 2008.

6.6 Time horizon:
1. One shot (cross sectional)
2. Longitudinal

The time horizon for my study is the four years time period.

6.7 Data collection method:
1. Primary data
2. Secondary data
3. Interviewing
4. Questionnaires
5. Observations
6. Unobtrusive methods.

My data collection is based on secondary data i.e. from websites, books, prowess, company’s balances sheets, etc.

6.8 Data analysis
1. Feel for data
2. Goodness of data
3. Hypothesis testing

For data analysis mostly the hypothesis testing will be used. By using SPSS Software it will be performed. Statistical tools will also be used. Analytical tools will also be used.

7. LIMITATIONS OF THE STUDY
Except the supreme power, the Almighty, no one is impeccable and prowess enough to accomplish anything without any faults and limitations. A research is no exception. No study is devoid of certain shortcomings. Some problems encountered in this study are under mentioned:

- **Time Constraints:**
  Time was a bit short to fathom into the depth of the study. But still all efforts to the best possible extent have been made to collect the data.

- **Data collection Constraints:**
  Since data used is secondary in nature, this poses the constraints on the validity and reliability of the data.

- **Secrecy of Internal Data**
  In today’s day the companies are very sensitive regarding their internal data, this proved a hindrance to my study.

- **Period of Analysis**
  Sample size of four years was taken by me i.e. from 2008-2009 which was sufficient but a bigger sample would be more effective.

7. RATIO ANALYSIS
FINANCIAL ANALYSIS:
Financial analysis is the process of identifying the financial strengths and weaknesses of the firm and establishing relationship between the items of the balance sheet and profit & loss account.

**RATIO ANALYSIS**
The term “Ratio” refers to the numerical and quantitative relationship between two items or variables. This relationship can be exposed as
- Percentages
- Fractions
- Proportion of numbers

Ratio analysis is defined as the systematic use of the ratio to interpret the financial statements. So that the strengths and weaknesses of a firm, as well as its historical performance and current financial condition can be determined. Ratio reflects a quantitative relationship helps to form a quantitative judgment.

**INVENTORY TURNOVER RATIO**
= cost of goods sold / average inventory

**Average Inventory**
= (opening stock + closing stock) / 2

<table>
<thead>
<tr>
<th>Year</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>4.8</td>
</tr>
<tr>
<td>2006</td>
<td>5.1</td>
</tr>
<tr>
<td>2007</td>
<td>5.3</td>
</tr>
</tbody>
</table>
INTERPRETATION:

- This ratio indicates whether stock has been efficiently used or not. It shows the speed with which stock is rotated into sales.
- In this ratio the company’s inventory holding is very efficient as the ratio has increased from 4.8 in the year 2005-06 and it rise subsequently to 5.7 in the year 2008-09.

### DAYS OF INVENTORY HOLDING

Days of Inventory Holding = 365/Inventory Turnover Ratio

<table>
<thead>
<tr>
<th>YEAR</th>
<th>RATIOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>5.71</td>
</tr>
<tr>
<td>2006</td>
<td>13.4</td>
</tr>
<tr>
<td>2007</td>
<td>17.93</td>
</tr>
<tr>
<td>2008</td>
<td>17.54</td>
</tr>
</tbody>
</table>

INTERPRETATION:

- This ratio resembles the no of days the inventory is hold in the stores or warehouses of the company.
- Lower the ratio better it is because if it is lower than carrying cost will also be less and vice versa.
- In this case the days of inventory holding is decreasing which is good for the company as it decreases from 76 days in 2005 to 64 days in 2008.

### WORKING CAPITAL TURNOVER RATIO

= Cost of goods sold / working capital

<table>
<thead>
<tr>
<th>YEAR</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>76</td>
</tr>
<tr>
<td>2006</td>
<td>72</td>
</tr>
<tr>
<td>2007</td>
<td>69</td>
</tr>
<tr>
<td>2008</td>
<td>64</td>
</tr>
</tbody>
</table>

INTERPRETATION:

- This ratio resembles that how quickly the working capital cycle is completed
- Higher the ratio better it is for the organization
- In this ratio of the company is rotating its working capital cycle more efficiently as the ratio has increased many folds from 5.71 in 2005-06 to 17.54 in the year 2008-09, which is a good sign for the company.

### Debtor Turnover Ratio

= Cost of goods sold / average debtors

<table>
<thead>
<tr>
<th>YEAR</th>
<th>RATIOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>2.9</td>
</tr>
<tr>
<td>2006</td>
<td>2.8</td>
</tr>
<tr>
<td>2007</td>
<td>3.3</td>
</tr>
<tr>
<td>2008</td>
<td>3.5</td>
</tr>
</tbody>
</table>
FIG: 4

INTERPRETATION:
- This ratio indicates the velocity of debt collection of a firm.
- Higher the ratio better it is, because it decreases the risk of bad debts of the firm.
- In this ratio of the company it is somewhere constant around 3 where it was 2.9 in the year 2005-06 & it rise marginally to 3.5 in the year 2008-09 which resembles the efficiency of the firm to collect its debtors.

AVERAGE COLLECTION PERIOD
=365 / debtors turnover ratio

Table: 5

FIG: 5

INTERPRETATION:
- This ratio represents the average number of days the firm has to wait before its receivables are converted into cash.
- Lower the ratio better it is.
- In this ratio of company the avg. collection period is somewhere around mid 125, where it was just 110 days in 2007-08 but it further rise to 122 days in 2008-09 which is not good for the company.

Table: 6

FIG: 6

INTERPRETATION:
- The ratio indicates the efficiency of management in selling, administrative & other activities of the firm.
- This ratio is the measure of firm’s overall measure of firm’s profitability.
- Higher the ratio better it is.
- In this ratio of the company the profit of the company is increasing continuously as it was 12.8 in2005-06 to 14.81 in 2008-09.
FIG:7

INTERPRETATION: -
- This ratio reflects the overall profitability of the company
- This ratio include the profits as well as the expenses of the firm
- This ratio is directly proportionate to the growth of the firm
- In this ratio of the company there has been a continuous increase in the gross profit of the firm as it was 13.83 in the year 2005-06 & it increased to 16.73 in the year 2008-09.

9. INVENTORY MANAGEMENT SYSTEM

Inventories constitute the most significant part of current assets. They are required for the smooth running of the business activities. It is necessary for every business concern to give proper attention to its inventory management. An efficient system of inventory management determines what to purchase, how much to purchase, from where to purchase, where to store, etc.

Inventory must be managed neither in such a way that neither there is over-stocking nor under-stocking. The over stocking would mean reduction of liquidity and starving of other resources. On the other hand, under-stocking would result in stoppage of work.

Therefore, keeping in view the importance of inventory management for a manufacturing concern, I undertook this study to stimulate my practical knowledge in the same and also to critically analyze how inventory is valued and controlled at Bharat heavy electrical ltd.

VARIOUS COSTS INVOLVED AT DIFFERENT STAGES OF INVENTORY

Raw Material Stage
- Material costs
- Transport costs, insurance cost etc.
- Inventory carrying costs
- Interest
- Storage
- Insurance cost
- Warehouse keeper’s salary etc.

Work in Progress stage
- Machine cost-depreciation
- Electricity/ power
- Consumable/ repair & maintenance
- Operators/ supervisors
- Engineers
- Re-processing cost/ wastage cost
- WIP Inventory carrying cost
- Idle time cost/ overtime cost

Finished Goods stage
- Inventory carrying cost – usable
- Interest
- Storage
- insurance

RELATIONSHIP BETWEEN SIZE OF ORDER AND COST OF CARRYING INVENTORY

The ordering and carrying costs have a reverse relationship. The ordering costs go up with the increase in number of orders placed. On the other hand, carrying costs goes down per unit with the increase in number of units purchased and stored. Thus lowering the total costs.

The determination of EOQ can be done with the following formula:

\[
EOQ = \sqrt{\frac{2AS}{I}}
\]

Where, \(A\)=Annual Consumption in Rupees
\(S\)=Cost Of Placing an Order
\(I\)=Inventory Carrying Costs of One Unit

Tools and Techniques of Inventory Management:

For valuation of inventory:
- First In First out (FIFO): In this method, the materials received first are issued first. The materials are issued in chronological order. The cost of goods sold is calculated keeping in view the earliest lots exhausted on the presumption that units are sold in the order in which they were acquired.

For control of inventory:
- Determination of Stock Levels: An efficient inventory management requires that a firm should maintain an optimum level of inventory where inventory costs are the minimum and at the same time there is no stock-out which may result in loss
of sale or stoppage of work. Various stock levels under this are:

- **Minimum Level**: This represents the quantity which must be maintained in hand at all the times. If stocks are less than the minimum level then there is every possibility that the work can stop due to shortage of material.

  Minimum Stock Level = Minimum Consumption \times Minimum Lead time

- **Re-ordering Level**: When the quantity of materials reaches at a certain figure then fresh order is sent to obtain materials again. This level is fixed between minimum level and maximum level.

  Re-Ordering Level = Normal Consumption \times Normal Lead time

- **Maximum Level**: It is the quantity of materials beyond which a firm should not exceed its stocks. If the quantity exceeds the maximum level limit then there will be overstocking.

  Maximum Stock Level = Maximum Consumption \times Maximum Lead time

- **Determination of Safety Stocks**: Safety stock is a buffer to meet some unanticipated increase in usage. The usage of inventory cannot be perfectly forecasted, it fluctuates over a period of time, and therefore, a firm usually maintains some margin of safety stock. Two costs are involved in the determination of this stock i.e. opportunity cost of stock outs and carrying costs.

- **Determination of Economic Order Quantity (E.O.Q.)**: Economic order quantity is a quantity of materials, which can be purchased at minimum costs. It is generally a point at which inventory carrying costs are equal to ordering costs. The quantity to be purchased should neither be small nor big because costs of buying and carrying materials are very high i.e. the cost of managing inventory made up of two parts - ordering costs and carrying costs.

- **A-B-C Analysis**: This analysis helps to divide materials in to three categories for the purpose of exercising selective control on materials i.e. A, B & C. It is generally seen in a manufacturing concern that almost 10 percent of the items contribute to 70 percent of the value of consumption and is termed category ‘A’. About 20 percent of the items add to 20 percent of the value of consumption and is branded as category ‘B’. Category ‘C’ covers about 70 percent of items of materials which contribute to 10 percent of value of consumption. This analysis concentrates on important items only.

- **V-E-D Analysis**: It is generally used for spare parts. The demand for spares depends upon the performance of the plant and machinery. Spare parts are classified as Vital (V), Essential (E) and Desirable (D). The vital spare parts are a must for running the concern smoothly otherwise it will cause havoc in the concern. The (E) types of spare parts are also necessary but their stocks can be kept at low figures. If the lead time of D kind of spare parts is less, then their stocking can be avoided.

- **Inventory turnover ratio**: This ratio measures how fast stock is converted into sales. It also indicates the time which inventories spend in the warehouse or whether inventories have been used resourcefully or not.

  Inventory Turnover Ratio = Cost of goods sold / average inventory

  Inventory holding period = 365 / Inventory turnover ratio

**ANALYSIS FOR INVENTORY CONTROL**

Determination of raw material stock levels(steel castings)

Yearly consumption of Raw material

<table>
<thead>
<tr>
<th>Year</th>
<th>Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001-02</td>
<td>50312</td>
</tr>
<tr>
<td>2002-03</td>
<td>45567</td>
</tr>
<tr>
<td>2003-04</td>
<td>35439</td>
</tr>
<tr>
<td>2004-05</td>
<td>49643</td>
</tr>
<tr>
<td>2005-06</td>
<td>54786</td>
</tr>
<tr>
<td>2006-07</td>
<td>58987</td>
</tr>
<tr>
<td>2007-08</td>
<td>59887</td>
</tr>
<tr>
<td>2008-09</td>
<td>60343</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>414964</strong></td>
</tr>
</tbody>
</table>

Average yearly consumption = 51870.5 MT
Maximum yearly consumption = 60343 MT
Minimum yearly consumption = 35349 MT

**Re-ordering level**: When the quantity of materials reaches the reorder point, and then fresh order is placed to replenish the inventory. The order is sent before the materials reach minimum stock level.

Normal lead time = 3 months

Re-Ordering Level = Average Consumption \times Normal Lead Time

= 51870.5 \times 1/4
= 12967 MT

Thus, the reordering level at Bharat heavy electrical ltd. is 12967 MT

**Minimum stock level**: It signifies the quantity that must be maintained in hand at all times by the firm.
If stocks are less than this level then the work will stop due to the shortage of materials.

Minimum Lead time = 1 months

**Minimum Stock Level = Minimum Consumption * Minimum Lead time**

= 35349 * 1/12
= 2953 MT

Hence, minimum stock level maintained by Bharat heavy electrical ltd. is 2953 MT.

Maximum Lead time: 6 months

**Maximum Stock Level = Maximum Consumption * Maximum lead time**

= 60343 * 1/2
= 30171.5 MT

Hence, maximum stock level retained by Bharat heavy electrical ltd. is 30171.5 MT.

**Determination of safety stocks:** Safety stock is a buffer to meet some unanticipated / increased usage. The demand for materials may fluctuate and the delivery of inventory may also be delayed and in such a situation the firm may face a problem of stock out. This level is usually fixed between the re-ordering level and the minimum stock level. Since all the material is imported, the company keeps 3 months of inventory as safety stock in warehouse.

**Economic order quantity (EOQ):** This technique is used to determine the quantity to be ordered once the inventory gets replenished. It is the quantity which can be purchased at minimum costs. Generally, the point where inventory carrying costs equates order costs is EOQ point.

**EOQ = \sqrt{\frac{2AS}{I}}**

Where, 

A = annual consumption in kgs. (60343 MT)

S = cost of placing an order (Rs. 819)

I = inventory carrying costs per kg (Rs.113 per MT)

EOQ = \sqrt{ (2 x 69343 x 819) / 113 }

EOQ = 935.25 MT

So, the quantity of materials purchased by Bharat heavy electrical ltd. Should be at least 935.25 MT.

**10. A-B-C Analysis**

It is a selective inventory control technique where the materials are divided into three categories to identify which items need most effort in controlling. The high-valued items are classified as ‘A’ items and are under highest control. ‘C’ items represent relatively least value and are under simple control. ‘B’ items fall in between these two categories, require reasonable management attention.

<table>
<thead>
<tr>
<th>Item</th>
<th>Stock Category</th>
<th>Stock Value</th>
<th>Stock Quantity</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turbo alternators</td>
<td>A</td>
<td>6</td>
<td>975.21</td>
<td>A</td>
</tr>
<tr>
<td>Heat turbines</td>
<td>A</td>
<td>63</td>
<td>317.177</td>
<td>A</td>
</tr>
<tr>
<td>Heat exchanger</td>
<td>A</td>
<td>131</td>
<td>394.806</td>
<td>A</td>
</tr>
<tr>
<td>Wheel alternators</td>
<td>C</td>
<td>1834</td>
<td>311.814</td>
<td>C</td>
</tr>
<tr>
<td>Capacitors</td>
<td>B</td>
<td>502</td>
<td>280.223</td>
<td>B</td>
</tr>
<tr>
<td>Bushings</td>
<td>A</td>
<td>24</td>
<td>808.323</td>
<td>A</td>
</tr>
<tr>
<td>Traction control</td>
<td>B</td>
<td>492</td>
<td>241.117</td>
<td>B</td>
</tr>
<tr>
<td>Industrial control gear</td>
<td></td>
<td>33</td>
<td>330.113</td>
<td>A</td>
</tr>
<tr>
<td>Power transformers</td>
<td>A</td>
<td>73</td>
<td>217.880</td>
<td>A</td>
</tr>
<tr>
<td>Hydro sets</td>
<td>C</td>
<td>892</td>
<td>111.887</td>
<td>C</td>
</tr>
<tr>
<td>Turbo sets</td>
<td>B</td>
<td>298</td>
<td>222.406</td>
<td>B</td>
</tr>
<tr>
<td>Steel castings</td>
<td>B</td>
<td>251</td>
<td>210.119</td>
<td>B</td>
</tr>
<tr>
<td>Steel forgings</td>
<td>C</td>
<td>989</td>
<td>201.995</td>
<td>C</td>
</tr>
<tr>
<td>Gas turbines</td>
<td>A</td>
<td>19</td>
<td>191.887</td>
<td>A</td>
</tr>
<tr>
<td>boilers</td>
<td>C</td>
<td>924</td>
<td>154.339</td>
<td>C</td>
</tr>
<tr>
<td>valves</td>
<td>B</td>
<td>512</td>
<td>117.098</td>
<td>B</td>
</tr>
<tr>
<td>Instrument transformers</td>
<td></td>
<td>679</td>
<td>65.640</td>
<td>C</td>
</tr>
<tr>
<td>ESP transformers</td>
<td>C</td>
<td>631</td>
<td>59.065</td>
<td>C</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>8353</strong></td>
<td><strong>5211.549</strong></td>
<td></td>
</tr>
</tbody>
</table>

**A-B-C Analysis Summary Chart**

<table>
<thead>
<tr>
<th>Classification</th>
<th>Stock Value</th>
<th>Percentage</th>
<th>Stock Quantity</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>3285.8</td>
<td>62.0</td>
<td>349</td>
<td>4.17</td>
</tr>
</tbody>
</table>

**Table: 10**
INTERPRETATION:

- A-B-C Analysis chart represents the bifurcation and division of the total inventory on the basis of the percentage of the stock value they hold as a part of the total stock value.
- In this analysis total inventory is divided into 3 major parts
  1. A-represents those parts of the inventory whose percentage of stock quantity is less but they hold a majority of stock value of the inventory
  2. B-represents those parts of the inventory whose percentage of stock quantity is moderate and they hold average stock value of the inventory
  3. C-represents those parts of the inventory whose percentage of stock quantity is more but they hold very less part of stock value of the inventory.

In this A-B-C analysis of the company it is found that

- Various crucial parts of the company such as turbo alternators, heat turbines bushings heat alternators etc constitute 3285.833 crore which is 62.08% of the stock value & they hold just 4.17% of the stock quantity of the company.
- Various other parts of the company such as traction control, capacitors, turbo sets, steel castings etc constitute 1070.963 crore which is 20.54% of the stock value & they hold 24.60% of the stock quantity of the company.
- Various basic and common parts of the company such as hydro sets, steel forgings, boilers etc constitute 904.753 crore which is 17.38% of the stock value & they hold majority of 71.23% of the stock quantity of the company.

11. HYPOTHESIS TESTING ANOVA

The basic purpose of using anova is to test the difference among the mean of population by examining the amount of variation within the each of these samples relative to the amount of variation between the samples.

Lets, H0:- There is no impact of cost of holding inventory on profits.

H1:- There is impact of cost of holding inventory on profits.

Table: 11 ANOVA

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>Df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>1.391E11</td>
<td>1</td>
<td>1.391E11</td>
<td>1.220</td>
<td>0.685</td>
</tr>
<tr>
<td>Residual</td>
<td>1.266E11</td>
<td>2</td>
<td>6.329E11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1.405E11</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), Cost of holding inventory
b. Dependent Variable: profit

INTERPRETATION:
As the level of significance is greater than 0.05, i.e. .685 so, we reject our null hypothesis and accept our alternate hypothesis i.e. cost of holding inventory effects the profitability of the company.

H2:- There is impact of cost of holding inventory on sales

Table: 12 ANOVA

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>Df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>7.308E14</td>
<td>1</td>
<td>7.308E14</td>
<td>2.79</td>
<td>.237</td>
</tr>
<tr>
<td>Residual</td>
<td>5.239E14</td>
<td>2</td>
<td>2.619E14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1.255E15</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

INTERPRETATION:
As the level of significance is greater than 0.05, i.e. .237 so, we reject our null hypothesis and accept our alternate hypothesis i.e. cost of holding inventory effects the sales of the company.

12. REGRESSION

Linear Regression between the cost of holding inventory & Profitability of the company.

Table: 13
1.674 -0.099 -0.351 7.95552E5

**INTERPRETATION:** -
According to the linear regression the cost of holding inventory has 9.9% impact on the profits of the company. Regression between the cost of holding inventory & Sales of the company.

**Table: 14 Model Summary**

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.902</td>
<td>.582</td>
<td>.374</td>
<td>1.61849E7</td>
</tr>
</tbody>
</table>

**INTERPRETATION:** -
According to the linear regression the cost of holding inventory has 58.2% impact on the sales of the company.

**13. CORRELATION**
Correlation analysis deals with the association between two or more variables

**TYPES OF CORRELATION:**-
- Positive and Negative Correlation
- Simple, Partial and Multiple Correlations
- Linear and Curvi-Linear Correlation

**DEGREE OF CORRELATION:**-

**Table: 15**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Degree of correlation</th>
<th>Positive</th>
<th>Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Perfect correlation</td>
<td>+1</td>
<td>-1</td>
</tr>
<tr>
<td>2</td>
<td>High Degree of correlation</td>
<td>Between +.75 to +1</td>
<td>Between -.75 to -1</td>
</tr>
<tr>
<td>3</td>
<td>Moderate Degree of Correlation</td>
<td>Between +.25 to +.75</td>
<td>Between -.25 to -.75</td>
</tr>
<tr>
<td>4</td>
<td>Low Degree of Correlation</td>
<td>Between 0 to +.25</td>
<td>Between 0 to -.25</td>
</tr>
<tr>
<td>5</td>
<td>Absence of Correlation</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Correlation between the cost of holding inventory & Sales of the company.

**Table: 16**

<table>
<thead>
<tr>
<th>Pearson correlation</th>
<th>sales</th>
<th>cost of holding inventory</th>
</tr>
</thead>
<tbody>
<tr>
<td>sales</td>
<td>1.000</td>
<td>.902</td>
</tr>
</tbody>
</table>

**INTERPRETATION:** -
According to this correlation model there is a high degree of correlation between sales and cost of holding inventory up to 90.2%

Correlation between the cost of holding inventory & profitability of the company.

**Table:17**

<table>
<thead>
<tr>
<th>Pearson correlation</th>
<th>profitability</th>
<th>cost of holding inventory</th>
</tr>
</thead>
<tbody>
<tr>
<td>profitability</td>
<td>1.000</td>
<td>.674</td>
</tr>
<tr>
<td>cost of holding inventory</td>
<td>.674</td>
<td>1.000</td>
</tr>
<tr>
<td>sig(1 tailed)</td>
<td>.163</td>
<td>.163</td>
</tr>
</tbody>
</table>

**INTERPRETATION:**
According to this correlation model there is a moderate degree of correlation between profitability and cost of holding inventory up to 67.4%

**14. FINDINGS**
- The company has a strong inventory holding of an average of 51870.5 metric tonnes per year which is highest in the industry.
- The company is having a centralised system of inventory control its central warehouse supplies inventory to every manufacturing concern.
- The company is having a lot of variation between the lead time it ranges from 1 month as the minimum lead time to 6 month as the maximum lead time.
- There is a huge difference between the re ordering level and the economic order quantity as re ordering level is at 12967 metric tonnes and the economic order quantity is at just 935.25 metric tonnes.
• There is a high degree of correlation between the sales and cost of holding inventory i.e. up to 90.2% and moderate degree of correlation between cost of holding inventory and profitability up to 67.4% of the company.
• There is a very less part of the inventory holding majority of share of stock value of the company i.e. only 4.17% of total inventory constituting 62.08% of the company.
• The average collection period is increasing in the current year i.e. it is increasing from 110 days to 122 days which is further increasing the risk of bad debts.
• The inventory turnover of the company is speeding continuously, the days of inventory holding is also at the minimum in the current year.
• The company is fetching profits since 1972 i.e. from last 37 years.
• The company is a market leader with more than 72% of the total market share in Thermal, Hydro and Gas based turnkey power projects, substation projects, and rehabilitation projects, Transformers, Compressors, Valves and Oil field equipment, Electrostatic Precipitators, Insulators, Heat Exchangers, Switchgears, Castings and Forgings.
• The working capital turnover ratio is also increasing subsequently which is showing favourable results & revealing that working capital is also maintained efficiently.

15. RECOMMENDATIONS
• Company should reduce its reordering level in order to have economy in orders, as there is huge difference between them.
• Company should pay extra attention on the various crucial parts of the inventory, as they affect the total inventory system.
• Company should have an decentralised system of inventory holding as the centralised system is adding to the total cost of holding the inventory.
• Company should have an “scrap management system” in order to reduce the inventory cost of the company.
• Company should pay extra attention on the “lead time” as there is a lot of variation in the lead time ranging from 1 month to 6 months.
• The company should try to reduce its average collection period as it is increasing subsequently and also increasing the chances of bad debts.
• The company should pay extra attention to the economic order quantity level as the ordering cost is at the rise.
• As the company is the market leader so it should try to explore as many unexplored areas of the country.

• Although the inventory turnover of the company is speeding but it is still very less as compared to the rest of the industry so the company should try to speed it further.

16. CONCLUSION
In the last it could be concluded that the overall inventory management system of the company is satisfactory the company is using satisfactory techniques of managing its inventory with latest techniques but the biggest & the most important thing is that the company is using the natural resources of the country so there should be any “scrap” management system or any “wastage” management system, other than this the system was good and although it is a PSU but their management is not less than any private firm.