Inventory management of cement industries in Ariyalur district - a study
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ABSTRACT

The inventory management is one of the most important and challenging aspect of the overall working capital management. Merely effective and efficient management of inventory can ensure survival of a manufacturing enterprise. Inventory management is concerned with the problems that arise in attempting to manage the inventory. The main objectives of this study are to examine and evaluate the inventory management in five sample cement units in Ariyalur district of Tamil Nadu. The study covers a period of 10 years Viz, 2004-2013. For the purpose of investigation both primary and secondary data are used. The collected data is analyzed by applying research tools which include accounting as well as statistical tools. They reveal that the selected cement companies have been following a conservative approach in inventory management. The first sample cement unit TANCEM has the highest inventory turnover ratio of 7.28 times in a year which took 50 days to convert its stock into sales. However, there is no stability in its inventory turnover ratio trends. The second sample cement units (CCL) took 114 days to convert its stock into sales which shows that it is not at all active in maximizing its sales efforts. The ICL also took 101 days to convert its stock into sales which is also not a satisfactory level. The ACL and RCL took in between 78 and 83 days to convert their stocks into sales which show a fair position on their active sales making efforts. The correlation between costs of goods sold and inventory is all the sample cement units are a high degree of positive correlation. The Chi-square test applied for hypothesis is rejected. There is no significant difference between costs of goods sold and inventory. However, in the ANOVA test applied for hypothesis is accepted. There is significant difference between costs of goods sold and inventory.

Key words: Inventory turnover ratio, parameter non-parameter test.

1. Introduction

Inventories constitute the most significant part of current assets for a large majority of companies in India. On an average, inventories are approximately 60 percent of current assets in public limited companies in India. Because of the large size of inventories maintained by firms, a considerable amount of funds is required to be committed to them. It is, therefore, absolutely imperative to manage inventories efficiently and effectively, in order to avoid unnecessary investment.

1.1 Meaning of inventory

The dictionary meaning of inventory is ‘stock of goods, or a list of goods’. The word ‘inventory’ is understood differently by various authors. In accounting language it may mean
stock of finished goods only. In a manufacturing concern, it may include raw materials; work in process and stores, etc.

1.2 Nature of inventories

Inventories are stock of the product a company is manufacturing for sale and components that make up the product. The various forms in which inventories exist in a manufacturing company are raw materials, work-in-process and finished goods.

2. Objectives of inventory management

The main objectives of inventory management are operational and financial. The operational objectives mean that the materials and spares should be available in sufficient quantity so that work is not disrupted for want of inventory. The financial objective means that investments in inventories should not remain idle and minimum working capital should be locked in it. The following are the objectives of inventory management:

In the context of inventory management, the firm is faced with the problem of meeting two conflicting needs:

1. To maintain a large size of inventories of raw material and work-in-process for efficient and smooth production and of finished goods for uninterrupted sales operations.
2. To maintain a minimum investment in inventories to maximize profitability.

Both excessive and inadequate inventories are not desirable. These are two danger points within which the firm should avoid. The objective of inventory management should be to determine and maintain optimum level of inventory investment. The optimum level of inventory will lie between the two danger points of excessive and inadequate inventories. The firm should always avoid a situation of over investment or under-investments in inventories. The major dangers of over investment are:

a. Unnecessary tie-up of the firm’s funds and loss of profit,
b. Excessive carrying costs, and
c. Risk of liquidity.

The excessive level of inventories consumer’s funds of the firm, which then cannot be used for any other purpose, and thus, it involves an opportunity cost. The carrying costs, such as the costs of storage, handling, insurance, recording and inspection, also increase in proportion to the volume of inventory. These costs will impair the firm’s profitability further. Excessive inventories, carried for long-period, increase chances of loss of liquidity. It may not be possible to sell inventories in time and at full value. The aim of inventory management, thus, should be to avoid excessive and inadequate levels of inventories and to maintain sufficient inventory for the smooth production and sales operations. Efforts should be made to place and order at the right time with the right source to acquire the right quantity at the right price and quality. An effective inventory management should:

1. Ensure a continuous supply of raw materials, to facilitate uninterrupted production.
2. Maintain sufficient stocks of raw materials in periods of short supply and anticipate price changes.
3. Maintain sufficient finished goods inventory for smooth sales operation, and efficient customer service.
4. Minimize the carrying cost and time, and
5. Control investment in inventories and keep it at an optimum level

The investment in inventories constitutes the most significant part of current assets / working capital in most of the undertakings. Thus, it is very essential to have proper control and management of inventories in general and manufacturing industries in particular. To know the pattern of inventory management in manufacturing industries, the cement companies have been chosen for the study.

2.1 Cement industries in India

India has become the second largest cement producing country in the world. The gap between the largest producer China and the second largest producer are quite wide. China produces 1,400 million tons per year while India produces a mere 183 million tons. It is noted that there is an interlinking relation between cement consumption and the growth of economy. The country is on a high growth track and the focus now is on the development of the infrastructure facilities such as, highways, ports, canals, bridges, power-houses etc. The performance of cement industry has been commendable even during the global economic slowdown.

2.2 Major players in Indian cement industry

The Indian cement industry comprises 185 large and about 365 mini cement plants, including public sector units. Large producers contribute about 95 percent to the installed capacity, while mini plants account for the rest. Holcim Group and Aditya Birla Group have emerged as the largest players in the Indian cement industry, with a market share of 46 percent and 38 percent, respectively, in 2009.

3. Statement of the problem

Due to rapid industrialization and economic development in India, demand for cement is increasingly rapidly. To meet this growing demand, technology upgradation of existing plants by bringing about operational improvements and efficiency are also needed. In fact cement industries are established in those areas where such raw materials are available in abundance. Ariyalur and its surroundings areas are gifted with such raw materials in plenty.

3.1 Database and methodology

3.1.1 Sampling design

Purposive sampling method has been employed in the study. There are six cement industries in Ariyalur District. Out of these, five cement industries were selected for this study. Such industries are: 1. Tamil Nadu Cement Corporation Limited (TANCEM), 2. Chettinad Cement Limited (CCL), 3. Aditya Birla Cement Limited (ACL), 4. Ram Co Cement Limited (RCL) and 5. India Cements Limited (ICL). The first sample unit TANCEM is a public sector unit, while the other four units are from private sector. The Aditya Birla Cement Company is the largest cement industries in Ariyalur District. The six th cement industry in Ariyalur District is
Dalmia Cement Limited which is not taken for the study due to inadequate data for the entire study period.

3.2 Nature of study

The study analyzed the relationship of inventory with different variables like cost of goods sold, current assets etc.

3.3 Data period

The company wise information has been collected on a number of variables during the period from 2004 to 2013, covering ten years.

3.4 Data collection

For the purpose of the present study, various primary and secondary data are used for analysis. Most of the primary data required for the study, have been collected through personal visits, interviews with senior officials of the concerns. On the other hand, secondary data have been acquired through periodicals, newspapers, Government publications and annual reports and accounts of the cement companies. The available relevant studies relating to the title of the present research work have been referred by the researcher through the library work.

3.5 Data analysis

The following analysis is made with regard to the inventory management of the selected sample cement industries.

1. Inventory Turnover Ratios in Times and Days.
2. Parameter and non-parameter test.

3.6 Inventory turnover or stock turnover ratio

Every firm has to maintain a certain level of inventory of finished goods so as to be able to meet the requirements of the business.

3.7 Parameter and non-parameter test.

The word parameter is used to indicate various statistical measures like,

1. Mean deviation
2. Standard deviation
3. Correlation etc.

The non-parameter is used to indicate various statistical measures like,

1. Chi-square test
2. ANOVA test

As against this the term statistic refers to the statistical measures relating to the sample. From the distribution test result it is found that the collected data were normally distributed. Hence, the researcher has decided to apply the parametric and non parametric test.

In addition to ratio analysis on the inventory management techniques of cement industries the researcher has also applied the following statistical tools to evaluated the overall efficiency.
inventory management in the sample units. The results of such analysis are presented in Table 2.

3.8 Mean deviation

The mean deviation is measure of dispersion based on all items in a distribution. Mean deviation is the arithmetic mean of the deviations of a series computed from any measure of central tendency; i.e., the mean, median or mode. Here, mean deviation is calculated from the arithmetic mean which is an absolute measure. For the purpose of comparing variation among the different series which are expressed in the same or different units, a relative mean deviation is enquired. The relative mean deviation or Co-efficient of mean deviation is obtained by dividing the mean deviation by the average used for calculating mean deviation. The Co-efficient of mean deviation is calculating same below;

\[
\text{Mean deviation} \div \text{Mean} \times 100 \quad \text{------------------- (1)}
\]

3.9 Standard deviation

Standard deviation is the square root of the sum of squared deviation from average. It is a prominent and widely used measure of dispersion. In this method, deviations should be taken only from the arithmetic mean. Standard deviation is the best measure of dispersion. It is widely used in statistics because it possesses most of the characteristics of an ideal measure of dispersion. It is widely used in sampling theory. The standard deviation is calculated as below:

\[
\text{S.D} = \sqrt{\frac{\sum d^2}{N} - \left[\frac{\sum d}{N}\right]^2} \quad \text{------------------- (2)}
\]

3.10 Co-efficient of variation (Relative standard deviation)

The standard deviation in is an absolute measure of dispersion. Therefore, the standard deviation must be converted into a relative measure of dispersion for the purpose of comparison. The relative measure is known as the Co-efficient of variation.

\[
\text{C.V} = \frac{\text{S.D}}{\text{Mean}} \times 100 \quad \text{------------------- (3)}
\]

3.11 Correlation

Karl Pearson’s co-efficient of correlation is applied to measure the magnitude of the linear relationship between cost of goods sold and inventory in the sample cement units.

\[
r = \frac{\sum dx dy - (\sum dx)(\sum dy)}{\sqrt{\sum dx^2 - (\sum dx)^2} \times N} \div \sqrt{\sum dy^2 - (\sum dy)^2} \times N}
\]

3.12 Hypotheses

Hypothesis is an assumption which may or may not be true about a population parameter. The above two deviations and the correlation analysis are made under parameter test. By using Non-parameter tools like Chi-square test and ANOVA test.

4. ANOVA (Analysis of Variance)

The ANOVA is essentially a procedure for testing the difference among different groups of data for homogeneity. “The essence of ANOVA is that the total amount of variation in a set of data is broken down into two types, that amount which can be attributed to chance and that amount which can be attributed to specified causes”. There may be variation between
samples and also within sample items. ANOVA consists splitting the variance for analytical purposes. Hence it is a method of analyzing the variance to which a response is subject into its various components corresponding to various source of variation. A manager of a big concern can analyses the performance of various salesmen of his concern in order to know whether their performance differ significantly.

Calculation of ANOVA: there are four steps.

Step 1 Correction factors [C.F]
\[ C.F = G^2 \div N \]
\[ G^2 = \text{grand total} \]
\[ N = \text{No. of frequencies} \]

Step 2 Column sum of square [CSS]
\[ \Sigma c^2 \div R = \text{total dividing balance} \]
\[ \Sigma c^2 = \text{Column square} \]
\[ R = \text{Rows} \]

Step 3 Random sum of square or total sum of square [RSS or TSS]
\[ \text{TSS} - \text{C.F} \]

Step 4 Error sum of square [ESS]
\[ \text{TSS} - \text{CSS} \]

Table 1 and 1(a) exhibit the Inventory Turnover Ratio (ITR) in case of the selected sample cement industries. Namely: TANCEM, CCL, ACL, RCL, and ICL for the decade of the study.

<table>
<thead>
<tr>
<th>YEAR</th>
<th>TANCEM</th>
<th>CCL</th>
<th>ACL</th>
<th>RCL</th>
<th>ICL</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003-04</td>
<td>13.21</td>
<td>3.47</td>
<td>5.82</td>
<td>7.80</td>
<td>3.75</td>
</tr>
<tr>
<td>2004-05</td>
<td>8.23</td>
<td>2.61</td>
<td>5.50</td>
<td>3.46</td>
<td>3.45</td>
</tr>
<tr>
<td>2005-06</td>
<td>8.46</td>
<td>2.93</td>
<td>4.79</td>
<td>5.60</td>
<td>3.76</td>
</tr>
<tr>
<td>2006-07</td>
<td>7.32</td>
<td>4.73</td>
<td>5.07</td>
<td>5.54</td>
<td>3.76</td>
</tr>
<tr>
<td>2007-08</td>
<td>7.26</td>
<td>2.85</td>
<td>4.13</td>
<td>3.83</td>
<td>3.57</td>
</tr>
<tr>
<td>2008-09</td>
<td>7.06</td>
<td>2.57</td>
<td>4.78</td>
<td>3.97</td>
<td>4.03</td>
</tr>
<tr>
<td>2009-10</td>
<td>9.24</td>
<td>2.97</td>
<td>4.11</td>
<td>3.39</td>
<td>3.96</td>
</tr>
<tr>
<td>2010-11</td>
<td>5.81</td>
<td>3.71</td>
<td>3.34</td>
<td>3.69</td>
<td>3.67</td>
</tr>
<tr>
<td>2011-12</td>
<td>0.64</td>
<td>2.99</td>
<td>4.30</td>
<td>3.24</td>
<td>3.98</td>
</tr>
<tr>
<td>2012-13</td>
<td>5.58</td>
<td>2.86</td>
<td>4.03</td>
<td>3.08</td>
<td>1.82</td>
</tr>
<tr>
<td>AVE. IN A YEAR</td>
<td>7.28</td>
<td>3.17</td>
<td>4.59</td>
<td>4.36</td>
<td>3.57</td>
</tr>
<tr>
<td>AVE. DAYS</td>
<td>50</td>
<td>114</td>
<td>78</td>
<td>83</td>
<td>101</td>
</tr>
</tbody>
</table>

Source: Secondary data

Table 2: Statistical analysis of selected cement industries in Ariyalur district for the study period 2004 – 2013.
The Inventory Turnover Ratio in times / Days for the Five sample cement units are presented in Table 1

<table>
<thead>
<tr>
<th>Different statistics tools</th>
<th>TANCEM</th>
<th>CCL</th>
<th>ACL</th>
<th>RCL</th>
<th>ICL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>0.64</td>
<td>2.61</td>
<td>3.34</td>
<td>3.08</td>
<td>1.82</td>
</tr>
<tr>
<td>Maximum</td>
<td>13.21</td>
<td>4.73</td>
<td>5.82</td>
<td>7.80</td>
<td>4.03</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>7.28</strong></td>
<td><strong>3.17</strong></td>
<td><strong>4.59</strong></td>
<td><strong>4.36</strong></td>
<td><strong>3.57</strong></td>
</tr>
<tr>
<td>Mean deviation</td>
<td>0.33</td>
<td>0.42</td>
<td>0.41</td>
<td>0.23</td>
<td>0.34</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>43%</td>
<td>47%</td>
<td>46%</td>
<td>30%</td>
<td>36%</td>
</tr>
<tr>
<td>Correlation</td>
<td>0.84</td>
<td>0.98</td>
<td>0.99</td>
<td>0.98</td>
<td>0.97</td>
</tr>
<tr>
<td>Chi-square test</td>
<td>3.05</td>
<td>3.24</td>
<td>15.20</td>
<td>8.35</td>
<td>16.64</td>
</tr>
<tr>
<td>ANOVA test</td>
<td>15.93</td>
<td>18.95</td>
<td>36.63</td>
<td>15.13</td>
<td>13.52</td>
</tr>
</tbody>
</table>

**Figure 1:** Inventory turnover ratio

The average inventory turnover ratio for TANCEM is 7.28 times in a year and it ranges between minimum 0.64 and maximum 13.21 times in a year during the study period. The ratio decreases during the study period from 2006-07 to 2008-2009 TANCEM has comfortable ITR with 9.24 times in the year 2009-10.
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The average ITR for CCL is 3.17 times in a year during the study period. The minimum level of ITR is 2.61 and maximum level of ITR is 4.73 times in a year during the study period. The ITR has improved to 3.71 in 2010-11.

The average ITR for ACL is 4.59 times in a year during the study period. The minimum level of ITR is 3.34 and maximum level of ITR is 5.82 times in a year during the study period. The ACL is maintaining a stable ITR throughout the study period. It deviates from this general standard trend only during the year 2010-11 with just 3.34 times in a year.

The average ITR is 4.36 times in a year is maintained by RCL. The lowest level of ITR is 3.08 and highest level of ITR is 7.80 times during the study period. In the second year of the study period the ITR comes down to 3.46 and in the next two years it has risen to 5.60 times, thereafter it has established stability in its ITR trend. The average ITR 3.57 times in a year is maintained by ICL. The minimum average ITR level is 1.82 and the maximum ITR level of 4.03 times during the study period. The ratio is improved slightly during the year 2008-09 only. In respect of other years, it has maintained the ratio in between 3 and 4 only. During the last year of the study period it reached to its lowest level of ITR of 1.82 times in a year.

The ITR of the sample industries is also expressed in average days TANCEM took just 50 days only to convert its stock into sales. From this it is observed that it maintains a highest ITR among the sample units which helps to achieve more and more sales during the study period. The second sample units took 114 days to convert its stock into sales which shows that it is not at all active in maximizing its sales efforts. The ICL also took 101 days to convert its stock into sales which is also not a satisfactory level.

The ACL and RCL took in between 78 and 83 days to convert their stocks into sales which show a fair position on their active sales making efforts. The inventory turnover ratio analysis of the sample cement industries is presented in Table 1. The maximum inventory turnover ratio is 7.28 times in a year is maintained by TANCEM. The second highest inventory turnover ratio of 4.59 times is maintained by ACL.

The RCL average ratio is 4.36 times in year which is very close to ACL. The remaining two sample societies ITR is also almost identical with 3.17 times and 3.57 times in a year. The TANCEM’s ITR is highest among the sample societies. However, there no stability in its ITR trends from year to year. For example in the first year of the study the ratio is 13.21 times and the lowest ITR of 0.64 times in a year which is also reported in the same sample unit in the year 2011-12. This shows that the TANCEM is not maintaining a standard ITR. The mean deviation of the sample cement units are exhibited in Table 1 (a) The lowest mean deviation of 23 percent is reported in RCL which means this units inventory fluctuations are kept at minimum level. The mean deviations of CCL and ACL are almost identical and their inventory levels are widely fluctuating. Almost uniform fluctuations of inventory level are observed in TANCEM and ICL. The inventory fluctuations are the minimum in the case of RCL and maximum is observed in CCL and ACL sample units. The TANCEM and ICL present a fair position in the inventory maintenance level.

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The correlation between cost of goods sold and inventory is all the sample cement units are a high degree of positive correlation.

Hypotheses

“The inventory turnover ratio of the selected cement companies under study does not differ significantly and it is almost same”.

The table value for \([r-1] [c-1] = [10-1] [2-1] = 9\) d.f (degree of freedom) at 5% level of significant is 16.9190. Table 1 (a) indicates that the Chi-square test value is TANCEM 3.05 less than table value is 16.9190. The hypothesis is rejected at 5% level. It is concluded that there is no significant difference between cost of goods sold and inventory. The Chi-square test values for other four units are CCL- 3.24, ACL- 15.20, RCL- 8.35, and ICL- 16.64. Hence these values are less than 16.9190 which is the degree of freedom at 5% level of significance, the above conclusion is once again conformed that there is no significance difference between cost of goods sold and inventory in respect of all sample units.

ANOVA test for TANCEM sample unit

For the application of ANOVA test the two variables are:
1. Cost of goods sold
2. Inventory

The ANOVA test of the selected sample units are also stated in Table 2

Table 2 indicate that the calculate value of F is TANCEM 46.39 more than the table value of F 4.41 at 5% level with d.f being \(v_1 = 1\) and \(v_2 = 18\) and hence there is a significant difference between the cost of goods sold and inventory.

Applications of ANOVA test in other four sample unit’s value of F are CCL 9.903, ACL 9.680, RCL 20.038 and ICL 25.033 more than the table value of F 4.41 at 5% level of significant d.f being \(v_1 = 1\) and \(v_2 = 18\) and hence there is a significant difference between cost of goods sold and inventory in respect of all sample units.

5. Conclusion

The inventory management of the selected cement industries is Satisfactory. The Company has no problem in the management of inventory. Since, there is always a heavy and continuous demand for cement from different agencies there is no problem of accumulation of inventory for all the sample cement industries.

6. References

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Abbreviation used

ACL: Aditya Birla Cement Limited.
C.F: Correction Factors.
C.V: Co-efficient Variation.
CCL: Chettinad Cement Limited.
CSS: Column Sum of Square.
D.F: Degree of Freedom.
ESS: Error Sum of Square.
ICL: India Cement Limited.
ITR: Inventory Turnover Ratio.
M.D: Mean Deviation.
RCL: Ramco Cement Limited.
S.D: Standard Deviation.
TANCEM: Tamil Nadu Cement Corporation Limited.
TSS: Total Sum of Square