MATERIALS COST MANAGEMENT: AN OVERVIEW

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ABSTRACT

Raw material is very important in ceramics in various aspects. It is one of the most decisive factors for the quality of a product.[1] Roughly speaking, half of the quality of a product is determined by the characteristics of raw materials in the current production technology. Use of proper raw material is critical for producing ceramics of high quality at a minimal cost. Technologically, the raw powder sets a fair starting point for industries. Raw materials of high quality are in the market, and are equally available for all users for their disposal. Proper selection of raw powders and their post-treatment is critical for successful competition in the market. A variety of factors affects the characteristics of raw powders. Information on the product specification as well as their production method is very important in the proper selection of raw materials[2]. Post-treatments such as grinding, mixing and classification also have critical effects on the characteristics. Their effects must be considered carefully to control and also to understand the characteristics of raw powders.

KEYWORDS: *Raw Material, Minimal Cost, Raw Powders, Materials Cost Management.*

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Introduction

Material means those items which are used for manufacturing of a product[3]. This is the cost of material or the commodity used by the organization for its production purpose. Material is the substance, from which a product is made, for example sugarcane in sugar, cotton in cloth etc. These items are called as material. Material cost can be divided into two parts as follows.

- **Direct Material Cost:** It refers to those materials which become a major part of the finished product and can be easily traceable to the units, eg. Paper in book Direct material is directly related to production, i.e. if production is increased cost of direct material is also increased[4]. So, direct material costs can be defined as material costs which can be directly allocated to cost centers or cost units.

- **Indirect Material Cost:** All materials which are used as ancillary to production and which cannot be conveniently assigned to specific physical units is termed as indirect material e.g. oil, grease, consumable stores etc. According to CIMA London, "Indirect material cost is material cost which cannot be allocated but which can be apportioned to or absorbed by cost centres or cost units."[5]

Cost management is the process whereby companies use cost accounting to report or control the various costs of doing business.

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[2] Cushing, B.E., Accounting Information system and Business Organisation , (London, Addison Wesley), 2012.
[3] N.K. Prasad, Principles and Practices of Cost accounting(Book Syndicate Pvt. Ltd., Calcutta,2010).
[4] C.T. Horrngren,Introduction to Management Accounting,(Prentice-Hall,New Jersey,2011),p.118.
[5] Horngrer,op.cit.,p.208.

The term cost management is widely used in business today. Unfortunately cost management has no uniform definition. Cost management generally describes the approaches and activities of managers in short run and long run planning and control decisions that increase value for customers and lower costs of products and services[1]. For example, managers make decisions regarding the amount and kind of material being used charges of plant processes, and changes in product designs. Information from accounting systems helps managers make such decisions, but the information and the accounting systems themselves are not cost management[2].

Objectives of Materials Control

Material control can be defined as the systematic control concerned with procuring, storing and using of materials so as to minimize wastage and losses and at the same time avoiding excess investment in materials[3].

Objectives of Materials Control

- **To Ensure Continuity in Production:** The success of an undertaking depends upon the continuity in production. Stoppage of production has adverse impact not only in terms of restarting of production as in the case of furnaces but also in the cancellation of orders by the customers. Therefore, care must be taken to ensure that production is not stopped for want of raw materials and other sundry supplies.

- **To Purchase Requisite Quality of Materials:** The quality of finished goods depends upon the quality of raw materials used. Any purchase of inferior quality of materials lead to sub-standard production of goods which are likely to be rejected by customers[4]. At the same time, a very superior quality of materials should also be avoided as it may entail payment of high prices. This may lead to the increased cost of production and consequently increased selling price, which is also likely to be rejected by the customers.

- **To Eliminate Losses and Wastages:** Materials are subjected to rust, dust, dirt, moisture. Sometimes they are also lost due to theft and careless handling of materials. Hence, it must be the endeavour of material management to investigate the causes for the losses and wastage of materials and take prompt action to eliminate such losses.

- **To Avoid Overstocking of Materials:** Overstocking of materials lead to incurring of the following expenses:
    - **Capital Cost:** Any excess purchase of materials result in the sinking of capital in the purchase of materials which could otherwise yield a higher rate of return, if invested in profitable investment[5].
    - **Storage Cost:** Storage or excess quantity of materials require incurrence of additional amount of rent, heating, lighting etc.
    - **Equipment Cost:** Additional equipments such as bins, racks, etc. are required to store overstocked materials.
    - **Personal Cost:** Personal costs such as salaries and wages are to be paid for additional staff recruited for storing, stock verification security, etc.
    - **Obsolescence:** The higher the stock of materials, higher is the chances of obsolescence because they are kept in store room for longer duration.
    - Loss of Account of Deterioration and Evaporation in case of certain types of liquid materials[6].

- **To Avoid under Stocking of Materials :** The under stocking of materials results in the following consequences:
    - There is a danger in the stoppage of production for want of materials.

1   Gibbs, G., Accounting for Management Decisions, (Scranton, International Textbook), 2010.
2   Hartley, R.V., Cost and Managerial Accounting, (Boston, Allyn and Bacon, Inc.),2011.
3   Direct costing, 2011.
4   Applications of Direct Costing, 2010.
5   Moriarity , S.and C.P. Allen, Cost Accounting (New York , Haper and Row), 2011.
6   J.F. Weston and E.F. Bribham, op.cit.p.123-130.

- ▪ Stoppage in production results in delayed deliveries thereby leading to cancellation of orders.
  - ▪ While there may not be any revenue earned during the period of stoppage in production, it involves incurring of fixed expenses such as wages, rent etc.
- **Purchase at Reasonable Price:** Purchase of materials must be always at a reasonably low price. Otherwise a large amount of money is lost in purchasing the materials[1]. However, quality should not be scarified at the cost of lower price.
- **Knowledge about the Sources of Materials:** A good system of material control must facilitate ready availability of information about various sources of suppliers, so that the best terms of purchase can be resorted to.

Techniques of Material Control

The important techniques used to exercise control over materials are as follows:

- ABC analysis
- Level setting
- Economic order quantity
- Inventory turnover
- Stock checking and stock taking-perpetual inventory system.
- Input-Output ratio analysis.
- Classification and codification of materials.
- Miscellaneous techniques.
- New techniques of material control.

ABC Analysis or Selective Inventory Control

When this technique is used as a tool of material control, the materials are classified into three categories, designated as 'A' category materials, 'B' category materials and 'C' Category materials. The features of such materials can be stated as under:

Category 'A' Items: Small in number, high in usage value-the 'vital few' from a financial point of view.

Category 'B' Items: Medium number, medium usage value-normal items'.

Category 'C' Items: High number, low usage value-the 'trivial many'.

According to this technique a strict control is exercised over 'A' category material, perhaps under the supervision of an experienced person, a moderate control is exercised over 'B' category materials and relatively lesser degree of control over 'C' category materials. The object of carrying out ABC analysis is to develop policy guidelines for selective controls.

Level Setting

This technique of material control is helpful in avoiding overstocking and under stocking of materials in storeroom. The stock levels are fixed by the management and it is the duty of storekeeper to observe them. The various stock levels commonly fixed are as follows.

- **Maximum Level:** It is the level beyond which storage of raw materials are not allowed to go. The main purpose of this level is to avoid blocking up of capital unnecessarily on materials.

  Analysis of materials cost management in the companies under study:

- **Materials Consumed:** Table 1 Shows the materials consumed in the companies under study.

Table 1: Materials Consumed in Selected Public and Private Sector Companies under Study (From 2012-13 to 2016-17)

(Rs. in Crore)

Years	Public Sector		Private Sector	
	BHEL	SAIL	Tata Steel	L & T
2012-13	10069.31	14715.86	3743.14	11427.60
2013-14	15148.94	20470.04	6068.78	14498.48
2014-15	17295.34	17656.75	5663.82	14280.12

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[1]   Fourth Conference of Asian and Pacific Acountants, (New Delhi 1965),p.143

2015-16	19417.59	20639.99	6424.21	17807.43
2016-17	24549.35	23407.15	8223.89	22619.54
Average	**17296.10**	**19377.96**	**6024.77**	**16126.63**
S.D.	**5337.30**	**3305.96**	**1607.30**	**4275.63**
C.V. (%)	**30.85**	**17.06**	**26.68**	**26.51**

Source: Annual Reports and Accounts of the companies under study from 2012-13 to 2016-17

Table 1 shows the materials consumed in the selected public and private sector companies under study. It can be observed from the above table that the material consumed in **BHEL** showed an increasing trend throughout the period under study and it was because of increasing trend of production in BHEL. During the year 2012-13 the materials consumed was Rs. 10069.31 crores which kept on increasing and increased to Rs. 24549.35 crores in 2016-17. The average of the materials consumed in BHEL amounted to Rs. 17296.10 crores with standard deviation of Rs. 5337.30 crores. The coefficient of variation was 30.85 percent indicating a fluctuating trend which was mainly due to increasing trend of the materials consumed.

SAIL

It is evident from the above table that the materials consumed in SAIL showed a mixed fluctuating trend during the whole period of study. The materials consumed during the year 2012-13 was Rs. 14715.86 crores increased to Rs. 20470.14 crores in 2013-14 but decreased to Rs. 17656.75 crores in 2014-15 and then after it showed an increasing trend and increased to Rs. 23407.15 crores in 2016-17. The average material used in SAIL was Rs. 19377.96 crores with standard deviation of Rs. 3305.96 crores. The coefficient of variation of the materials used was 17.06 percent denoting a moderate fluctuating trend according to the materials used in the production.

Tata Steel

It can be visualized from the above table 3.1 that the materials consumed in Tata Steel registered a fluctuating trend during the period of study. It should be noted that materials consumed is a direct element of production and fluctuations are according to the production in the manufacturing unit. The materials consumed in Tata Steel fluctuated within the range of 8223.89 crores in 2016-17 to Rs. 3743.14 crores in 2012-13.The average of the materials used in Tata Steel amounted to Rs. 6024.77 crores during the period of study. The standard deviation was Rs. 1607.30 crores with coefficient of variation as 26.68 percent indicating a fluctuating trend which is quite obvious according to the usage of materials in the production.

L&T

It can be noted from the above table that the materials used in L&T showed an increasing trend throughout the period under study except in the year 2014-15 when the materials consumed marginally decreased. The amount of materials consumed during the year 2012-13 was Rs.11427.60 crores increased to Rs. 14498.48 crores in 2013-14 but marginally decreased to Rs. 14280.12 crores in 2014-15. The materials consumed increased to Rs. 17807.43 crores in 2015-16 and further to Rs.22619.54 crores in 2016-17. The average of the materials consumed was Rs. 16126.63 crores during the period under study with standard deviation of Rs. 4275.63 crores. The coefficient of variation was 26.51 percent denoting a fluctuating trend which cannot be controlled because the amount of materials consumed varies according to production where the materials consumed keeps an important place.

An overall study of materials consumed by all the companies under study reveals that the value of materials consumed showed an increasing trend during the period of study except in a few years where the value of materials consumed had marginally decreased. The increasing trend of materials consumed shows that all the companies under study are progressive as their production kept on increasing. The average was highest for SAIL followed by BHEL, L&T and Tata Steel. The coefficient of variation was highest in BHEL at 30.85 percent followed by Tata Steel at 26.68 percent, 26.51 percent in L&T and at 17.06 percent in SAIL.

Test of Significance for the Average of Materials Consumed Among the Companies under Study

To test the significance of the average of the material consumed, t test has been applied and the following hypotheses have been formulated.

- **Null Hypothesis (Ho) =** There is no significant difference in the mean values of the materials consumed by the companies under study.

- **Alternative Hypothesis (Ha) =** There is a significant difference in the mean values of the materials consumed by the companies under study.

  For the purpose of carrying out the t test the comparison has been done in the following manner

- **Between BHEL and SAIL**

  Computed value of t =0.74

  Critical value of t at 5 percent level of significance (for V=8) is 2.306

  Decision: Since the computed value of t is less than the critical value of t at 5 percent level of significance, hence the null hypothesis is accepted and it can be concluded that the difference in the mean values of the materials consumed by BHEL and SAIL is not significant.

- **Between BHEL and Tata Steel**

  Computed value of t = 4.52

  Critical value of t at 5 percent level of significance (for V=8) is 2.306

  Decision: As the computed value of t is greater than the critical value of t at 5 percent level of significance, hence there is no evidence of accepting the null hypothesis. Therefore, the alternative hypothesis is accepted and it is concluded that the difference in the mean values of the materials consumed between BHEL and SAIL is significant.

- **Between BHEL and L&T**

  Computed value of t = 0.38

  Critical value of t at 5 percent level of significance (for V=8) is 2.306

  Decision: The calculated value of t (0.38) is less than the table value of t (2.306) at 5 percent level of significance. Therefore, the null hypothesis is accepted and it may be concluded that the difference in the average values of the materials consumed between BHEL and L&T is insignificant.

- **Between SAIL and Tata Steel**

  Computed value of t = 6.11

  Critical value of t at 5 percent level of significance (for V=8) is 2.306

  Decision: The null hypothesis is rejected because the computed value of t is greater than the table value at 5 percent level of significance. Hence, the alternative hypothesis is accepted and it is concluded that the difference between the mean values of materials consumed of SAIL and Tata Steel is significant.

- **Between SAIL and L&T**

  Computed value of t = 1.35

  Critical value of t at 5 percent level of significance (for V=8) is 2.306

  Decision: As the computed value of t is less than the critical value of t at 5 percent level of significance, hence the null hypothesis is accepted and it is concluded that the difference between the mean values of materials consumed of SAIL and L&T is not significant.

- **Between Tata Steel and L&T**

  Computed value of t = 4.04

  Critical value of at 5 percent level of significance (for V=8) is 2.306

  Decision: Since the computed value of t is more than the critical value of t at 5 percent level of significance, hence the null hypothesis is rejected and it is concluded that the difference in the mean values of the materials consumed of Tata Steel and L&T is significant.

Test of Significance of the Variance of Materials Consumed in the Companies under study (F Test)

Two F test has been applied to find whether the difference in the materials used by the companies under study and following hypotheses have been tested

- **Null Hypothesis(Ho):** There is no significant difference in the materials consumed between the companies under study.

- **Null Hypothesis (Ho):** There is no significant difference in the materials consumed within the companies under study.

Table 2: ANOVA

Source	Sum	Degree of Freedom (d.f.)	Variance (Sum /d.f)	F Ratio
Between Companies (SSC)	530.68	(c-1)=(4-1)=3	176.89	F= 54.26 (Between Companies)
Within Companies(SSR)	202.49	(r-1)=(5-1)=4	50.62	F= 15.52 (Within Companies)
Error	39.11	(c-1)(r-1)=12	3.26	

- **F Test Between the Companies**

$$F= \frac{\text{Higher Variance}}{\text{Smaller Variance}}$$

$$= \frac{176.89}{3.26} = 54.26$$

Critical value of F at 5 percent level of significance (for V1=3 & V2=12) =3.49

Decision: As the computed value of F is more than the critical value of F at 5 percent level of significance, hence the null hypothesis is rejected and it is concluded that the difference in the materials consumed between the companies under study is significant.

- **F Test Within the Companies**

$$F= \frac{\text{Higher Variance}}{\text{Smaller Variance}}$$

$$= \frac{50.62}{3.26} = 15.52$$

Critical value of F at 5 percent level of significance (for V1=4 & V2=12)=3.26

Decision: Since the computed value of F is greater than the table value of F at 5 percent level of significance. Therefore, the null hypothesis is rejected and alternative hypothesis is accepted and it is hereby concluded that the difference in the materials consumed within the companies under study is significant.

Revaluation Materials Consumed in the Companies under Study

The revaluation material consumed in the companies under study has been shown in the following table 3:

Table 3:Revaluation Materials Consumed in Base Year (2012-13) Prices in Selected Public and Private Sector Companies under study (From 2012-13 to 2016-17)

(Rs. in Crore)

Years	Public Sector		Private Sector	
	BHEL	**SAIL**	**Tata Steel**	**L & T**
2012-13	10069.31	14715.86	3743.14	11427.60
2013-14	14269.24	19281.34	5716.36	13656.55
2014-15	15937.65	16270.70	5219.21	13159.13
2015-16	16927.48	17993.12	5600.37	15523.80
2016-17	19952.98	19024.63	6684.13	18384.48
Average	15431.33	17457.13	5392.64	14430.31
S.D.	3641.49	1936.12	1068.50	2648.68
C.V. (%)	23.60	11.09	19.81	18.35

Source: Computed on the basis of whole sale price index issued by RBI.

Table 3 shows the revaluation of materials consumed in the selected public and private sector companies under study with the base year as 2012-13. On the basis of this table it can be concluded that in **BHEL** the value of material consumed showed an increasing trend during the whole period of study because the revalued amount of material used in BHEL during the year 2012-13 was Rs.10069.31 crores increased to Rs. 14269.24 crores in 2013-14 and after a continuous increase it reached to Rs. 19952.98 crores in 2016-17.The average of the revalued material used was Rs. 15431.33 crores with standard deviation of Rs. 3641.49 crores. The coefficient of variation was 23.60 percent denoting a moderate fluctuating trend of the materials consumed.

SAIL

It can be noted from the above table the value of revalued materials used in SAIL a fluctuating trend during the whole period of study like the value of raw material originally used. During 2012-13 the amount of revalued material in SAIL was Rs. 14715.86 crores increased to Rs. 19281.34 crores in 2013-14 but decreased to Rs. 16270.70 crores in 2014-15. The amount of revalued materials increased to Rs. 17993.12 crores in 2015-16 and further to Rs.19024.63 crores in 2016-17. The average of the revalued material used in SAIL was Rs. 17457.13 crores with standard deviation of Rs. 1936.12 crores. The coefficient of variation was 11.09 percent denoting a consistent trend of the revalued material used in the company.

Tata Steel

It can be observed from the above table that the value of revalued material consumed by Tata Steel showed a fluctuating trend throughout the period of study. The amount of revalued materials used in 2012-13 was Rs. 3743.14 crores increased to Rs. 5716.36 crores in 2013-14 but decreased to Rs. 5219.21 crores in 2014-15. The value of revalued materials used increased to Rs. 5600.37 crores in 2015-16 and further to Rs. 6684.13 crores in 2016-17. The average of the revalued materials used was Rs. 5392.64 crores for the period of study. The standard deviation was Rs. 1068.50 crores with coefficient of variation as 19.81 percent.

L&T

It can be noted from the above table 3.2 that the value of revalued materials used in L&T showed an increasing trend during the whole period of study except in the year 2014-15. Initially, during 2012-13 the value of revalued material used in L&T was Rs. 11427.60 crores increased to Rs. 13656.55 crores in 2013-14 but decreased to Rs. 13159.13 crores in 2014-15. The value of revalued material increased to Rs. 15523.80 crores in 2015-16 and reached to Rs. 18384.48 crores in 2016-17. The average of the revalued material in L&T was Rs. 14430.31 crores with standard deviation of Rs. 2648.68 crores. The coefficient of variation was 18.35 percent denoting a moderate fluctuating trend of revalued material used.

An overall comparison of the revalued materials used by the companies under study reveals that the average of the revalued material used was highest in SAIL at Rs. 17457.13 crores followed by BHEL at Rs. 15431.33 crores, L&T at Rs.14430.31 crores and Tata Steel at Rs. 5392.64 crores. The coefficient of variation was highest for BHEL followed by Tata Steel, L&T and SAIL.

Test of Significance for the Average of Revalued Materials Consumed Among the Companies under Study

To test the significance of the average of the revalued material consumed t test has been applied and the following hypotheses have been formulated:

- **Null Hypothesis (Ho):** There is no significant difference in the mean values of the revalued materials consumed by the companies under study.

- **Alternative Hypothesis (Ha):** There is a significant difference in the mean values of the revalued materials consumed by the companies under study.

  For the purpose of carrying out the t test the comparison has been done in the following manner

- **Between BHEL and SAIL**

  Computed value of t =1.10

  Critical value of t at 5 percent level of significance (for V=8) is 2.306

  Decision: Since the computed value of t is less than the critical value of t at 5 percent level of significance, hence the null hypothesis is accepted and it can be concluded that the difference in the mean values of the revalued materials consumed by BHEL and SAIL is not significant.

- **Between BHEL and Tata Steel**

  Computed value of t = 5.91

  Critical value of t at 5 percent level of significance (for V=8) is 2.306

  Decision: As the computed value of t is greater than the critical value of t at 5 percent level of significance, hence there is no evidence of accepting the null hypothesis. Therefore, the alternative hypothesis is accepted and it is concluded that the difference in the mean values of the revalued materials consumed between BHEL and SAIL is significant.

- **Between BHEL and L&T**

  Computed value of t = 0.50

  Critical value of t at 5 percent level of significance (for V=8) is 2.306

  Decision: The calculated value of t (0.50) is less than the table value of t (2.306) at 5 percent level of significance. Therefore, the null hypothesis is accepted and it may be concluded that the difference in the average values of the revalued materials consumed between BHEL and L&T is insignificant.

- **Between SAIL and Tata Steel**

  Computed value of t = 12.20

  Critical value of t at 5 percent level of significance (for V=8) is 2.306

  Decision: The null hypothesis is rejected because the computed value of t is greater than the table value at 5 percent level of significance. Hence, the alternative hypothesis is accepted and it is concluded that the difference between the mean values of revalued materials consumed of SAIL and Tata Steel is significant.

- **Between SAIL and L&T**

  Computed value of t = 2.06

  Critical value of t at 5 percent level of significance (for V=8) is 2.306

  Decision: As the computed value of t is less than the critical value of t at 5 percent level of significance, hence the null hypothesis is accepted and it is concluded that the difference between the mean values of revalued materials consumed of SAIL and L&T is not significant.

- **Between Tata Steel and L&T**

  Computed value of t = 7.07

  Critical value of t at 5 percent level of significance (for V=8) is 2.306

  Decision: Since the computed value of t is more than the critical value of t at 5 percent level of significance, hence the null hypothesis is rejected and it is concluded that the difference in the mean values of revalued materials consumed of Tata Steel and L&T is significant.

Ratio of Materials Consumed to Sales

The ratio of materials consumed to sales of the companies under study has been shown in the following table 4.

Table 4: Ratio of Materials Consumed to Sales in Selected Public and Private Sector Companies under study (From 2012-13 to 2016-17)

(Ratio in Percentage)

Years	Public Sector		Private Sector	
	BHEL	**SAIL**	**Tata Steel**	**L & T**
2012-13	47	32	17	45
2013-14	54	42	23	42
2014-15	51	40	21	38
2015-16	45	43	20	40
2016-17	50	46	22	42
Average	49.4	40.6	20.6	41.4
S.D.	3.507	5.272	2.30	2.607
C.V. (%)	7.10	12.98	11.16	6.30

Source: Annual Reports and Accounts of the companies under study from 2012-13 to 2016-17

Table 4 shows the ratio of material consumed to sales in the selected public and private sector companies under study. It can be noted from the above table that the ratio of material consumed to sales in **BHEL** showed a mixed fluctuating trend during the period of study. The materials used during the year 2012-13 was 47 percent which increased to 54 percent in 2013-14 but decreased to 51 percent in 2014-15 and further to 45 percent in 2015-16. This ratio increased to 50 percent in 2016-17. The average of the ratio of materials used to sales was 49.4 percent which is very high and it is suggested that the management of BHEL should try to control and reduce the ratio of materials used to sales to decrease the cost of production and increase the profit margin. The standard deviation was 3.507 percent while the coefficient of variation was 7.10 percent denoting a consistent trend but this consistency should be maintained after decreasing the proportion of materials to sales.

SAIL

It is evident from the above table that the ratio of materials consumed to sales in SAIL registered an increasing trend during the whole period of study except in the year 2014-15. The ratio of materials used to sales in SAIL during the year 2012-13 was 32 percent increased to 42 percent in 2013-14 but marginally decreased to 40 percent in 2014-15. The ratio of materials consumed to sales increased to 43 percent in 2015-16 and further to 2016-17. The average of the materials used to sales for the period of study in SAIL was 40.6 percent which is though reasonable but the management of the company should try to reduce it. It is further suggested that the increasing trend of the ratio of materials used to sales should be controlled by the management. The standard deviation was 5.27 percent and the coefficient of variation was 12.98 percent denoting a consistent trend which should be followed in future also but the ratio of cost of materials used to sales should be kept under control.

Tata Steel

Table 4 shows that the ratio of the cost of material used to sales in Tata Steel showed a fluctuating trend during the period of study and fluctuated within the range of 23 percent in 2013-14 to 17 percent in 2012-13. The average of the cost of material used to sales for the period of study was 20.6 percent which is quite satisfactory with the standard deviation as 2.30 percent. The coefficient of variation was 11.16 percent indicating a consistent trend in the ratio of the cost of material used to sales. It is suggested that the management of the company should try to follow the same policy in future also.

L&T

It is evident from the table 3.4 that the ratio of the cost of material consumed to sales in L&T showed a decreasing cum increasing trend throughout the period of study. The ratio of the cost of material consumed to sales during the year 2012-13 was 45 percent which decreased to 42 percent in 2013-14 and further to 38 percent in 2014-15. This ratio increased to 40 percent in 2015-16 and again to 42 percent in 2016-17. The average of the ratio of the cost of material consumed to sales was 41.4 percent which seems to be reasonable but, however, it is suggested that the increasing trend of the ratio of cost of material should be controlled and the management of the company should try to reduce the ratio of the cost of material used to sales to increase the profitability. The standard deviation was 2.61 percent with the coefficient of variation as 6.30 percent denoting a stable trend of the ratio of material consumed to sales. It is however, suggested that the management of the company should try to follow the same policy in future and control the increasing trend of the ratio.

Test of Significance for the Average Ratio of Material Consumed to Sales of the Companies under Study

To test the significance of the average ratio of material consumed to sales of the companies under study, t test has been applied and the following hypotheses have been formulated and tested:

- **Null Hypothesis (Ho):** There is no significant difference in the average ratio of material consumed to sales of the companies under study.

- **Alternative Hypothesis (Ha):** There is a significant difference in the average ratio of material consumed to sales of the companies under study

    For the purpose of carrying out the t test the comparison has been done in the following manner

- **Between BHEL and SAIL**
  Computed value of t =3.11
  Critical value of t at 5 percent level of significance (for V=8) is 2.306

  Decision: Since the computed value of t is more than the critical value of t at 5 percent level of significance, hence the null hypothesis is rejected and it can be concluded that the difference in the average of the material consumed to sales ratio between BHEL and SAIL is significant.

- **Between BHEL and Tata Steel**
  Computed value of t = 15.36
  Critical value of t at 5 percent level of significance (for V=8) is 2.306

  Decision: As the computed value of t is more than the critical value of t at 5 percent level of significance, hence there is no evidence of accepting the null hypothesis. Therefore, null hypothesis is rejected and it is concluded that the difference in the average ratio of material consumed to sales between BHEL and SAIL is significant.

- **Between BHEL and L&T**

  Computed value of t = 4.09

  Critical value of t at 5 percent level of significance (for V=8) is 2.306

  Decision: The calculated value of t (4.09) is more than the table value of t (2.306) at 5 percent level of significance. Therefore, the null hypothesis is rejected and it may be concluded that the difference in the average ratio of material consumed to sales between BHEL and L&T is significant.

- **Between SAIL and Tata Steel**

  Computed value of t = 7.78

  Critical value of t at 5 percent level of significance (for V=8) is 2.306

  Decision: The null hypothesis is rejected because the computed value of t is more than the table value at 5 percent level of significance. Hence, the alternative hypothesis is accepted and it is concluded that the difference between the mean values of material consumed to sales of SAIL and Tata Steel is significant.

- **Between SAIL and L&T**

  Computed value of t = 0.30

  Critical value of t at 5 percent level of significance (for V=8) is 2.306

  Decision: As the computed value of t is less than the critical value of t at 5 percent level of significance, hence the null hypothesis is accepted and it is concluded that the difference between the mean values of material consumed to sales of SAIL and L&T is not significant.

- **Between Tata Steel and L&T**

  Computed value of t = 13.38

  Critical value of at 5 percent level of significance (for V=8) is 2.306

  Decision: Since the computed value of t is more than the critical value of t at 5 percent level of significance, hence the null hypothesis is rejected and it is concluded that the difference in the mean values of material consumed to sales ratio between Tata Steel and L&T is significant.

Variance (Adverse) from the Bench Mark

The variance from the bench mark of the ratio of materials consumed to sales in the companies under study has been shown in the following table 3.5

Table 5: Adverse Variance from the Bench Mark of Material Consumed to Sales in Selected Public and Private Sector Companies (From 2012-13 to 2016-17)

(in Base Year Prices)

Years	Public Sector		Private Sector	
	BHEL	**SAIL**	**Tata Steel**	**L & T**
2012-13	2	0	0	7
2013-14	9	10	6	4
2014-15	6	8	4	0
2015-16	0	11	3	2
2016-17	5	14	5	4

Table 5 shows the computation of the variances from the bench mark of the ratio of material consumed to sales. These variances will refer to adverse variance because the variances have been computed from the minimum ratio of direct material consumed to sales. It can be noted from the above table that in **BHEL** the adverse variance was 2 in the year 2012-13 which increased to 9 in the year 2013-14 and came down to 6 in 2014-15. During the year 2015-16 it was nil because the ratio of direct material to sales was taken as the base. The adverse variance during the year 2016-17 increased to 5 during the year 2016-17. It is suggested that the management of the company should try to control the extent of the adverse variance and try to keep it at minimum level.

SAIL

In SAIL the adverse variance from the base year 2012-13 showed significant fluctuations. The adverse variance during the year 2013-14 was 10 which decreased to 8 in the year 2014-15 and further increased to 11 in the year 2015-16. The adverse variance reached to 14 in the year 2016-17. The extent of variation in the adverse variance in SAIL was high which should be kept under control and the management of the company should try to minimize it.

Tata Steel

The adverse variance of the ratio of direct materials to sales from the base year bench mark of the base year 2012-13 showed a decreasing trend as the adverse variance during the year 2013-14 was 6 which decreased to 4 in the year 2014-15 and further to 3 in the year 2015-16. The adverse variance marginally increased to 5 in the year 2016-17. The decreasing trend of the adverse variance can be regarded favourable for the company and it indicates that the management of the company had a proper control over the adverse control.

L&T

The base year for the computation of adverse variance of the ratio of direct materials consumed to sales was 2014-15 because in this year the ratio of direct materials used to sales was the lowest. The adverse variance during the year 2012-13 was 7 which decreased to 4 in the year 2013-14. During the year 2015-16 the adverse variance was 2 but increased to 4 in the year 2016-17. Though the adverse variance of the ratio of direct materials used to sales was kept by the management under control but however, it is suggested that the management of the company should try to keep it at its minimum level.

Conclusion

The important role is played by material cost in the total cost structure of a product. It starts right from the designing stage and ends with optimum consumption of, and proper accounting for materials. An efficient system of materials control will lead to a significant reduction in production cost.

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