

EMPIRICAL STUDY ON MATERIALS MANAGEMENT OF WATER TREATMENT PLANT

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ABSTRACT

Construction industry plays a vital role in the overall development of a country, as it creates huge investment opportunities, but due to improper management within the industry a lot of these opportunities are not utilized completely. Time overrun and cost overrun are two of the major factors plaguing this industry which ultimately leads to wasted investment. One of the most critical elements of the construction industry is management of materials, as the cost of materials used constitutes to about 60% of the total construction cost. So, mismanagement of materials often leads to material wastage and huge losses to the project. In this research, we have worked on the analysis of management of materials used for the construction of a Water Treatment Plant using various tools and techniques such as “ABC Analysis”, “Earned Value Analysis” and “VED Analysis”. Through our analysis we observed that the project was behind schedule and over budget. This could have been avoided if more efficient techniques were used.

Keywords: ABC Analysis, Earned Value Analysis, VED Analysis, Water Treatment Plant.

ARTICLE INFO

Article History

Received: 23rd May 2022

Received in revised form :

23rd May 2022

Accepted: 25th May 2022

Published online :

26th May 2022

I. INTRODUCTION

Materials management is an integrated process consisting of individuals, organizations, technology and procedures which helps to identify, measure, obtain, accelerate, check, transport, receive, store and preserve materials, equipment and other related information throughout the life-cycle of the project. It is interrelated with the processes and stages of construction projects which it depends on various other factors that have high uncertainty.

Materials management is vital in the construction industry as it has an important role in the progress of the economic growth of a country, the more difficulties from construction projects show greater demand for construction managers to deliver projects on time, in a planned budget and with high quality. The obstacles faced by the construction industry in developing countries are a matter of continuous delay and overruns because of improper management of materials. Management of Materials includes material planning and forecasting, vendor evaluation and selection, purchasing, expenditure, shipping, material receiving, warehousing and

material inventory and material distribution. The construction project has unstructured communication and there is no clear responsibility between the parties, this increases the challenge of implementing an effective materials management. MM is related to campus planning and for the movement of materials, or with those who deal with the real mechanism of the supply chain. Especially, this includes the acquisition of spare parts and replacement, the purchase section of quality control, and the principal involved in ordering, shipping, and warehousing materials needed for construction. The right materials management can reduce delays. Because of delays, there will be an increase in project costs.

The reason for construction materials to be an important part of the construction project is that the cost for material handling can range from 60 - 80% of the total construction costs. MM can be considered a major uncertainty in construction projects. Therefore, ineffective material management can cause losses that cannot be avoided for construction projects.

A number of studies have been carried out in the field of construction projects, revealing that most projects turn

blind eye to materials management techniques. A bad materials management system can increase the overall cost and delay planned schedule, also shortage of material will also reduce labour productivity. Materials management can be said to be that process which coordinates, supervises and executes the tasks associated with the flow of materials.

BACKGROUND

In the construction industry, one of the general challenges faced by people is a problem with inventory and materials management in place. As the contract size increases, so does the scale of materials management activities. Change in the procedure, installation and use of new information technology with the increasing managerial practices to the point where the decision model in everyday use is known to stress the organization that pursues the improvement in materials management.

Material management is planning and control of all efforts needed to ensure that the quantity and quality of materials and equipment installed is properly determined, obtained at a reasonable and available cost if needed. Thus, effective management systems can be vital for the success of any construction company. Material management is considered as one of the most important management fields in the current situation of price increases, lacks, low productivity etc.

MATERIAL PROCUREMENT CYCLE

Procurement material is an important aspect of the construction process because contractors will usually be flooded with demand from suppliers to supply goods and services. Therefore, they must order materials that are in harmony with client and contracting purposes.

Developing the most appropriate purchase strategies will involve selection of material suppliers in accordance with various criteria that tend to include shipping speed, cost, quality, specific project constraints, risks, ownership and asset financing.

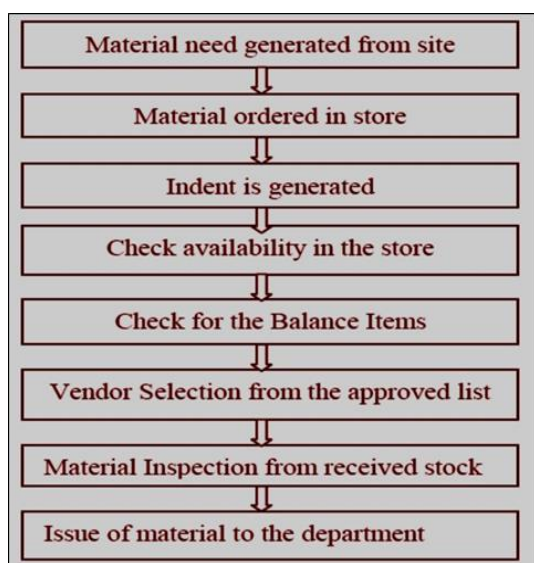


Figure 1.1: Process of Material Procurement

II. LITERATURE REVIEW

Deepak Karoriya et al. stated that construction material cost is one of the major costs of the total costs in a construction project as it constitutes about 50 percent of the total cost. The main aim of materials management is to make sure that there is no shortage of materials when needed, so a proper material procurement is the key to successful completion of project. EOQ plays a major role in minimizing the wastage in construction sites and thereby enhancing the cost aspect of the project. EOQ requires systematic planning and controlling of the construction works and is found to save a substantial amount of the project cost if implemented efficiently.

P. Ezhilmathi et al. discussed the scheme of Material Management for Construction Site and by applying the inventory control technique so as to analyse the effect of material management on constructions projects. Also gaining a stronger research design and achieving more valid and reliable findings. The methodology used was to compare Planned Vs. Actual material consumption using MSP software then to find the problems in planning, purchasing, procurement & to suggest remedies regarding the material management. S Curve Analysis was used for comparison of planned and actual cost of construction material. Reasoning over S curve Analysis. Apply inventory control technique so as to minimize the total cost of inventory using EOQ analysis.

In the research Sayali Shet et al. stated that the efforts should be made to reduce the cost of materials with the identification of estimation with materials requirement, procurement, storage, inventory control, disposal of surplus materials and scrap. The methodologies used were ABC analysis, VED analysis and SDE analysis which gives inventory value, priority to utility and availability of materials respectively.

In the research D. Deepak et al, found that inventory management is nothing but keeping sufficient supply so as to meet unexpected demands. This could include anything from raw materials, work in progress, finished products, or spares and other indirect materials. Materials management efficiency acts as an indicator of the company's management prowess. Optimal policies and procedures for procurement of commodities is devised by Inventory management. In real case scenarios, it is not possible to refill the stocks immediately so inventories are maintained.

Khyomesh V. Patel et al, stated in the research that the material management can be defined as a process that coordinates planning, assessing the requirement, sourcing, purchasing, transporting, storing and controlling of materials, minimizing the wastage and optimizing the profitability by reducing cost of material. Building materials account for 60 to 70 percent of direct cost of a project or a facility, the remaining 30 to 40 percent being the labour cost. Thus, Materials management is an important element in project management. Materials represent a major expense in

construction, so minimizing procurement costs improves opportunities for reducing the overall project costs.

Praveen DP et al. discussed about effective management and control of materials which helped in achieving the overall increase the productivity by using various inventory, control and monitoring techniques such as ABC analysis, VED analysis, HML analysis, EOQ analysis and S-Curve technique. They observed that the quantity of work should be planned and procured based on above mentioned techniques, also discussed about the deviation of project based on time and cost to improve the overall productivity of the project by minimizing the wastage.

In the research C.K. Georgekutty et al. stated that a project is said to be successful only when it is finished in time, is within the budget and of required quality. In this paper, the problematic areas of the current scenario are exploited. The major objective is to find whether the processes practiced in the construction such as implementation, technical competency, slippages, setbacks, technology adoption, methodology are sound or not. The method used for this research is that a questionnaire survey was performed in a few projects in Kerala. The data obtained is then analysed by SPSS (Statistical Package for Social Sciences) and the results were examined in detail. The results obtained imply that, majority of the failures were due to the adoption of inappropriate Engineering and Management technology, especially in Kerala.

III. RESEARCH ANALYSIS

3.1 ABC ANALYSIS

The grouping of all materials used in production which require the highest attention, materials which require medium attention and materials which require the least attention such that the control mechanism be focused on a selective class of materials is called selective inventory control. Thousands of items are kept in inventory. Periodic reviews of inventories of items have to be taken under for effective inventory control. An equally critical analysis of all items is very expensive and time- consuming.

Material classification concerning a particular function under examination is the solution. Among the methods that are available for classification, ABC analysis is most commonly used. This method is very well suited for the construction industry and is also being used very widely.

ABC analysis is a method used to classify a material's stock items into three categories – A, B and C based on their value to the project. 'A' item is the most important in terms of the value they bring a company, whilst 'C' items are the least valuable. The objective of ABC inventory analysis is to help managers focus their time on their most valuable/important products and adapt their inventory control policies accordingly.

3.2 EARNED VALUE ANALYSIS

Earned Value Analysis (EVA) is a method that allows the project manager to measure the amount of work performed on a project beyond the basic review of cost and scheduled

reports. EVA provides a method that permits the project to be measured by the progress achieved. The project manager is then able, using the progress measured, to forecast a project's total cost and date of completion, based on trend analysis or application of the project's "burn rate". This method relies on a key measure known as the project's earned value.

This a measure which enables the project manager to compute performance indices or burn rates for cost and schedule performance, which provides information on how well the project is doing or performing relative to its original plans. These indices, when applied to future work, allow for to project manager to forecast how the project will do in the future, assuming the burn rates will not fluctuate, which oftentimes is a large assumption. The formulae for calculation used in Earned Value Analysis are as follows:

- i. Schedule Variance is computed for Class A material items which is given

$$SV = BCWP - BCWS$$

- ii. Schedule Performance Index is calculated using the formula

$$SPI = BCWP / BCWS$$

- iii. Cost Variance is computed for Class A material items which is given

$$CV = BCWP - ACWP$$

- iv. Cost Performance Index is calculated using the formula

$$CPI = BCWP / ACWP$$

Where,

ACWP - Actual Cost of Work Performed

BCWP - Budgeted Cost of Work Performed

BCWS - Budgeted Cost of Work Scheduled

- v. Budget at Completion (BAC) is calculated as the sum of all budgets allocated which is always equal to Project Total Planned Value.

- vi. Estimate at Completion (EAC) is the best way to estimate the total project cost at project completion, it is calculated as

$$EAC = BAC / CPI$$

3.3 VED ANALYSIS

VED-vital, essential, desirable, analysis is used primarily for control of spare parts. The spare parts can be divided into three categories-vital, essential and desirable, keeping in view the criticality to production. The spares, the stocks out of which even for a short time will stop production for quite some time and where the cost of stock out is very high, are known as vital spares. The spares, the absence of which cannot be tolerated for more than a few hours or a day and

the cost of lost production is high and which are essential for the production to continue, are known as essential spares. The desirable spares are those spares which are needed but their absence for even a week or so will not lead to stoppage of production. Some spares, though negligible in monetary value, may be vital for the production to continue and require constant attention. Such spares may not receive the attention they deserve if they are maintained according to ABC analysis because their value of consumption is small. So, in their cases, VED analysis is made to get effective results.

VED analysis is an inventory management technique that classifies inventory based on its functional importance. It categorizes stock under three heads based on its importance and necessity for an organization for production or any of its other activities. VED analysis stands for Vital, Essential, and Desirable.

IV. CONCLUSION

It is evident from this research that proper and systematic management of the materials and resources right from planning and designing to phase to execution phase is of great importance to the successful completion of any project both with respect to time and cost.

This study reveals that an upgradation is needed in the general material handling policy for more efficient and effective execution process. This upgraded material handling policies can significantly improve the project performance in terms of cost, time and quality.

Resource management is a daily activity and maintaining it properly often leads to near accurate budgetary forecasting. Use of appropriate materials management methods helps an organization save substantial amount of time and money in a project. Proper coordination and communication between the organization and site should be set up and a centralized material management plan should be adopted. Resource coding system should be adopted in order to track and monitor correct movement and supply of materials.

Through our rigorous analysis, we observed that the management of materials in the construction of Water Treatment Plant was that the techniques were not effectively followed which resulted in the cost overrun and delay in the execution of the project. This was observed by Earned Value Analysis. Also, ABC and VED analysis simplified the materials procurement process by categorising the materials based on different parameters.

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