A PROACTIVE STUDY ON MATERIAL MANAGEMENT TECHNIQUES IN CONSTRUCTION INDUSTRY

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ABSTRACT- Construction industry is an industry, which is involved in the planning, execution and evaluation (monitoring) of all types of civil works. Physical infrastructures such as buildings, communication & energy related construction works, water supply & sewerage civil works etc. are some of the major projects in the construction industry. Construction industry plays an important role in social, economical & political development of a country. The industry has been experiencing such problems as managing and minimizing wastage of construction materials due to lack of effective management and planning. This project work is on the analysis of factors affecting effective materials management in building construction industry. Having the right materials in the right place at the right time is important for effective execution of a building project. In recent years with the competition in the construction market is fierce increasingly, profit margin of construction enterprises is getting smaller and smaller, and cost control of construction projects becomes more and more important. The total cost of materials may be up to 60% or more of the total cost incurred in construction project dependent upon the type of project. Effective construction materials management is a key to success for a construction project. The control of construction project cost becomes one of the cores in project management. Construction project management is a systematic, comprehensive, dynamic subject, requiring construction project manager to regularize and standardize the organization, goal, quality, safety, and cost of construction project. Construction waste is another serious problem in construction industry. A large and various types of construction waste with different characteristics are created at all the stages of construction. Construction industries have a larger part in contributing environmental problems. The economic and environmental benefits must be gained from construction waste minimization. This project presents a review on systematically investigation of the management of construction materials in the industry. It was recommended that organizations should incorporate materials management in the overall policy of the firms in order to eliminate some of these problems. The efficient procurement of material represents a key role in the successful completion of the work. Poor planning and control of material, lack of material when needed, poor identification of material, re-handling and inadequate storage cause losses in labor productivity and overall delays that can indirectly increase total project cost. Effective management of materials can reduce these costs. This project is to explore the current practices of Material Management, it gives the Qualitative information regarding deviation in planned and actual materials in terms of S curve analysis using MSP tool and reasoning over the deviation is essential to know the effect of material planning before execution of project. Various comments on S curve analysis have given in terms of problems of administrative causes, consultant’s causes, contractor’s faults, and unavailability of resources. These major reasons of changes represented in terms of pie chart. To maintain sufficient stock of raw material in period of short supply, to protect inventory against deterioration and control investment in inventories and to keep it in an optimum level an inventory control techniques such as ABC and EOQ analysis is carried out to overcome the problems of stock out.

1. INTRODUCTION

Construction Industry is Largest Economic Expenditure in India. According to eleventh five year plan, it is the second largest economic activity after agriculture. Materials management is an important element in project management. Effective construction materials management process is a key to success of a construction project. For many years it has evolved and changed with respect to the ever growing complexity of projects. It is very important to understand the origin of materials management procedures and how these procedures differ from those of other industries. Materials constitute a major cost component for construction Industry. The total cost of materials may be 60% or more of the total cost incurred in construction project dependent upon the type of project and the extent of mechanization and
such a large investment requires considerable planning and control so as to minimize wastage which invariably affects the performance of the organization. Materials management is a coordinating function responsible for planning and controlling materials flow. One of the major problems in delaying construction projects is poor materials management. Ensuring a timely flow of materials is an important concern of material management. The management of procuring materials is critical as any materials surpluses or shortages will delay the project and put it at risk. This then affects the maintenance of a consistent flow of materials for production, thus affecting the overall project.

2. THEORETICAL BACKGROUND

Materials Management is simply the process by which an organization is supplied with the goods and services that it needs to achieve its objectives of buying, storage and movement of materials. Basically, material management is concerned with the planning, identification, procuring, storage, receiving, and distribution of materials. The purpose of material management is to assure that the right materials are in the right place, in the right quantities when needed. The increased economic growth as well as urbanization has led into extensive construction activities that generate large amounts of construction wastes.

Benefits of study:
• Improvements in labor productivity
• Improvements in project schedule
• Quality control
• Better field material control
• Better relations with suppliers
• Better handling of material
• Reduction in duplicated orders
• Material is on site when needed and in the quantities required
• Reducing the overall costs of material

3. LITERATURE REVIEW

In 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 labor cost

1. Measuring Effectiveness of Materials Management Process: Material management planning and controlling is to ensure the required quantity, quality of construction materials and installed equipment, planned in the schedule and are acquired at equitable cost when required” - James K. Plemmmons and Lansford C. Bell (1995).

2. Material Management Techniques on Construction Project: In this paper stated that the efficient procurement of material represents a key role in the successful completion of the work. Poor planning and control of material, lack of material when needed, poor identification of material, re-handling and inadequate storage cause losses in labour productivity and overall delays that can indirectly increase total project cost. – Patil and Pataskar (2014).

3. Material procurement and storage on construction sites need to be properly planned and executed to avoid the negative impacts of material shortage or excessive material inventory on-site deficiencies in the supply and flow of construction material were often cited as major causes of productivity degradation and financial losses (G.Kanimozhim et al. 2014).

05. A properly implemented materials management program can achieve the timely flow of materials and equipment to the jobsite, and thus facilitate improved work face planning, increased labor productivity, better schedules, and lower project costs. (S. Sabihuddin).

4. MATERIAL MANAGEMENT

Material management is defined as the process to provide right material at right place at right time in right quantity so as to minimize the cost of project. Material management is concerned with the planning, identification, procuring, storage, receiving and distribution of material. The responsibility of Material management department for the flow of material from the time the material is ordered, received, and stored until they are used is the basic responsibility of material management. The main goal of material management is to ensure that the materials are available at their point of use when needed hence, efficient procurement of material represents a key role in the successful completion of the work.

VENDOR SELECTION AND EVALUATION
• Formal procedures used for the taking of quotations.
• Vendor selection will be done based on the quotes and profile
• Vendor performance monitored
• Commitments and schedule requirements computerized
• Use of quality evaluation on vendors

FUNCTIONS OF MATERIAL MANAGEMENT

The functions of material management are discussed below:

In order to fulfill the objectives of material management as stated above to meet the basic objectives and goals, the functions of the material
management are also categorized as primary and secondary functions.

**Advantages of Material Management**
The Advantages of material management are as follows:
- Systematic operations
- Reduction in cost of material handling
- Reduction in overall cost of the project
- Increase in productivity of the labors
- Time management
- Quality control
- Better relations with suppliers
- Better relations with customers

### 5. MATERIAL MANAGEMENT TECHNIQUES

Materials management is categorized to 5 processes these processes are majorly followed on construction site they are namely
1. Planning
2. Procurement
3. Logistics
4. Handling
5. Waste control processes.

### 6. BENCHMARKING PROCESSES

The process of finding the best available product features, processes & services and using them as a standard for improving a company’s own products, processes & services is known as benchmarking process.

### INPUTS AND OUTPUTS

Usually material requirement planning is done with the help of computer programs on material requirement packages. For this purpose, the input system requires the corporate business plans, aggregate production plans, sales forecasts, master production schedules, inventory status file, and the parts explosion list or the bill of materials. The primary computer output includes plant order schedules, order releases and changes to plant orders. The secondary output from computer comprises planning reports, performance alms, exemption reports and inventory transactions.

### OBJECTIVES OF PURCHASING

Purchasing outputs are not just to select a supplier to award a contract. Rather, they are very much related to policies, data and procedures for future purchases. Each purchase provides some additional information that is useful for future purchases. As such, for improving future purchasing activity, proper records should be maintained, such as:
- A list of supply sources
- A scientific appraisal of supplier performance
- Cost and price data
- A database for make/buy or lease decisions
- A proper evaluation of purchasing performance

### QUALITY AND INSPECTION

Today, most industrialists are following the motto: 'Manufacturing and marketing of goods/Services of the highest quality at reasonable cost.' Quality control principles aided by statistical techniques, aim at improving the product quality and decreasing' the production cost by concentrating on high standards of quality and controls which ensure that the standards are always maintained.

### STORES LOCATION AND LAYOUT

Storage system has to accommodate the inflow of inputs of materials and bought out components from the outside sources, the in-process inventories and the outflow of finished goods to customers. The system’s efficiency may be compared and assessed in terms of unit cost of moving goods through storage sites and storage over a given period. It usually takes into account the elements of labor, space and equipment needs and costs.

### TYPES OF ANALYSIS

There are different types of Analysis used to define an inventory categorization technique often used in material management for identifying items that will have a significant impact on overall inventory cost, while also providing a mechanism for identifying different categories of stock that will require different management and controls. The types of analysis used in material management are as follows:
- ABC Analysis
- XYZ Analysis
- HML Analysis
- FSN Analysis
- VED Analysis
- GOLF Analysis
- SDE Analysis
- SOS Analysis
- EOQ analysis

### 7. CONSTRUCTION WASTE MANAGEMENT

Construction waste consists of unwanted material produced directly or incidentally by the construction or industries. Construction and demolition waste is generated whenever any construction/demolition activity takes place. Construction wastes in any project are in the form...
of building debris from demolition process, rubble, earth material, concrete waste, steel waste, timber waste, and mixed site clearance construction materials, arising from different construction activities of project including land excavation or formation on site, civil and building construction materials, site clearance waste, demolition activities waste, roadwork waste, and building renovation waste.

CONTROL OF CONSTRUCTION WASTE

Reduction of waste can be done by practicing attitude towards Zero wastage, proper decisions at design stage, site management, proper standardization of construction materials, and Codification of the same. Construction waste can also be reduced by using waste management system on project. The project activities are to be planned at every stage by every construction personnel, who are involved, in minimizing the overall waste generation at project. Waste rate estimation method can be used to improve the handling material, reduce the waste rate, and improve productivity. Concept of 3R and 4R can be also beneficial to reduce the wastage of construction materials, which includes reduce, reuse, recycle, and recovery. These can be applied to the entire lifecycles of products and services. The free-flow mapping presentation technique can be adopted in the study for investigating the waste flow practice on construction sites.

8. DATA COLLECTION & ANALYSIS

The methodology adopted for data collection in this study was questionnaire survey. The questionnaire used for the data collection is given in the annexure at the end. The data gathered from the questionnaire survey was arranged and studied properly. According to gathered data it was found that there were few flaws in the material management systems of all three sizes of construction firms which affect the material management.

General Procedure for Material Management of Large firms

- Planning by project manager
- Requisition form or indent preparation
- Study of various indents
- Centralized purchase from corporate office
- Sending enquiry to various supplier
- Study of receiving quotations
- Preparation of comparative statement
- Negotiation of rates
- Approval from respected authority
- Preparation of purchase order
- Sending purchase order to selected supplier
- Tracking of delivery of material
- Inspection of received materials
- Issue to store department & supply as demand

Figure: General Procedure for Material Management of Large firms

9. CASE STUDY

Management for organizations:

| Name of the Organization | SWAAD (Restaurant) | Savvy Infrastructure | VMC
|-------------------------|---------------------|---------------------|-----
| Type of work undertaken by the company | Residential, Commercial Buildings etc. | Infrastructure projects, commercial buildings etc. | Infrastructure projects, commercial Buildings etc.
| Establishment year | 2015 | 2003 | 2017 |

<table>
<thead>
<tr>
<th>Problem</th>
<th>Description</th>
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<tbody>
<tr>
<td>Incorrect type of material delivered</td>
<td>There are differences in material ordered and delivered</td>
</tr>
<tr>
<td>Incorrect sizes delivered</td>
<td>-</td>
</tr>
<tr>
<td>Incorrect quantities delivered</td>
<td>-</td>
</tr>
<tr>
<td>Keeping track of material</td>
<td>Don’t know where material comes a certain period of time</td>
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<tr>
<td>Reminding of material</td>
<td>-</td>
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<tr>
<td>Storage of material</td>
<td>-</td>
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<tr>
<td>Loss of material</td>
<td>-</td>
</tr>
<tr>
<td>Damage</td>
<td>-</td>
</tr>
<tr>
<td>No supplier QA</td>
<td>No quality assurance from supplier</td>
</tr>
<tr>
<td>Poor communication</td>
<td>-</td>
</tr>
<tr>
<td>Receiving, handing and storage of used Materials</td>
<td>-</td>
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</tbody>
</table>

Construction Phase:

Problems acquired in construction phase

10. FUTURE SCOPE

1. Material Planning and scheduling can be done at every stage using construction software such as MSP.
2. Hit office also a very good software for maintaining material inward, issue records which gives the accurate results in terms of Reconciliation Report.
3. An effective Inventory Control model can be developed using Regression Analysis is further scope of study.

11. CONCLUSION

- There should be a centralized material management team co-ordination between the organization and the site team.
- Proper controlling, tracking and monitoring of the system is required. Awareness and accountability should be created within the organization.
- There is a need of an efficient MIS integrating all aspects of material management. Firms employing proper material management system are seen to have increased their overall efficiency by 35%. 
• Construction projects have a large number of different parties, skills and specialists each form an independent variable within projects.
• Good communication and coordination among the participants is a good way to overcome the gap between different parties and achieve the overall goals of the project.
• Manufactures and suppliers schedule their deliveries and cause responsibility once the materials have been delivered.
• Also appropriate and affordable technology should be used to help with the better management of materials through the order process up to placing on site so new technology such as internet, RFID (Radio Frequency Identification), GPS (Global Positioning System), tracking technology, extranet are instrumental and affordable in this process.
• Better communication and flow information by using such a simple and affordable technology, make it more efficient. On-site and off-site construction activities should be use as a body to cover whole range of construction activities.
• Flow of information across their interface has an important affect.
• The systematic literature review identified that Materials management processes require a transformation to improve the overall in handling of materials for more efficiency and effectiveness on the construction site.
• This is because poor handling of construction materials affects the overall performance of construction projects in terms of cost, time, quality, and productivity.
• From the literature review it is understood that this area require further research to find some feasible solutions to control the total project cost.
• There is no proper system for procurement of construction materials.
• This give light to the fact that pre-planning and material procurement are equally important in controlling the total project cost.
• It reveals that the minimization of materials wastage during the construction phases is important in order to avoid loss of profits.
• It is observed that considerable research has been conducted to investigate individual construction waste management strategies at a specific stage of a construction project.
• Currently, the majority of research efforts have been given to the material loss in construction activities rather than the non-value adding work as an intangible waste.
• Waste Generation Rate is an effective indicator for measuring construction waste and benchmarking construction waste management performance.

REFERENCES