

A Systematic Literature Review of Material Management In Construction Industry

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Abstract - Material management is a crucial and integral function in the construction industry, significantly impacting project efficiency, cost control, and overall success. It involves a comprehensive process that includes planning, material take-off, vendor evaluation, procurement, transportation, storage, inventory control, and on-site distribution, all of which must be carefully coordinated to ensure the timely availability of resources. Since material costs constitute a major portion of total project expenditure, effective management is essential to maintain financial stability, prevent cost overruns, and achieve competitive project delivery. Inefficiencies such as poor planning, inaccurate estimation, improper storage, and delays in material supply can lead to significant losses in labor productivity and disruptions in project schedules. Implementing a well-structured material management system enhances workflow, improves work-face planning, and ensures optimal utilization of resources. The adoption of modern software technologies and tracking systems has transformed material management into a more transparent and data-driven practice, allowing real-time monitoring, reduced wastage, and improved accountability. Ultimately, effective material management serves as a vital link between planning and execution, ensuring timely project completion, improved productivity, and sustainable cost optimization, thereby contributing to the overall success and profitability of construction projects.

Key Words: Material Management, Construction, Inventory, Planning, Procurement and Productivity

1. INTRODUCTION

In any industry—whether service, manufacturing, production, or construction—five fundamental resources play a crucial role: material, man, money, machine, and time. Among these, materials are one of the most significant components as they directly influence the cost, quality, and overall progress of a project. This is particularly evident in the construction industry, where materials alone contribute to nearly 50–60% or more of the total project cost. Because of this high cost share, even small inefficiencies in material handling can lead to major financial losses. Therefore, effective material management becomes essential for achieving project success in terms of

cost efficiency, timely completion, and desired quality standards.

Materials management is a coordinated and systematic approach that ensures the availability of materials in the right quantity, quality, place, and time, while maintaining minimum overall cost. It integrates various interrelated activities such as planning, procurement, transportation, storage, and utilization into a single streamlined system. Ineffective material management often results in delays, cost overruns, wastage of resources, and reduced labour productivity. On the other hand, efficient management improves workflow continuity, enhances coordination among departments, and contributes significantly to better project performance. Due to these reasons, materials management is considered a core and indispensable function in both construction and industrial sectors.

Materials management can further be defined as an integrated process that involves planning, sourcing, purchasing, storing, handling, and controlling materials from the stage of requirement identification to their final utilization. It ensures a smooth and systematic flow of materials across all stages of a project lifecycle. The primary focus is to deliver the right material at the right time and place while maintaining cost effectiveness and quality standards. Its objectives include proper estimation of material requirements, timely procurement, safe and efficient storage, effective inventory control, and smooth distribution. Additionally, it supports key functions such as demand forecasting, production scheduling, standardization, and value engineering, thereby minimizing wastage, avoiding excess or shortages, and improving overall productivity and operational efficiency.

The materials management process typically begins with identifying the requirement at the site and continues through planning, estimation, procurement, transportation, inspection, storage, and final usage. Despite its importance, several challenges exist, especially in small-scale industries, such as limited financial resources, dependence on a limited number of suppliers, lack of proper forecasting methods, and inadequate storage facilities. Furthermore, insufficient adoption of

advanced technologies and lack of skilled personnel can lead to inefficiencies, delays, increased costs, and poor inventory control. However, when implemented effectively, materials management has a significant positive impact by reducing wastage, optimizing resource utilization, improving cash flow, ensuring consistent quality, and strengthening supplier relationships, thereby contributing to long-term sustainability and competitiveness.

The objective of this paper is to analyse the role and significance of materials management in improving project efficiency, cost control, and productivity in construction and related industries. It aims to examine the processes, techniques, and challenges associated with materials management and to emphasize the importance of adopting systematic approaches and modern technologies for enhancing project performance and achieving long-term organizational success.

2. LITERATURE REVIEW

[1] **Georgekutty C. K., Dr. Georgemathew** - have given the conclusion and report of the extensive literature review and data collected from various site visits and questionnaire surveys. The researches have tried to address various problems in construction industries that generally cause time and cost overruns in this aspect; they have focused on materials management in construction industry. The data collected was statistically analyzed by various tools and techniques like Statistical Package for Social Sciences (SPSS), Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA) and various constants are used. After these, aspects where materials management in construction industry lacks is identified and addressed.

[2] **Narimah Kasim** - Developing materials management| this paper is forecast that in the near future there may be a move towards the conscious development of materials management within manufacturing industry. This development will be based upon management recognition of the significance of materials management, combined with extensive pressure upon the costs and efficiency in the functions which make up the materials management systems. There will be a number of urgent motivating factors, ensuring that solutions are found to overcome any difficulties, and that change takes place to introduce the materials management concept. The final outcome is forecast to be an integration of the materials management function into one group; with the explicit task of, maintaining a constant flow of product, reducing costs where feasible, and improving relationships with both suppliers and other functions within the company.

[3] **Narimah kasim** - intelligent materials tracking system for construction projects management| This paper An essential factor adversely affecting the performance of construction projects is the improper handling of materials during site activities. In addition, paper-based reports are

mostly used to record and exchange information related to the material components within the supply chain, which is problematic and inefficient. Findings from a literature review and surveys showed that there is a lack of positive examples of such tools having been used effectively. Therefore, this research focused on the development of a materials tracking system that integrates RFID-based materials management with resources modelling to improve on-site materials tracking. Rapid prototyping was used to develop the system and testing of the system was carried out to examine the functionality and working appropriately. The proposed system is intended to promote the employment of RFID for automatic materials tracking with integration of resource modelling (Microsoft Office Project) in the project management system in order to establish which of the tagged components are required resources for certain project tasks. In conclusion, the system provides an automatic and easy tracking method for managing materials during materials delivery and inventory management processes in construction projects.

[4] **R. Shreena Shankari , D. Ambika , S.S. Kavithra** - a review on waste material minimization in construction industry. This paper is material waste has been identified as a major problem in the construction industry. Studies from various sites confirmed that even the materials that are least wasted like glass, electrical fixtures, paints etc. Represents a relatively certain percentage on construction cost. These materials also have an adverse effect on environment. Materials are very important on building sites, and all the materials that are delivered are not used for the purposes for which they had been ordered and disappearance of these materials constitute a part of waste and it has a negative effect on environment and also effects the contractors profitability Considering materials.

[5] **Elijah E. Ogbadu (2009)** - made a research to increase the profit through proper management of materials. For that, ninety four (94) copies of questionnaires were distributed out of which eighty six (86) were filled and used for the research. All eighty-six respondents approved that the delivery of poor quality raw materials is a hitch of materials management. He came to the conclusion that, the inefficiencies, breakdown and shut down of the plant decrease the profitability. Establishing good relationship with suppliers of spare parts for minimizing losses arising from frequent breakdown improves profitability.

[6] **P. Gopalakrishnan and M. Sundaresan, (January 2007)** - When asked to describe the largest issue they face in organizing maintenance work, many planners and supervisors reply "Finding materials and getting them to the right place at the right time". Spare Parts and materials are a large part of any plant's costs and not having the right materials in the right place at the right time is a common cause of productivity loss and reduced reliability.

[7] **Madhavarao k. Mahindra** - a critical analysis of material management techniques in construction project| In this report construction sector, material management plays major role for effective completion of the project. The

cost of project increases when the planning, material identification system is poor. Shortage and deficiency in storage of material will cause losses in labour productivity. To maintain the effective management, to achieve the timely supply of materials and equipment and to reduce the cost of projects, a well-planned material management program is required. This improves planning, higher labour productivity, proper schedules and lower project costs. This paper explains about the techniques for material management for construction project by using S-Curve, ABC Analysis for clear understanding the management of four important construction materials. By implementing these techniques, we have found an optimized way to reduce the cost of the project. Using S-curve technique, the variation in planned cost and actual cost is assessed. Quantity of materials procured for the project should be determined by the using A-B-C analysis.

[8] Patil Ashwini R., Pataskar Smita V - mainly focused on variation in planned Vs actual material cost through S curve analysis and applying inventory control technique so as to maintain sufficient stock of raw material in period of short supply, to protect inventory against deterioration and control investment in inventories, to keep it in an optimum level and to minimize stock out problems, to minimize the total cost of inventory. In this research, inventory control techniques which were used are ABC analysis and Economic Order Quantity (EOQ) technique. It also 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 between actual cost of materials and planned cost of materials are addressed in this paper in detail.

[9] Nigeria, Olatunjiayetun, John small wood - improving materials management effectiveness||This research provides a literature review in the field of uncertainty dampening methods for manufacturing systems, and proposes a new model to improve materials management effectiveness in materials requirements planning environments. The literature review gives rise to a classification framework of the models along nine structural dimensions that refer to the safety buffer treatment, the environmental characteristics and the type of approach. On the basis of the classification framework, the proposed model provides guidelines for approaching the problem of dimensioning, positioning and managing safety stocks against demand uncertainty. The effectiveness of the proposed model has been tested by comparing it to the traditional approach, through a computer- based simulation.

[10] Caldas Carlos H., et al - have described the results of their study which was aimed to identify materials

management system that reflects current and emerging in capital projects industries. This research was done by surveys, interviews and case studies that involved 54 different organizations. Set of different practices, concepts and issues related to materials management was formed collectively and the responses given by organizations are given in form of percentage. With the help of the extensive data collected with this research, different aspects and stages of materials management system are addressed in detail. The research paper conclude by highlighting importance of proper materials management system and also one of the main points explained here is use and up gradation of modern IT systems for materials management in construction related industries.

[11] Khyomesh v. Patel (pg student) prof. Chetna m. Vyas (ph.d. cont.) - construction materials management on project sites||This paper is written to fill a void created by the absence of proper materials management on construction sites. To managing a productive and cost efficient site efficient material management is very essential. Research has shown that construction materials and equipment may constitute more than 70% of the total cost for a typical construction project. Therefore the proper management of this single largest component can improve the productivity and cost efficiency of a project and help ensure its timely completion. One of the major problems in delaying construction projects is poor materials and equipment management. This paper describes the main results of survey carried out in Ahmedabad that investigated the material management of 3 well known builders of Ahmedabad.

[12] Ss. Asadi - improving materials management on Construction projects -this report is An essential factor adversely affecting the performance of construction projects is the improper handling of materials during site activities. Materials management is made problematic by materials shortages, delays in supply, price fluctuations, damage and wastage, and lack of storage space. The results were used to develop a real-time framework for integrating RFID-based materials tracking and resource modelling. It is concluded that the prototype system developed can improve materials management on construction projects. And to improve the real-time management of materials on sites, and hence improve project performance.

[13] Bernold and Treseler(1991) - stated that the performance of suppliers is related to the success of the material management system, thus selection of vendors is a very important aspect. They introduced the Concept of Best Buy. Best Buy assumes certain level of suitability, but considers cost and procurability, transportation and disposal. Best Buy not necessarily means best price, procurement and technical specifications should also be considered. In addition, other factors such as

specifications, price, delivery time, etc. should be considered. Material Management an integrated approach

[14] **Greeshma C., K. Harish** - aimed to find out the various materials management tasks and their priority, problems that are faced in materials management process and their occurrence. The data was collected by the authors by survey and questionnaire. The index and priority number is given for individual point considered under materials management. After analyzing data, researchers have attempted to develop materials management software that will be helpful for materials management on the site and will give ease in for materials management processes on site.

[15] **Karoriya Deepak, Dr. Pandey Mukesh** - mainly focused on Economic Order Quantity (EOQ) technique used for materials management in construction industry. The researchers have tried to present the literature review and data collected from various surveys related to the materials management. Various problems that are faced in materials management in construction industry on site are also addressed. According to the researchers, EOQ technique can prove to be helpful to minimize the cost overrun problems due improper materials management in construction industry. The part of paper addresses in brief about materials wastage management on the construction site. The researchers have tried to explain how EOQ helps to order the perfect required amount of materials at the particular time at right place.

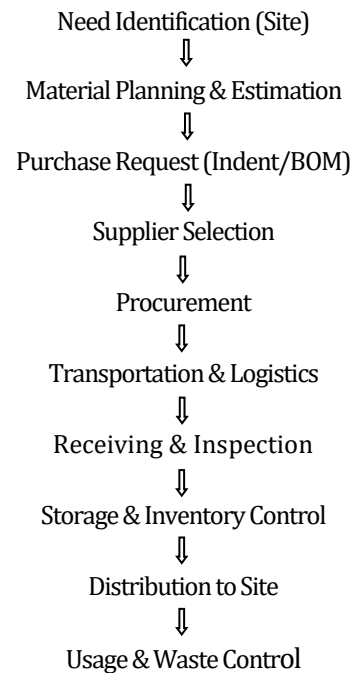
[16] **Roger Antony A., Navodaya V.** - have explained an automatic technique approach to overcome some of the errors that take place during materials management process. In this approach a combination of Near Field Communication (NFC) & Global Positioning System (GPS) technologies is used for materials management which has potential to facilitate low cost, ease to implement solutions to identify materials and components and to track those. This system is fully automatic. This system provides effective identification and tracking in all phases like production, transportation, on construction site. In this paper the system is explained with basic principle, working and use.

3. RESULT AND DISCUSSION

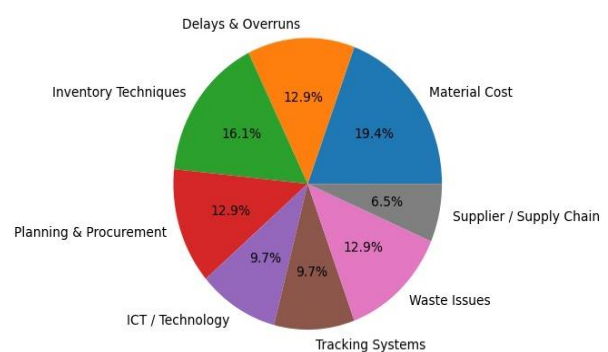
The analysis of the literature and compiled data highlights the critical aspects influencing effective material management in construction projects. The results, represented through the pie chart, indicate that material cost constitutes the most significant concern, followed by the adoption of inventory control techniques and issues related to delays, planning, and waste management. Additionally, emerging factors such as ICT integration and material tracking systems demonstrate a growing importance in improving efficiency and control. The flow diagram further supports these findings by illustrating

that material management is a continuous, interconnected process, where inefficiencies at any stage can impact overall project performance. Together, these insights emphasize that a well-coordinated, systematic approach is essential for optimizing cost, reducing waste, and ensuring timely project execution.

FLOW CHART: Flow of Materials Management Process



PIE CHART : Analysis of Major Material Management Issues



4. CONCLUSION

The review shows that the main issues in material management are high material costs, poor planning, delays in getting materials, lack of proper control, material wastage, poor tracking, and weak coordination between

suppliers and site. To solve these problems, it is important to follow a well-organized material management process with proper planning and timely purchasing. Using simple digital tools and tracking methods can help in better monitoring of materials. Improving communication with suppliers, reducing waste, and storing materials properly can help improve overall efficiency, reduce costs, and ensure projects are completed on time.

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