Literature Review on Inventory and Material Management in Construction Industries

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Abstract: **The term 'inventory' refers to a company's stockpile of material and the components that make up the output. Inventory and material management refers to "managing the quality, amount, location, transportation, and timing of various products" utilized in manufacturing by various industrial organizations. Materials on a construction project can contribute up to 60 percent of the total cost of the project, therefore Materials management and decreasing procurement prices is critical task in the construction project, but if done systematically, it can enhances prospects to reduce overall project expenses. This review paper discusses effective inventory management and material management techniques and attempts to provide a clearer picture of the same.**

Keywords: **Inventory, Inventory management, Material management, Management techniques.**

1. INTRODUCTION

The construction industry largely relies on inventory and material management. Material planning include calculating, purchasing, and scheduling the required materials. The purpose of materials management is to ensure that construction materials are readily available when needed. The materials management system strives to ensure that the necessary quality and quantity of materials are identified, purchased, delivered, and managed on site in a timely and cost-effective manner. It was discovered that planning is a critical procedure for increasing productivity, profitability, and optimizing project completion time.

In the current environment, material costs account for around 60-70 percent of overall building costs. Material management goals include obtaining low-cost resources, keeping department expenditures low, establishing good supplies, and maintaining strong relations and records. As a result, maintaining a consolidated material management team who will cooperate between site and organization is critical. This may be accomplished more successfully by adopting management tools and software, which simplify processes and improve operational precision. Material waste must be reduced during construction to avoid financial loss for construction enterprises. Construction material mishandling has an impact on the entire performance of construction projects in terms of time, money, quality, and productivity.

1.1 Objectives of inventory and material Management
- Purchasing material
- Procurement
- Assuring the quality
- Storing of material
- Utilization of stocks
- Predicting material demand and quality requirements
- Waste reduction and management

1.2 Steps for efficient material management
1. Planning
2. Procurement
3. Inventory control and storage
4. Arrival, Inspection, and Distribution
5. Valuation
6. Transportation
7. Scrap disposal and material preservation

1.3 Purpose of Inventory and material management
- To save funds on purchases
- Carrying spare stock to avoid stock outs
- Stabilizing consumption fluctuations
- To reduce wastages
- To provide a decent level of customer service.

1.4 Factors affecting Inventory management
- Complexity in design
- Availability of funds
- Rates fluctuation
- Miscommunication

- Lack of storage spaces
- Mishandling
- Overstocking
- Climatic Condition
- Wastages

2. LITERATURE REVIEW

B. Madhavrao et.al. (2018) according to this paper, material management plays an important role in the construction business. When project planning and material identification systems are inadequate, project costs rise and also effects the timeline of the project. Labor productivity also suffer as a result of material shortages and inadequate storage. A well-planned material management program is essential to maintain effective management, to ensure timely delivery of materials and equipment, and to reduce cost of the project. This article discusses material management approaches for construction projects using S-Curve and ABC Analysis for a thorough understanding of the management of four main construction materials. We discovered an efficient strategy to reduce project costs by using these methods. The variance between projected and actual costs is examined using the S-curve approach. A-B-C analysis can be used to determine the quantity of materials procured for the project.

Dr. Kevin Aku Okorocha (2013) as a research to assess the factors influencing material management, he had selected a case study of chosen building sites in IMO state, Nigeria. The use of the appropriate materials in the right location at the right time is essential for the successful completion of a construction project. The acquired data was statistically analyzed using multiple regressions. This research is aimed at material management practices in the Nigerian construction sector. Questionnaires were applied to extract information from construction workers. Adequate materials requirement planning and handling are crucial for effective materials management on construction sites and the successful completion of construction projects in Nigeria. Although vital on construction sites, storage process systems do not play a significant part in successful materials management in Nigeria's construction sector. Over storage and handling costs on construction sites may be reduced by careful material need planning. The study indicated that material management leads to efficient cost control, improves the quality and timeliness of project execution, and lowers project failure.

Hemishkumar Patel et.al. (2015) conducted a survey of a total number of 80 respondents from the Gujarat region, viz. cities like Ahmedabad, Bardoli, Navsari and Surat out of which 25 respondents were contractors, to analysis of factors affecting material management and inventory management. In the survey 49 factors were found and were ranked according to Relative Importance Index (RII). The respondents were asked to rate the relevance of each of the 76 material management and inventory management elements in the Gujarat area as very high, high, mid, little, very low. According to the research, the most crucial factors impacting material management and inventory management in construction companies include engineer misunderstanding of owner's expectations, low material quality, and inaccurate specifications and insufficient details in drawings, poor use of advanced engineering design software, poor quality site documentation, underestimation of complexity, and poor use of advanced engineering design software. Design mistakes, a lack of resources (due to closure), poor communication, a lack of a material and time, waste management plan, slow response time from the consultant team to contractor enquiries, Safety precautions and measures.

Mayank A. Kanani et.al. in order to find the effective technique of inventory management system the author studied the types of inventory management systems and found there are 9 types of techniques out of which 5 are applicable in construction industries, viz. just in time - It entails getting things delivered as soon as a consumer buys them. It's riskier since it's reliant on customer behavior, which is often not predictable; ABC analysis – in this method, you classify the inventory into three categories, which are based upon the inventory's cost and values, i.e. A (highest value), B (Moderate Value), C (Lowest value); VED analysis – this is also classified elements approach, however the materials are classified into vital, essential, and desirable categories; FSN analysis - This strategy is mostly determined by how item is movable on any project the materials are analyzed in order to be categorized as Fast-moving (F), Slow-moving (S) and Non-moving (N) items , XYZ analysis – it is same as ABC analysis, but this research is often conducted two to three months before the end of the fiscal year in order to evaluate materials management performance to take remedial action. These IMS strategies are immensely effective and easy to use in the construction industry, allowing us to simply achieve our specified target.

Salawati Sahari et.al. (2012) studied the impact or effects of inventory management on the project performance and capital intensity within a Malaysian Construction Firm. This study was done o basis of the following three metrics 1) ROA as a financial performance metric, (2) ID, inventory days held as a metric of inventory management, and (3) CI, capital intensity evaluated by dividing fixed assets by the sum of fixed assets and inventory. This study was performed on a sample of 82 organizations' financial data from 2006 to 2010. The impact of inventory management on performance was shown to be insignificant in this study using regression approaches. The correlation between inventory management and financial performance, also with capital intensity was shown to be significantly positive.

Nann Lwin Phu et.al. (2014) in this study, construction inventory management is divided into three categories: methods for effective material management on construction sites, reasons that increase waste on construction sites, and inventory control challenges. The primary data gathering method is quantitative survey (numerical values); questions for field surveys. Data for the study are gathered via a standardized questionnaire distributed to 53 respondents. There were 18 project contractors among the responders. Inferential statistics, such as the Relative Importance Index (RII), are used to analyze the data, and the perspectives of project engineers, site engineers, and contractors are checked to see if there is a substantial degree of agreement among respondents using the Kruskal Wallis test or the H test. The overall findings of this study show that present inventory management techniques in local construction projects require systematic and effective oversight. According to the results of the agreement study, the perceptions of three respondents (project engineers, site engineers, and contractors) are same in all three cases which were methods for effective material management on construction sites, reasons that increase waste on construction sites, and inventory control

challenges. As a result, all project engineers, site engineers, and contractors are considered to be primarily concerned with material management, and their responsibilities and decisions are critical to improving successful material management.

Ahmad Zeb et.al. (2017) conducted various field visits in order to collect data regarding a bridge project, and it was gathered from inventory books and physical stock verification. After which the ABC analysis was done using MS excel using following steps (1) collect items details with their unit prices. (2) Find the total value to the item in the project by the product of expected units required and unit price. (3) Arrange the items in descending order of their values. (4) And then classified according to ABC - A (highest value), B (Moderate Value), C (Lowest value). FOR THE DETAILED analysis S curve analysis was done of cement, in which planned cost of the material procurement was compared with actual cost. According to the study, cement and steel is categorized in Class A, Aggregates are in Class B and stones are in Class C.

Madhavi et.al. (2013) conducted a thorough case study, surveys, and interviews with professionals working in this field. The biggest issue with materials procurement is connected to project schedule delays and a lack of stipulated quality. Following some study, they implemented in the future several inventory control techniques such as Always Better Control (ABC) analysis and the First in First Out (FIFO) Method at various workplaces. They also stated that utilizing the ABC analysis lowered the material cost in total and actual cost by 20%, and First in First Out (FIFO) Method employing at work site controlled the costs of contractor quoting the rate, as well as assisting in appropriate release of the finance and preparation of the budget process.

Gulsen et al. (2012) had been discovered a multiple parameter ABC (Always Better Control) analysis using fuzzy, c-means (FCM) clustering. It is not cost effective to establish an inventory management strategy for each individual stock keeping unit (SKU). ABC analysis is one of the most often used methods for classifying stock holding units (SKUs). The conventional method ranks stock keeping units (SKUs) in descending order of annual dollar consumption, which is the product of unit price and annual demand. The few stock keeping units (SKUs) with the greatest yearly dollar usage are in group A and should be examined the most; the stock keeping units (SKUs) with the lowest annual dollar usage are in group C and should be considered the least; and the other stock keeping units (SKUs) are in group B. We suggested fuzzy, c-means (FCM) clustering to a multi-criteria ABC analysis issue in this work to assist managers in making better decisions under fuzzy conditions. The results suggest that the fuzzy, c-means (FCM) approach is a straightforward and adaptive solution for inventory management.

Vikram Kulkarni et.al. (2017) this research is being conducted to overcome the weaknesses left by poor material management on construction sites. Materials account for more than 70% of project costs and, if not handled appropriately, can have an impact on overall project costs. The study examines nine distinct small, big, and medium-sized construction organizations in Maharashtra. The questionnaire survey approach was used to collect data in this study. The questionnaire survey approach was used to collect data in this study. In the Maharashtra area of India, nine organizations (3 small, 3 medium, and 3 big) were chosen at random for this study. The data received from the questionnaire survey was carefully organized and evaluated. According to the data acquired, there were a few problems in the material management systems of all three types of construction enterprises that affected material management. According to the results of this poll, only major enterprises employ standard protocols and software for material management, thus they have few issues. Medium and small businesses, on the other hand, lag behind in material management because they do not employ software or are unaware of material management procedures. Material management should receive more attention from top management.

Mr. M.kalilurrahman (2017) this paper is about the construction sector is quickly expanding over the world, and this growth has resulted in a severe problem in the creation of construction wastes in many developing countries, as well as a great consumption of natural resources. Construction waste is classified as physical and non-physical waste, and it has a higher influence on the ecology, economic, and social well-being of each country. It is critical to identify the fundamental cause of the generation before it can be effectively handled. This article analyses and detects aspects that lead to construction waste creation. For identification purposes, a mapping approach was used, and interviews were done to discover physical and non-physical trash. These elements were classified into seven clusters: design, handling, worker, management, site condition, procurement, and external factor. Each waste category's important elements were identified. The findings will assist construction companies in avoiding, reducing, and recycling physical and non-physical waste. Furthermore, the article makes several ideas for improved construction modifications. According to this paper, construction waste happens during real construction operations, and it is understood that it is created by activities and actions during the design, materials procurement, and construction stages of project delivery processes. The adoption of a Just-in-Time (JIT) delivery system, as well as the prevention of over-ordering, are also vital for reducing waste in material procurement procedures. The report highlights and discusses additional measures that might improve waste efficiency during the procurement process. The study's findings may aid in understanding a set of procedures that should be implemented during the materials procurement phase, therefore correlating waste management techniques at the design and construction stages of the project delivery process.

3. CONCLUSION

After studying these reviews it can be concluded that the inventory management is a crucial part of project management as the material and resources contribute about 60-70% of the total project cost. To achieve the desired control on the inventories, using the tools like ABC Analysis, XYZ Analysis, FSN Analysis is effective. But it is observed that, only big investing companies are aware of it and applies it in their routine but the small and medium industries are still in the dark. Also it is observed that big industries have special department and utilize the softwares to control on inventory and material, but medium and small industries lack of them may be due to insufficient funds or unawareness. An one of the strongest part of material management is avoiding wastage by controlling overstocking, reusing and recycling.

Briefly, Inventory and material management contributes in controlling cost as well as the timeline of the project

REFERENCES
[1] B. Madhavrao, K. Mahindra SS. Assadi, "A Critical Analysis Of Material Management Techniques In Construction Project", 2018
[2] Dr. Kevin Aku Okorocha, "Evaluation of Materials Management Strategies in the Nigerian Construction Industry" 2013
[3] Hemishkumar Patel, Prof. Jayeshkumar Pitroda, Prof. J. J. Bhavsar, "Analysis Of Factor Affecting Material Management And Inventory Managemtent: Survey Of Construction Firms Using RII Method", 2015
[4] Mayank A. Kanani, Dr. Neerajkumar D. Sharma, Mr. Bhavin K. Kashiyani, "A Study On Different Inventory Management Techniques In Construction"
[5] Salawati Sahari, Michael Tinggi and Norlina Kadri, "Inventory Management in Malaysian Construction Firms: Impact on Performance" 2012
[6] Nann Lwin Phu and Aye Mya Cho, "Factors Affecting Material Management in Building Construction Projects", 2014.
[7] Ahmad Zeb, Daud Khan, Muhammad Sajid and Sikandar Bilal Khattak, "Inventory Analysis Of Construction Project", 2017
[8] Madhavi P. T., Mathew V. S., Sasidharan R., "Material Management In Construction – A Case Study" (2013)
[9] Gulsen A. K., Coskun O., "Multiple criteria ABC analysis with FCM clustering" (2012)
[10] Vikram Kulkarni and Rohit Sharma," Factors Affecting Material Management on Construction Site" (2017)
[11] Mr.M.KalilurRahman, Mr.S.S.Janagan, "Construction Waste Minimization and Reuse Management" (2015)