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STUDY ON MATERIAL MANAGEMENT – AN ART OF REVIEW

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Abstract - *The Construction industry of India is a significant indicator of the development as it creates investment opportunities. The opportunities are diminishing due to improper management. Cost overrun is considered as the most important problems that encumber projects progress, since it reduces the contractor's profit leading to enormous losses, and leaving the project in great troubles. Material management is a critical element of the construction industry. The effective materials management plan enhances an institutional master plan by filling in the gaps and generating an environmentally liable and resourceful outcome. Materials management can deal with planning and building design for the movement of materials, the acquisition of spare parts and replacements, quality control in purchasing and ordering parts, and the standards involved in ordering, shipping, and warehousing the required materials. Better construction management is required for optimizing resources and maximizing productivity, efficiency and complete project on time.*

Key Words: **Cost overrun, Loss, Material management, Efficiency, Maximum productivity**.

1. INTRODUCTION:

Construction industries play a vital role in the progress of the economic growth of a country. The increasing difficulty of the construction projects shows a greater demand on construction managers to deliver projects on time, within planned budget and with high quality. The main confront faced by the construction industry in the developing countries is the persistent trouble of delay, cost overruns due to improper management. Material management plays a vital role as a diagnosis for the above crisis.

Materials management deals with campus planning and for the movement of materials, or with those that deal with the tangible mechanism of a supply chain. Specially, this covers the acquisition of spare parts and replacements, quality control purchasing parts, and the principals involved in ordering, shipping, and warehousing the materials needed for the construction. By proper material management, the delay could be reduced. Due to delay there will be increase in the cost of the project. Thus inventory management is adopted to minimize the cost. The qualitative and quantitative analysis viz., ABC analysis and EOQ analysis has been done to cut off cost overrun and delay of the project.

2. MANAGEMENT OF MATERIALS:

Kevin Aku Okorocha had done a research to find out the factors affecting material management. For that he had selected a case study of selected building sites, in IMO state, Nigeria. Usage of right materials in the right place at the right time is important for effective execution of a building project. Data collected were analysed by statistical analysis through multiple regressions. The research concluded that Material management leads to effective cost control, to improve the quality and time execution of their projects and reduces failure of a project.

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.

Khyomesh V.Patel (2011) made a study to find voids created by the absence of proper materials management on construction sites. The research was carried out in Ahmedabad. He has done careful study right from first step till the end of the project i.e., from material indent to material usage. Since each step was managed, the voids could be identified. He concluded that, team co-ordination between the site and the organization, proper control,

tracking and monitoring of the system, awareness and accountability, efficient MIS integration will end in better results.

Georgekutty (2012) had undergone literature review to find out the causes for incompletion of project. A questionnaire survey was conducted in Kerala. From the research, the main delay or incompletion of project could be solved by proper pre-planning and scrutinize material procurement frequently to cut off the exceeding of project cost.

Case study was carried out by **Phani Madhavi (2013)** in material management in construction site. The objective of the study was to understand about all the problems occurring in the company because of improper application of material management. Analysis was done on site and management, Inventory controlling, purchasing procedures, Procurement and Tracking and cost. Stocks were analyzed by FIFO (First In First Out method). Cost estimation was done by ABC analysis. From the analysis, data were driven and new appropriate technological implications were introduced like RFID (Radio Frequency Identification), PDA (Personal Digital Assistant) which helped us in a proper scheduling and financial control.

In Nigeria brewing firms, **Nwosu Hyginus Emeka (2014)** examines the impact of materials management. Among total staff strength (4648) of Nigeria Breweries and Guiness Nigeria PLCs, sample size of 368 was selected to check the profitability of the firm. Z-statistics was applied for test of hypotheses and found that materials procurement, materials storage, materials inventory, interdepartmental collaboration has a significant effect on the profitability of brewing firms. Based on the above findings, the study therefore concludes that effective materials management is indispensible to brewing firms in making profits.

Olusakin S Akindipe (2014) made a study on role of raw material management in production operations. The author was conscious about the inefficiency in raw material management and the alternate solutions to overcome the problem. He found the relationship between raw material and Inventory management to solve the crisis. From this he had concluded that, the inefficiency were due to illiterate and non experts involvement in management, mishandling of materials and inability to use proper inventory model in the site. He added that, all the above said reasons are mainly due to the managers involved in the management process.

The role of material management in organizational performance was analyzed by **Pauline Jeruto Keitany (2014)** in Kenya. For that the author had chosen a case study of New Kenya Cooperative Creameries Limited. A sample of 49 respondents was selected from 56 employees of New KCC Ltd. Data were collected through questionnaire from seven departments such as Purchasing, Quality Control, Warehouse/store, Human Resource Development, Finance and audit and Physical Distribution departments. The data was evaluated through descriptive statistics such as mean, median, standard deviation and percentages. Results showed that there was increase in organizational performance due to inventory control system involvement. Additional, results showed that lead time was highly significant by acquiring and delivering the needed materials within the shortest time.

The benefits of material management to the organization were clearly explained by **Siddharth Nair (2014)** through his paper. The author also explained that the objectives of the material management to be regular uninterrupted supply of raw-materials maintain a high inventory turnover, providing economy in purchasing and minimizing waste, minimize the overall cost of acquisition and to maintain high degree of cooperation and coordination with user departments. He concluded that major benefits of material management were excessive investment in stocks will be avoided, there will not be stoppage of work because of lack of materials, productivity will be improved, Inventory losses will be minimized and the wastages are minimized.

Anwar Zeb (2015) made a questionnaire survey based on his previous researches, for which he has collected data for about 20 years. The survey was made in Pakistan and he interviewed the contractors and the sub contractors of the site. He has selected 5 factors which are limited storage on site, difficulty to store, conflicts between labourers, difficulty in work progress due to improper storage of materials and complexity in coordination of sub contractors on site. He had concluded from that research that increase in space for material storage, communication of sub contractors and the handling of materials will help to complete the project on time. He added that proper tracking of work progress and material management will give better results.

An empirical case study of material management in Residential project was done by **Anup Wilfred (2015)**. This study was made to find out the problems occurring due to the improper material management. Due to these problems, there will be rise in cost of the project. So he had undergone ABC analysis and S curve analysis. ABC analysis give complete study of quantity of material utilized. S curve analysis was helpful in finding the deviations in project. Class A materials give the profit rate. The deviation

from scheduled project is found by S curve analysis and suitable measures were taken.

Boopathi (2016) has made a study on material management using a real time residential project. The author had an opinion that the cost of the project increases mainly due to the improper material management. So in this project, planning, scheduling and budgeting were done by PRIMAVERA. Since he had followed a proper scheduling method there was no increase in cost of the project. The material cost constitutes the 50% of total cost which is normal.

The paper reports on the premature stages of research which is developing a new ICT-based approach to managing materials on fast-track schemes by **Kasim**. Planning, procurement, handling, storing and control must be taken care to complete project on time with high efficiency were revealed from his research. Implementation of IT in materials management could ease the successful and proficient control of materials on site. He concluded that fast track construction was preferred to improve the merit of the production process.

3. CONSTRUCTION WASTE MATERIAL MANAGEMENT:

Calistus Ayegba (2013) made a study to find the method of material procurement on construction site and the factors affecting material management as well as construction waste management on construction site. This research was carried on Minna metropolis Niger State. For that he made a questionnaire survey and collected respondents from head office provisions with and without site requisition and from site engineers. From this he identified the factors and gave solution that mishandling of materials, inadequate storage facilities, inefficient work force and negligence must be reduced to control construction waste on site.

Not only the construction materials are managed, the waste materials should also be properly managed as said by **Gulghane (2015)** to reduce environmental problems. He has undergone literature review to find out the techniques involved in waste material management. By construction waste minimization, economical and environmental benefits were enhanced. From the reviews, he accomplished that the pre planning and material procurement must be taken equal care to control project cost. Also, the material wastes minimization plays a part in project cost inorder to avoid profit or loss.

Construction wastes devour a large amount of natural resources. Hence a planned management is important to decrease or supervise construction waste. **Md Azree Othuman Mydin (2015)** had made a research in Malaysia to safeguard the environment by proper management of construction waste. From the examination the reason found to be the cost incurred in handling and transporting the physical waste to the dumpsite, clients with little primary financial support may allocate a smaller amount on waste management budget which leads to reduced priority in site management. Some even believed that the cost of reusing or recycling wastes was prohibitive. Thus proper recycling should be done to reduce construction waste was the solution of the author to the waste material management crisis.

4. INVENTORY MANAGEMENT:

Modelling of inventory management in construction operations which involves on-site fabrication of raw materials was made by **Do Young Jung (2007)**. The research was done to decide an optimal level of material inventories on considering vibrant variations of resources under uncertainty is very critical for the economical efficiency of construction projects. This paper developed a probabilistic optimal inventory management model on the process of on-site fabrication of raw materials such as iron-rebar process. From the research it was concluded that, the amount of inflow and outflow iron-bars at the temporary shop attained a stability by applying the pull system to the phase of raw material inventory management, moreover average inventory quantity were reduced, and by eliciting optimal time lags linking to the start of fabrication/assembly works, it was likely to reduce the holding time of assembled products, and inventory management costs could be reduced around a total of 25%.

For improving on-site materials tracking for inventory management in construction projects, **Narimah Kasim (2012)** made a research. The improper handling and storage of materials in construction site was difficult to track and locate materials. The on-site materials tracking and locating were made complicated by using traditional tracking process which is labour intensive, error-prone, unreliable and add to the raise in construction costs. Failure in organizing site inventory will result in cost overrun and reduce overall project performance. He concluded that, RFID in materials tracking helped in inventory control and retards the increase of project cost.

A Comparative Study was made by **Tom Jose (2013)** in Analysis of Inventory Control Techniques. The various analysis studied in this paper were EOQ analysis, ABC analysis and FSN analysis. From the analysis it was found that there was a difference in the EOQ & no. of unit purchased which means EOQ was practice in the company. Also, the company maintained low percentage in fast

moving items when compared to slow moving inventories on using controlling techniques which was not preferred.

Sindhu (2014) made performance analysis of Inventory Management System in Construction Industries in India. The main aim of the study is to evaluate the inventory management control approved and the efficient use of inventory at the construction site. Initially, questionnaire survey was conducted in various construction companies. Next, those results were analysed by using Statistical Package for Social Sciences (SPSS). ABC analysis is the conventional method to classify the inventories and the case study of a company is collected. The model dealt with uncertain demand and availability of supply. This research resulted in finding main factors which affected the inventory management system by preventing it to achieve the improved efficiency of project management and to reduce the waste of materials in the construction industries

Elema Boru Godana (2014) made a research to carry out effective inventory management at Kenol Kobil Limited at Kenya. Questionnaire was prepared and distributed for this research. The study involved both quantitative and qualitative analysis techniques. Data was obtained by tables, pie charts and bar graphs. Inferential statistics comprise of correlation and regression analysis. The data findings analyzed show that taking all other independent variables at zero, a unit increase in Information Technology, Distribution channels and Staff competency will lead to an increase in Effective inventory management by 0.877, 0.588 and 0.299 respectively.

Angel Raphella (2014) made a case study on inventory management. This study was done on analyzing the company's current forecasting model and recommending an inventory control model to assist them solve their present problem. As a result, an Economic Order Quantity (EOQ) and a Reorder Point was recommended to diminish the product stock outs. ABC analysis and EOQ analysis were done to identify the products. The survey was done for each month and a graph was drawn from the results. From that he concluded that, inventory management technique is more useful in determining the optimum level of inventory and resulting answers to problem of safety stock and lead time.

A case study of school building was taken by **Dipak P. Patil (2014)** for inventory management. This research was done to find out cost requisite for project with and without material management. The mathematical module of ABC analysis and EOQ gives the significance of material and its effect on cost of construction. The research concluded that with proper management the cost was saved. He added that the following were done by proper management viz., Wastage control, Right incoming quantity, Materials handling, Frequent ordering, Accurate forecast & Reduce lead time etc.

Olusakin S Akindipe (2014) made an experiment to bring to the front the prominent issue of inefficiency in the performing inventory management and its effects on production operations of manufacturing concerns. Data were collected by questionnaire and further analysis was done by Pearson correlation coefficient. The study concluded that efficient management of stock would be achieved by determination of stock levels, commitment of skilled store personnel, and the use of automated stock control. It added that lack of stock, the resultant low capacity utilization, loss in production time, which improves overall efficiency of the manufacturing SMEs and breed high performing entrepreneurs would be solved by optimal use of resources through efficiency in the management of stock.

A Study on Inventory Management at Amara Raja Electronics Ltd was made by **Rambabu (2014).** It was quite difficult to collect data in the company. From the data obtained the research were made and findings revealed that proper maintenance of EOQ, availability of stocks, procurement of raw materials increase the profit of the company.

A literature review on models of inventory Management under uncertainty was done **Serhii Ziukov (2015)**. This paper analyzed probable parameters of existing models of inventory control. An attempt was made to provide an up-to-date review of literature, concentrating on the characteristics and types of inventory control models that have been developed. The existence of models shows that fuzzy set theory is one of the apt methods, which make a great progress in inventory management. The prominence in each review was to identify how the fuzzy set theory was used in the formulation of the inventory model.

Siti Radziah Liwan made a study on Materials Tracking Practices for Inventory Management in Construction Projects. The research was done in Malaysia. The findings reveal that construction projects in Malaysia were using manual material tracking practices. In material tracking practices, the main problems in Malaysian construction projects regarding were excessive paper-based report, lack of up-to-date information, theft and labour intensive processes. Thus, there is a need of RFID to progress materials tracking practices for the use of inventory management in construction projects.

5. TECHNIQUES OF MATERIAL MANAGEMENT:

S curve analysis was done to check the deviations in the progress of the scheduled project. The tracking should be done then and there to find the fault in earlier stage itself. **Aditya A. Pande (2015)** carried out S curve analysis using MSP software. S curve analysis was done to compare planned and actual material consumption. The deviations curve in the S shaped graph produced by the increasing expenditure of certain parameters against time was the representation of project path. This analysis was carried for comparison of planned and actual cost for material. The author concluded that due to deviation in items the consequences would be on material procurement which affects the project budget.

EOQ analysis was done after the delay in the project. The delay was due to the deviations in the scheduled project. EOQ analysis was made to reduce the increasing project cost. **Ashwini R. Patil (2013)** carried out this method and found the frequent order quantity. The frequent order quantity should be known to purchase the required materials on time. Moreover the order of frequency could also be achieved. The Economic order quantity was calculated using the formula,

$$Q = \sqrt{\frac{2 * C_0 * S}{C_u * I}}$$

where, Q=Economic Order Quantity

C_0= Ordering Cost

C_u= Cost of Item

S= Total Consumption

I=Inventory carrying Cost

By using the formula, total cost of inventory and economic order quantity were found. The cost obtained after adoption of EOQ analysis was less than without adopting EOQ. Thus the cost was minimized and this analysis was recommended.

6. CONCLUSION:

From the literature review it is very clear that material management plays a vital role in the construction field. Whether it is a small firm or large firm the material management should be done. Material management holds a part right from purchasing of materials till its utilization. Moreover the S curve analysis should be done to check the deviations in the planned process to avoid the delay of the project. In case of delay, EOQ analysis is recommended to complete the project efficiently within stipulated time and cost.

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