

**ANALYZING INVENTORY MATERIAL MANAGEMENT CONTROL
TECHNIQUE ON RESIDENTIAL CONSTRUCTION PROJECT**

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Abstract: Materials management is a critical component of the construction industry. As such, organizations need to understand the effects of proper materials management techniques on the effectiveness of project execution. 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. Materials represent a major expense in construction, so minimizing procurement cost improves opportunities for reducing the overall project cost. If materials are to be purchased too early, capital may be held up and interest charges incurred on the excess of inventory of materials. This paper deals with identification of selective inventory control technique and developing a framework for assessing the various material management techniques. In the end, a framework has been developed which can be used for the future research in this area.

Key Words: Materials Management, Jobsite, Labor Productivity, Procurement

INTRODUCTION

Materials management is the system for planning and controlling all of the efforts necessary to ensure that the correct quality and quantity of materials are properly specified in a timely manner, are obtained at a reasonable cost and most importantly are available at the point of use when required. Thus materials management is an important element in project management. Materials management requires the right blend of technical and commercial expertise operating within the framework of an appropriate and good organizational structure if it is provide the efficient and effective service demanded of it. Increasingly, selective techniques are being applied to all the function within the materials management to achieve an efficient method to reduce the inventory cost.

Materials Management is a key business function that is responsible for coordination of planning, sourcing, purchasing, moving, storing and controlling materials in an optimum manner so as to provide a pre-decided service to the customer at a minimum cost. Thus materials management is an important element in project management. The materials on a project can represent anything from 50% to 60% of the cost of the work, so minimizing procurement costs improves opportunities for reducing the overall project costs.

LITERATURE REVIEW BASED ON INVENTORY MANAGEMENT

Iyer et al. (2003) conducted a series of studies and concluded that construction project slippages in India are mainly due to the following three sectors- Project planning, designing, implementation and material procurement and storage. Efforts have been made during the last sixty years, to improve technology in the construction industry. These efforts have resulted in the adoption of new technology. ^[9]

Navon et al. (2005) analyzed that materials resources constitute a large portion of a project's total cost and this makes them an important and attractive subject to control. Proper control and management of materials can meaningfully increase productivity by 6%, or more. Some model based on automatic, or semiautomatic, data collection for materials management and control said that the main benefits of improving materials management, increased productivity and avoiding delays 8-10% productivity gain due to the availability of materials prior to commencing the work; reduction in the man hours that storekeepers, or foremen, currently spend searching for materials and following up purchase orders and reduction in the cost of the materials due to reduced waste. ^[18]

According to **Onwubolu et al. (2006)** ABC (Always Better Control) analysis tends to measure the significance of each item of inventory in terms of value. When the ABC (Always Better Control) analysis is applied to an inventory situation, it shows the importance of items and level of control placed on the items. ^[19]

Kros et al. (2006) carried out raw materials are component parts from the stock of inventories carried by a manufacturing firm at a given time. Every organization has inventories of some type and the economics and techniques for inventory management are critical for efficient operation, profitability and survival; especially in a highly competitive environment. ^[10]

Gupta et al. (2007), Madan et al. (2014) applied that ABC (Always Better Control) and VED (Vital, Essential, and Desirable) selective inventory control techniques are applied for cutting tool inventory modeling and medical stores in an industry. An ABC-VED matrix was constructed for economic analysis of drug expenditure and cutting tools of priced of different items. It was suggested that to sell off the scraps and extra unused items in order to reduce the inventory holding costs and empty the space which have been un-necessarily being occupied. By this study of selective inventory control techniques they concluded that their inventory more effectively and hence later it helped them to reduce the inventory which added increased productivity, business growth and reduce the losses. ^[8, 17]

Rajeev et al. (2008) observed that a study of forty small and medium enterprises (SMEs) in Bangalore, India in an inventory intensive manufacturing industry sector, Inventory material management practices was poor. He went further that the use of formal practices for managing inventories was also inadequate. According to him, poor material management practices were characterized by a lack of an integrated approach in the form of the absence of links between physical stock and accounting system. ^[24]

Ogbadu et al. (2009) said that one of the problems facing Manufacturing Company is the growing trend towards the high cost of materials and services and constant shutdown of factories, which erode business profit. They have found out that there is a positive and significant relationship between materials management problems and the frequent breakdown of the plant. It becomes very necessary to re-organize the materials management department,

establish good relationship with suppliers of spare parts in order to minimize losses arising from frequent breakdown and improve profitability. ^[20]

Patel et al. (2011) noted that 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 costs of a project or a facility, the remaining 30 to 40 percent being the labor cost. ^[23]

Kasim et al. (2011) presented that ICT (Information and Communication Technology) Implementation of Materials Management in Construction Projects: Case Studies. They reveal that the implementation of ICT in the materials management processes for construction projects in Malaysia is at an early stage. Microsoft Excel Spreadsheet and handheld devices are found to be the common ICT tools adopted in the materials management processes. The main barrier is found to be the cost involvement at the initial stage or overall implementation of ICT in the materials management processes. ^[11]

Kuo En et al. (2012) described an Always Better Control (ABC) classification is a method of classifying inventory items according to the dollar value to a firm. Class A items, though smaller volumes, but tends to generate higher sales value, followed by the class B items. The class C items are of a very large volume, but generate a very small sales value. Class A items normally range from 5% to 20% of all inventory items and account for between 50% and 80% of sales value. The class B items normally range from 20% to 40% of all inventory items and account for 20% to 40% of sales value. The class C items normally constitute 50% to 70% of all inventory items and account for 5% to 25% sales value. ^[13]

Kasim et al. (2012) analyzed an improving on site material tracking for inventory management in construction projects. It is important to manage all materials and inventory throughout construction activities and process. Failure in managing site inventory will result in cost overrun, delays in project completion and reduce overall project performance. ^[12]

Gulsen et al. (2012) had found a multiple criteria ABC (Always Better Control) analysis with fuzzy, c-means (FCM) clustering. An inventory management policy for each individual stock keeping units (SKUs) is not economical to design. ABC analysis is one of the conventionally used approaches to classify stock keeping units (SKUs). In the classical method, the stock keeping units (SKUs) are ranked with respect to the descending order of the annual dollar usage, which is the product of unit price and annual demand. The few of the stock keeping units (SKUs) that have the highest annual dollar usage are in group A and should be taken into account mostly; the stock keeping units (SKUs) with the least annual dollar usage are in group C and should be taken into account least; the remaining stock keeping units (SKUs) are in group B. In this study, we proposed fuzzy, c-means (FCM) clustering to a multi-criteria ABC analysis problem to help managers to make better decision under fuzzy circumstances. The obtained results show that the fuzzy, c-means (FCM) is a quite simple and an easily adaptable method to inventory management. ^[7]

Ali et al. (2012) conducted that the previous study in Decision tree analysis will determine the best alternative whether forecasting and EOQ are necessary to be used and it will minimize the cost of raw materials inventory. The results of the analysis are inventory management of iron, cement, sand and split inventory should use Forecasting method and EOQ (Economic Order Quantity) model. So, companies can manage their inventory management efficiently and effectively. ^[2]

Akila et al. (2012) founded that Inventories constitute the most significant part, 30% of current asset of a majority of companies in India because of the large size of the inventor maintained by the firm a considerable amount of fund is locked in the form of inventory. The tools that are used like: ABC (Always Better Control) Analysis, Economic Order Quantity, Economic Batch Quantity, Inventory Ratios, Correlation Analysis, Trend Analysis. Inventory is considered as almost important as it covers up to 70% of the current assets of any firearms. The company can use proper technique to control the inventory to reduce the inventory level to a considerable degree reduction in excess inventories carries a favorable impact on the profitability of the company by way of unnecessary locking up of capital. ^[1]

Patil et al. (2013) described that the material management brings the objectives are Efficient material planning, buying or purchasing, procuring and receiving, storing and Inventory control supply and distribution of material, quality and assurance, good Supplier relationship. The material management brings the benefits are reducing the Overall cost of material, better handling of material, reduction in duplicate orders, improvements in labor productivity and project schedule, quality control. ^[21]

Aggarwal et al. (2013) analyzed that the overall inventory management system of the company is satisfactory the company is using satisfactory techniques with the help of inventory management tools, ABC (Always Better Control) analysis and EOQ (Economic order quantity). The purpose is to find out the ways of managing the inventory properly, so that there would be a little impact on the profits and sales of the company. ^[3]

According to **Dhoka et al. (2013)** popular concept - Importance and Exception (CIE) are employed to ensure that efficiency is maximized with the least effort. For inventory optimization and Inventory Forecasting, products need to be classified appropriately. There are most common several classification methods used for categorization of products and items is the Pareto analysis and check if some assumptions for ABC (Always Better Control) Analysis. It has been taken out the 1-month and 12 month data used for A-category. It was found that 1-Month data items resulting are loss of revenue and 12-Month data items resulting is Cash-flow issues. ^[6]

Madhavi et al. (2013) carried out a thorough study of cases, surveys and interviews to professionals involved in this area. The main problem of materials procurement is related to schedule delays and lack of specified quality for the project. After some analysis they applied in future some inventory control technique like Always Better Control (ABC) analysis and First in First out (FIFO) Method are used at work sites. Also, they said that after using the ABC analysis 20 % reduced the material cost in total, actual cost and First in First out (FIFO) Method using at work site cost controlling of contractor quotes a rate, and also helping in proper release of the finance and preparation of preparing the budget process. ^[15]

Tom et al. (2013) carried out the different inventory control technique like Always Better Control (ABC) analysis and Economic Order Quantity (EOQ) for efficient inventory management system. It found that there is a variation in the EOQ & no. of unit purchased. It is understood that the company is not following EOQ for purchasing the materials. From the ABC classification A, B, C classes are those whose unit value are more than Rs.100 and constitute 45%, between Rs.25-100 constitutes 35%, less than Rs.25 constitutes 30% of total components. It is good that the company maintains its inventories based on its value using controlling techniques. ^[27]

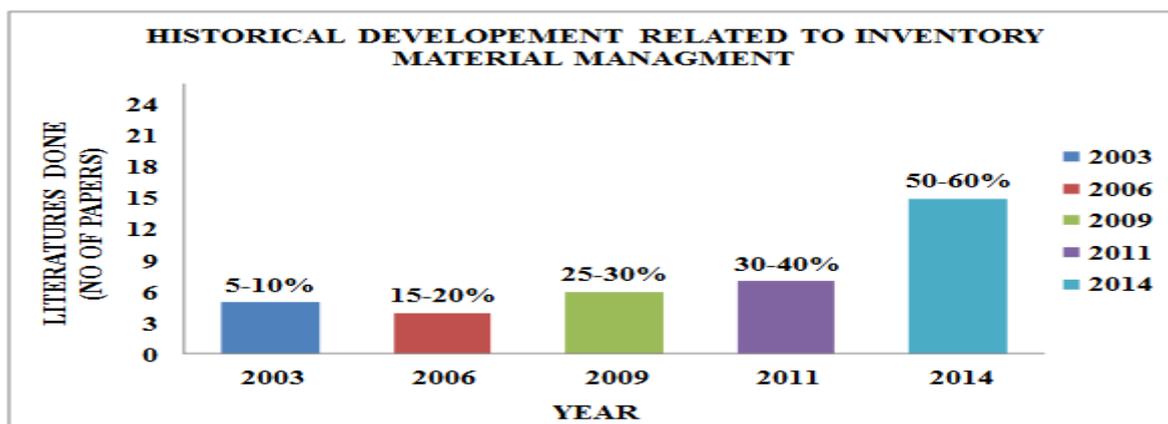
Arunprakash et al. (2013) analyzed that the inventory control practices adopted by the construction companies are based on the primary and secondary data by conducting questionnaire surveys and published Annual Report and stock sheets of companies. They are using Statistical tools like ABC (Always Better Control) analysis, FSN (Fast moving, Slow moving, Non moving) analysis. After conducting the questionnaire survey, it has been observed that, 60% of the companies maintain stock for cement based on the fund available. 50% of companies maintain stock for steel bars and steel rod stock between 5%-10%. Only 60% of companies use skilled and trained professionals in stock management. ^[4]

Kumar et al. (2013) studied that Inventory constitutes the most significant part of current assets of larger majority of Indian manufacturing industries. In the Manufacturing company can be evaluated and understood using inventory management technique ABC (Always Better Control) analysis Data collection is mainly through the interviews with the manager, annual reports, sales report, purchasing report of the company and the related journals. After data collection they concluded that future performance and past result projected investment and purchasing capacity and minimum and maximum inventories to investigate the potential for alternative stocking levels arrangements that would reduce investment liability and associated carrying costs. ^[14]

Mahant et al. (2013), Patil et al. (2014) decided that in the materials management control system they applied ABC (Always Better Control) analysis and EOQ (Economic Order Quantity) analysis to construction project, then there will be saved in cost and also avoids wastage material. It has been also observed that major factors of poor inventory control are Improper management of time, cost and manpower. ^[16, 22]

Angel et al. (2014) carried out the ABC (Always Better Control) analysis technique for the inventory control system is first used to identify the most important multiple products and then the Economic Order Quantity (EOQ) of each product is developed to find their inventory model equation individually. They have carried out the major use of materials like Cement and sand, Gravel, Bricks and Steel. They have found that Materials management unit should also pay attention to sales growth over the years and thus take into consideration. The sales and marketing department of the company should pay closer attention to the growth pattern of inventory usage and incorporate it in sales forecasting technique. ^[5]

Rambabu et al. (2014), Sindhu (2014) presented that any organization the inventory of materials plays vital role in working capital management. Inventory is the major part of their 25% cost of total production there is a need for inventory control by way of reducing cost and optimum utilization of materials stock is very high level. They can also suggest that the Inventory Management Technique like JUST IN TIME (JIT), the company can reduce its cost and supplies to finish the goods at reasonable prices to the customer. The company by strictly following management techniques like EOQ (Economic Order Quantity), ABC (Always Better Control) Analysis can increase its profits. ^[25, 26]



YEAR	PERCENTAGE	HISTORICAL DEVELOPEMENT IN MATERIAL MANAGMENT
2003	8-10%	Implementation and Procurement and
2006	15-20%	Increase Productivity level
2009	25-30%	Establish good Relationship With Suppliers
2011	30-40%	Inventory Cost Overruns
2014	50-60%	Combined Analysis Increase Its Profits

Figure 2.1: Historical Development in Material Management

CONCLUSION

1. Materials management are using the selective inventory control technique the main benefits of improving materials management, increased productivity and avoiding delays 8-10% productivity gain due to the availability of materials prior to commencing the work; reduction in the man hours that storekeepers, or foremen, currently spend searching for materials and following up purchase orders and reduction in the cost of the materials due to reduced waste and also increase business growth & reduced the losses. [18,19,8,9,15]
2. Every organization has inventories of some type and the economics and techniques for inventory management are critical for efficient operation, profitability and survival; especially in a highly competitive environment. [10,14]
3. It becomes very necessary to re-organize the materials management department, establish good relationship with suppliers of spare parts in order to minimize losses arising from frequent breakdown and improve profitability. [20]
4. In the material management the main important factors are planning, assessing the requirement, sourcing, purchasing, transporting, storing, and controlling of materials, minimizing the wastage and optimizing the profitability by reducing cost of material. [23,21,1]
5. Failure in managing site inventory will result in cost overrun, delays in project completion and reduce overall project performance. [12]
6. In some company is using satisfactory techniques with the help of inventory management tools, ABC (Always Better Control) analysis and EOQ (Economic order quantity). The purpose is to find out the ways of managing the inventory properly, so that there would be a little impact on the profits and sales of the company. [3,27,4]
7. In the future some inventory control technique like Always Better Control (ABC) analysis and First in First out (FIFO) Method are used at work sites. Also after using the ABC

analysis 20 % reduced the material cost in total, actual cost and First in First out (FIFO) Method using at work site cost controlling of contractor quotes a rate, and also helping in proper release of the finance and preparation of preparing the budget process. [15,27]

8. In the material management also observe the major factors of poor inventory control are Improper management of time, cost and manpower. [16, 22]
9. Inventory is the major part of their 25% cost of total production there is a need for inventory control by way of reducing cost and optimum utilization of materials stock is very high level. [25,26]

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