

A SURVEY ON MATERIAL MANAGEMENT FOR SMALL, MEDIUM AND LARGE SITE BY CARRYING OUT ABC ANALYSIS IN RELATION TO EOQ ANALYSIS

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Abstract- Materials management is an important component of the construction industry. Thus, organizations need to understand the effects of proper material management techniques on the effectiveness of the project. A material management program is implemented correctly to achieve timely flow of materials and equipment to the jobsite, and thus facilitate improved work planning the face, improved labour productivity, better schedules and lower project costs. Material is a big burden in development, so as to minimize procurement costs increase opportunities to reduce overall project costs. If the materials have to be bought too early, the capital can be raised and the cost of interest on excess supplies. This paper deals with the identification of selective inventory control techniques and the development of a framework for assessing a wide range of materials management techniques. In the end, the framework has been developed that can be used for future research in this area. Construction materials are a major cost component in the development of each project. The total cost of materials installed may be 50% or more of the total cost. Material is a huge cost in development. Delays and costs may be incurred if the material required for a particular activity. Ensure timely flow of materials is an important concern of materials management. The objective of the materials management is to ensure that materials are available at their point of use when needed then, efficient procurement of materials represent a key role in the successful completion of the construction work. The main objective of this project to find variations in vs Actual planned material costs through the analysis of the a-b-c and e-o-q and apply the material inventory management so as to minimize stock problems and minimize the total cost of residential construction projects. For this study we consider residential building construction SP construction Pune the abc analysis procedures for inventory control framework that was first used to distinguish the most important thing and following several economic order quantity (eoq) of each item produced to find the supplies they show independent state. Utilization of this model will help the association to determine the optimal number of items of the order within one year and when to put the new request for each item.

Keywords- Material Management, Carrying Out ABC Analysis, EOQ Analysis

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1. INTRODUCTION

1.1 GENERAL

Materials management is a system for planning and controlling all necessary efforts to ensure that the right quality and quantity of the correct material is determined in a timely manner, be obtained at a reasonable cost and most importantly provided at the point of use when needed. Thus the materials management is an element imp in project management. Materials management requires the right mix of technical and commercial expertise, which operates within the appropriate framework and organizational structure which is good if provide the most efficient and effective demanded it. Increasingly, the technique is being applied selectively to all functions in materials management to achieve an efficient method to reduce inventory costs. Materials management is the main business functions responsible for the coordination of planning, sourcing, purchasing, moving, storing, and controlling the material optimally so as to provide pre -decided services to customers at minimum cost. Thus the 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, thus minimizing procurement costs increase opportunities to reduce overall project costs.

Inventory management is the actions involved with developing and dealing with inventory levels of raw materials, completing half (work-in-process) and finished products that satisfy the supply of accessible and cost of over or under a low stock. Abc analysis is a method to regulate the management of inventory. Supplies ordered into three classes - a, b, and c. Most of the efforts of management and negligence exhausted in dealing with a case . C things slightest consideration and b stuff in the middle. Inventory is the company's resources, and in that capacity they are speaking with an effort. Since speculation requires responsibility assets, therefore companies need to keep inventory at the right level. On the off possibility that they turn out to be too broad, the company lost the opportunity to utilize these assets all the more appropriate. Basically, on the off chance that

they are too few, the company may lose deals. Therefore, there must be an optimal level of inventory. Eoq model is used to find the optimal amount can be obtained to limit the cost of the inventory carrying and processing procurement orders.

Materials management is planning and control efforts to ensure that the right quality and quantity of the correct material is determined in a timely manner, be obtained at a reasonable cost and most importantly provided at the point of use when needed. So the materials management is an important function in project management. Materials management function is responsible for the coordination of planning, sourcing, purchasing, moving, storing, and controlling the material optimally so as to provide pre-decided services to customers at minimum costing.

The material in any construction project can represent anything from 50% to 60% of all costs on the job, thus minimizing procurement costs increase opportunities to reduce overall project costs.

The aim of the thesis was to explore the local practices in inventory management of construction materials and also uses techniques such as selective inventory control is always better control (abc), economic order quantity (eoq), thus minimizing the cost of procurement increases opportunities to reduce the overall cost of the project.

1.2 PROCESS OF INVENTORY MANAGEMENT AND CONTROL

Inventory management and control refers to the planning for the optimal amount of material at all stages in the production cycle and develop techniques that will ensure the availability of supplies planned. Here are four steps involved in the process:

- a. **Determination of optimum inventory levels and procedures of their review and adjustment:** It is a significant step but a difficult one. Too much inventory results in locking up of working capital accompanied by increased carrying costs (but reduced ordering costs). Excess inventories, however, guarantee uninterrupted supply of materials and components, to meet production schedules and finished goods to meet customers demand. Too less of inventory releases working capital for alternative uses and reduces carrying costs and increases ordering costs. But there is the risk of stock out costs.
- b. **Determination of the degree of control that is required for the best results:** The second aspect of inventory management is to decide just how much control is needed to realize the objectives of inventory management. The difficulty is best overcome by categorization of inventory on the basis of value. Popularly called the ABC categorization, this approach is useful in deciding the degree of control. 'A' class items are 'high' in value but 'low' in quantity, 'C' class inventories are the opposite of 'A' group i.e. 'high' in quantity and 'low' in value. In between are the 'B' group stocks which are more or less equal in quantity and value proportion to the total inventory. Tight control is exercised on 'A' category items through accurate records of receipts and issues and by co-ordination of incoming shipments with production managements.
- c. **Planning and design of the Inventory control system:** An inventory system provides the organizational structure and the operating policies for maintaining and controlling goods to be inventoried. The system is responsible for ordering and receipt of goods, timing the order placement, and keeping track of what has been ordered, how much, and from whom.
- d. **Planning of the Inventory control organization:** It is yet another important aspect of inventory management because choosing the panel to control is very difficult.

1.3 INVENTORY CONTROL TECHNIQUES

Inventory control techniques are employed by the inventory control organization within the framework of one of the basic inventory models, viz., fixed order quantity system or fixed order period system. Inventory control techniques represent the operational aspect of inventory management and help realize the objectives of inventory management and control.

Several techniques of inventory control are in use and it depends on the convenience of the firm to adopt any of the techniques. What should be stressed, however, is the need to cover all items of inventory and all stages, i.e. from the stage of receipt from suppliers to the stage of their use. The techniques most commonly used are the following:

- a. **ABC Analysis:** ABC analysis is a business term used to define an inventory categorization technique often used in materials management. It is also known as 'Selective Inventory Control.' ABC analysis provides a mechanism for identifying items which will have a significant impact on overall inventory cost²¹ whilst also providing a mechanism for identifying different categories of stock that will require different management and controls.²² When carrying out an ABC analysis, inventory items are valued (item cost multiplied by quantity issued/consumed in period) with the results then ranked. The results are then grouped typically into three bands.²³ These bands are called ABC codes.

Abc codes

"A class" inventory will typically contain items that account for 80% of total value, or 20% of total items.

"B class" inventory will have around 15% of total value, or 30% of total items.

"C class" inventory will account for the remaining 5%, or 50% of total items. ABC Analysis is similar to the

Pareto principle in that the "A class" group will typically account for a large proportion of the overall value but a small percentage of the overall volume of inventory

Usages of abc analysis

1. In day to day warehouse operations, materials are some time under issued, over issued, issued and not accounted into the system, misplaced, stolen etc. This results into inaccuracy in the inventory. Cycle counting is the process to count and reconcile the materials. Ideally, every material in the warehouse should be counted during a fixed interval (every year) for maintaining 100% accuracy, but counting & reconciling every material is not cost effective and very expensive. To count the accuracy of the inventory in a cost effective manner, it is recommended to count the materials based on inventory classification. If A class materials are counted within a fixed interval (could be six months or a year) then the firm needs to count only 5% to 10% of the total materials and it will cover 60% to 80% of the inventory value. It means that firm only counts 5 % to 10% of the materials and remove the inaccuracy from the inventory value from 60% to 80%. Similarly B class materials can also be counted on a less frequency (from once in 18 months to 24 Months) as the number of materials become higher and C class materials at even lesser frequency (once in 27 months to 36 months) as number of material becomes more (60% to 85% of the total materials).

2. An inventory controller shall be concentrating more on the A class items for reducing the inventory as he/she shall be concentrating only 5% to 10% of the total items and shall be getting the opportunity to reduce inventory on 60% to 80% of the value.

3. Any reduction in lead time of A class items shall result in reduction in inventory, so procurement manager will work out with suppliers to reduce the lead time.

4. On issue of materials, tight control on A class, Moderate control on B class, Loose Control on C class. So 'A' class items may be issued after getting the approvals from Senior Executives of the company. B may be moderately controlled. Very little control can be exercised while issuing C class item

- b. **High, Medium and Low Classification:** The High, medium and Low (HML) classification follows the same procedure as is adopted in ABC classification. Only difference is that in HML, the classification unit value is the criterion and not the annual consumption value. The items of inventory should be listed in the descending order of unit value and it is up to the management to fix limits for three categories.

The HML analysis is useful for keeping control over consumption at departmental levels, for deciding the frequency of physical verification, and for controlling purchases.

Procurement department is more concerned with prices of materials so this analysis helps them to take them the decisions such as, who will procure what based on the hierarchy and price of material.

Some of the other objective can be as under

Helps in taking the decision such as whether to procure in exact requirement or opt for EOQ or purchase only when needed

When it is desired to evolve purchasing policies then also HML analysis is carried out i.e. whether to purchase in exact quantities as required or to purchase in EOQ or purchase only when absolutely necessary

When the objective is to keep control over consumption at the department level then authorization to draw materials from the stores will be given to senior staff for H item, next lower level in seniority for M class item and junior level staff for L class items.

Cycle counting can also be planned based on HML analysis. H class items shall be counted very frequently, M class shall be counted at lesser frequency and L class shall be counted at least frequency as compared to H & M class.

1.4 ECONOMIC ORDER QUANTITY: Economic order quantity is the level of inventory that minimizes the total inventory holding costs and ordering costs. It is one of the oldest classical production scheduling models. The framework used to determine this order quantity is also known as Wilson EOQ Model or Wilson Formula. The model was developed by F. W. Harris in 1913. But still R. H. Wilson, a consultant who applied it extensively, is given credit for his early in-depth analysis of the model.

Assume that the demand for a product is constant over the year and that each new order is delivered in full when the inventory reaches zero. There is a fixed cost charged for each order placed, regardless of the number of units ordered. There is also a holding or storage cost for each unit held in storage (sometimes expressed as a percentage of the purchase cost of the item).

An organization wants to determine the optimal number of units of the product to order so that it minimize the total cost associated with the purchase, delivery and storage of the product

The required parameters to the solution are the total demand for the year, the purchase cost for each item, the fixed cost to place the order and the storage cost for each item per year. It is worth notable that the number of times an order is placed will also affect the total cost; however, this number can be determined from the other

parameters

The ordering cost is constant.

The rate of demand is constant

The lead time is fixed

The purchase price of the item is constant i.e. no discount is available

The replenishment is made instantaneously; the whole batch is delivered at once.

EOQ is the quantity to order, so that ordering cost + carrying cost finds its minimum. (A common misunderstanding is that formula tries to find when these are equal.)

1.5 SUCCESSFUL INVENTORY MANAGEMENT

Successful inventory management involves balancing the costs of inventory with the benefits of inventory. Many small business owners fail to appreciate fully the true costs of carrying inventory, which include not only direct costs of storage, insurance and taxes, but also the cost of money tied up in inventory. This fine line between keeping too much inventory and not enough is not the manager's only concern. Others include:

Maintaining a wide assortment of stock -- but not spreading the rapidly moving ones too thin; Increasing inventory turnover -- but not sacrificing the service level; Keeping stock low -- but not sacrificing service or performance . Obtaining lower prices by making volume purchases -- but not ending up with slow-moving inventory and Having an adequate inventory on hand -- but not getting caught with obsolete items.

1.6 DEVELOPMENTS IN INVENTORY MANAGEMENT

In recent years, two approaches have had a major impact on inventory management: Material Requirements Planning (MRP) and Just-In-Time (JIT). Their application is primarily within manufacturing but suppliers might find new requirements placed on them and sometimes buyers of manufactured items will experience a difference in delivery.

Material requirements planning are basically an information system in which sales are converted directly into loads on the facility by sub-unit and time period. Materials are scheduled more closely, thereby reducing inventories, and delivery times become shorter and more predictable. Its primary use is with products composed of many components. MRP systems are practical for smaller firms. The computer system is only one part of the total project which is usually long-term, taking one to three years to develop.

Just-in-time inventory management is an approach which works to eliminate inventories rather than optimize them. The inventory of raw materials and work-in-process falls to that needed in a single day. This is accomplished by reducing set-up times and lead times so that small lots may be ordered. Suppliers may have to make several deliveries a day or move close to the user plants to support this plan.

1.7 OBJECTIVES OF THE STUDY

1. To study the present practices of materials management for construction area
2. To select the Qualitative analysis technique such as Always Better Control (ABC) and Quantitative Approach like Economic Order Quantity.
3. To apply and analysis ABC and EOQ technique on site and analyze the material performance.
4. To keep up the sufficient stock of raw material and Control investment in inventories and give helpful suggestion for Future work.

1.8 NEED OF STUDY

The need of material management is to assure that the right materials are in the right place, in the right quantities when needed. The purpose of inventory management is to ensure availability of materials in enough quantity as and when required and also to minimize investment and reduced the overall project cost of inventories

1.9 SCOPE OF STUDY

The Scope of research work is restricted to Residential building “s p construction ” project in construction firms at Pune in Maharashtra region

2. INVENTORY MATERIAL MANAGEMENT

2.1 INTRODUCTION

Material management is defined as “The 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.” Materials management is a concept having its definite organization to plan and control all types of materials, its supply, and its flow from raw stage to finished stage so as to deliver the product to customer as per hire requirements in time. It involves different functions like materials planning and controlling, purchasing, stores and inventory control. The materials requirements planning, purchasing, inventory planning, storage, inventory control, materials supply, transportation and materials handling are the activities of materials management.

2.2 FUNCTION OF MATERIAL MANAGEMENT

The major functions of material management are identified as:

1. Materials Planning and controlling: This involves estimation of the requirement of individual materials, preparing Material cost, determine levels of inventories and scheduling.
2. Purchasing: This involves planning, organizing and directing the purchase of all types of materials.
3. Stores and inventory control: This involves physical control of materials, optimizing of useless and damage materials through timely disposal and well-organized handle of materials, maintenance of store records, proper location and stocking of materials etc.
4. Planning of transportation in the most economical way for the incoming and outgoing of the materials.
5. To generate the coordination between various departments.

2.3 OBJECTIVES OF MATERIAL MANAGEMENT:

The main objective of material management is to reduce the cost of the material that is to be incurred on materials and to increase the profit of organization The objectives are as follows:

- Right quality of materials in required quantity at an appropriate cost from proper place with right terms and condition so as to remove the expenditure on materials.
- By preferring latest techniques, economy is to be achieved.
- Reduction in investment through scientific inventory control.
- Efficiently materials planning.
- Purchasing or Buying.
- Procuring .Receiving.
- To inventory control.
- For storing • Supplying & distribution of materials.
- For quality control.
- For the good supplier and customer relationship.
- To take make or buying decisions.
- To prepare the specification and standardization of materials.
- For determine demand and quality of material requirements.
- For handling of materials • Smooth flow of materials.

2.4 IMPORTANCE OF MATERIALS MANAGEMENT:

The management of the materials plays vital role for the successful completion of a project control of the materials management is a very important for every firms in the material management different materials account for a big part of product and cost of project. cost represent by material fluctuates and comprise between 20 to 50 % of the total cost of project and sometimes more many study concluded that materials account for around 50 to 60 % of the cost of project. The importance of material management may be as follows:

- The material cost content of total cost is held at a reasonable level. Scientific purchasing helps in obtaining of materials at reasonable prices. Proper storage of materials also helps in reducing their wastages. These factor help in controlling cost content of products.
- The equipment is properly used because there are no breakdowns due to late supplying of the materials.
- Loss of the direct labour is avoided. • The supply of materials is stimulate and cases of late delivery are only a few.
- The wastages of the materials are avoiding.
- The investments in materials are held in under control and avoid overstocking problems.

2.5 SCOPE OF MATERIALS MANAGEMENT:

Materials Management can be defined as that function that responsible for the Coordination of planning, sourcing, purchasing, moving, storing, and controlling of materials in optimum way so as to provide service for the customer, at a pre-decided level at a minimum cost.

2.6 ADVANTAGES OF MATERIALS MANGEMENT:

- Better controlling of material.
- Better quality control.
- Materials will be on site when needed and in the required quantities.
- Reduction of stock.
- Good relation with supplier.
- Site storage reducing.
- Saving on purchases.
- Reduction in transportation cost.

- Minimum prices and better delivery conditions for purchased materials.
- More flexibility.
- Improvements on project schedule.
- Minimized in duplicate orders.
- Good cash flow management.

2.7 MATERIAL REQUIREMENT PLANNING:

Planning of the material is a scientific way of assuring the requirements of raw materials, equipment, machinery and components that are required for meeting the resource requirement of a project within the overall financial investment policies of a construction company. Planning of material is a function sub system in the overall planning activity.

2.7.1 OBJECTIVE OF MATERIAL REQUIREMENT PLANNING

- To ensure that all material of components are available for the construction activity.
- To maintain optimum inventory level but also ensure right quantity of materials is available at the right time to produce right quantity of final products.

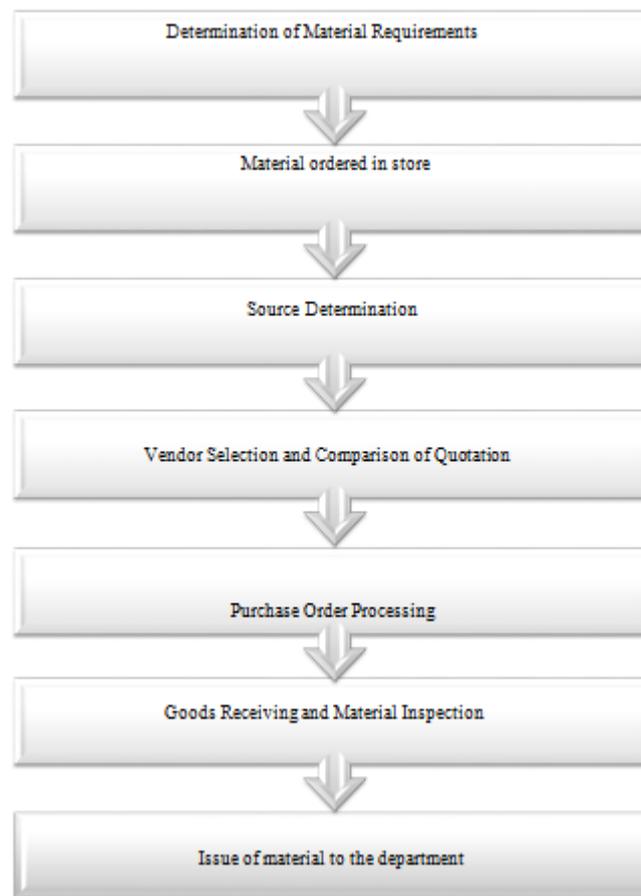


Fig 2.1 Material Management process for Construction Site

3. LITERATURE REVIEW

The review of existing literature in the field of Material Management which helps in capturing both conceptual and research based studies. A Number of studies have been conducted to find the determinants of investment in inventories and the process is still going on. The present study is the summary of critical points of a particular topic consisting of essential findings as well as theoretical and methodological contributions.

The following are the previous research review based on impact of material management on construction project

Abramovitz and Modigliani et al. (1957) they highlighted the connection between capability utilization as well as inventory investment. Existing inventory of inventories was likely to change to the desired quantities.

Hence the adjustable, existing inventory of inventories, was necessary to be badly associated with the preferred inventory. The end result was that there's good relation of all the ratio of inventory to product sales as well as inventory investment. High ratio of stocks to product sales in the past indicates necessity of higher amounts of inventories before and promising excessive buy of inventories in the present time too. (1)

Kulkarni Sharma Hote et al. they worked on the analysis of factors affecting effective materials management in building construction projects. They studied on nine different small, large & medium firms in Maharashtra. By studying gathered data, factors were found out affecting material management. They concluded that the large firms are good & capable enough in applying material management techniques on construction sites. Medium firms have some technical as well as some seasonal problems as they do not use any software. Small firms lack behind in material management as compared to medium & large firms due to lack of knowledge about material management. Use of software like MSP, PRIMAVERA, ERP, SAP, etc. should be done to avoid manual errors in material management. Before placing any order, every construction firm should apply EOQ technique to reduce project cost overrun. (2)

Patil Sarode et al. stated that Construction industry now a day is very progressive and innovative industry as compare to other industries in the world. At every construction industry for financial profit, need of people, owner various fast track techniques are used for completion of the construction work. They analyzed the Correlation coefficient between cost of project and cost on material management of 15 building sites by using following methods of correlation with results on SPSS statistical software,

Pearson correlation – $0.921+1 > 0.921 > 0$ - the correlation between the two variables is said to be perfect and positive

Kendall tau – $b - 0.543+1 > 0.543 > 0$ - the correlation between the two variables is said to be perfect and positive

Spearman rho – $0.688+1 > 0.688 > 0$ - the correlation between the two variables is said to be perfect and positive.

Hence, data analysis of total cost of project and the material management cost on project is perfect and gives positive results of correlation; data is useful for future survey work.(3)

George et al. (1972) It was the analysis on cross section analysis of balance sheet information of fifty two public restricted businesses because of the time of 1967 seventy. Accelerator, external and internal finance variables have been viewed in the formulation of formulas for raw materials such as goods-in-process inventories. Nevertheless, formulas for done products inventories conceive just output adjustable. Deliberation was provided on external finance variables and accelerator. (4)

Mishra et al. (1975) It's the analysis of 6 main public sphere enterprises. He realized that (i) inventory constitutes the most crucial element of working capital of public enterprises (ii) performance of working capital money used within receivables is awfully lower in the selected companies and also (iii) In most devices both today's assets as well as the fast ratios are higher compared to the standards of theirs. Enterprises require appropriate command on receivables. (5)

Lambrix and Singhvi et al. (1979) Adopted working capital cycle procedure in working capital management, additionally recommended that investment in working capital could be enhanced and money flows could be raised by decreasing time frame of bodily flow beginning from the receipt of raw material to the shipment of finished products, i.e. inventory management, and also by enhancing the conditions as well as conditions where firm offers items in addition to receipt of money. (6)

Lal et al. (1981) He learned Modi Steels Limited as a case study, his analysis concentrated on inventory control. He originated an unit which will include price varying in inventory management; previous cost variable in catalogue wasn't considered in that organization. The evaluation suggested stable policies, that will take care of external and internal factors, ultimately it'd aid in earning effective working capital control. (7)

Farzaneh et al. (1997) Presented a mathematical model, to help the businesses in the decision of theirs to change from EOQ to JIT purchasing policy. He defines JIT as "to produce and provide done foods only soon enough being available, sub-assemblies only in time to be assembled in products & bought substance only in time to be converted into fabricated parts". He highlights the EOQ design concentrates on reducing the inventory fees instead of reducing the inventory. Under the perfect problem wherein all of the circumstances satisfy, it's economically better off to select the JIT with the EOQ since it leads to purchase price, buying price. (8)

Dave Piasecki et al. (2001) He centred on listing type for calculating the perfect order quantity which utilized the Economic Order Quantity technique. He highlights that lots of businesses aren't utilizing EOQ type due to bad results resulted from incorrect details input. He claims EOQ is an accounting formulation which establishes the point at what the mixture of order costs as well as listing expenses would be the very least. He highlights that EOQ strategy wouldn't clash with the JIT method. He further elaborates the EOQ method which contains the parameters such as for instance annual use for device, carrying cost and order cost. Lastly, he proposes many measures to go by in employing the EOQ design. The limitation of this particular literature is it doesn't

elaborate relationship that is further between JIT. and EOQ It doesn't connect the listing turns with the EOQ formula and additionally fails to point out the benefit gain with all the amount is estimated. (9)

Gaur, Fisher and Raman et al. (2005) In their analysis examined firm level inventory behaviour amongst retailing businesses. They had taken a sample of 311 public listed list companies for all the years 1987-2000 to analyse the connection of inventory turnover with disgusting margin, sales and capital intensity surprise. They found that inventory turnover for retailing firms was favourably associated with sales and capital intensity surprise while inversely connected with disgusting margins. Additionally they recommended designs which yield an alternate metric of inventory productivity, adjusted inventory turnover which could be utilized in research of managerial decision-making and performance analysis. (10)

6. CONCLUSION

From the site investigation by applying ABC & EOQ in SP CONSTRUCTION PUNE following conclusion are drawn ABC analysis is kind of method, which provides the means for classifying those items that make the largest effect on a company's overall inventory cost performance

ABC classification to identify and define the safety stocks, which is a protection so that does not lack of material as well as stocks average, maximum and minimum, so as to assess the amount necessary to avoid a lack of raw material and without any accumulation in inventory.

Total investment cost of the material which widely used in SP CONSTRUCTION in Case study 1 without use of EOQ is Rs. 7381170 & with use of EOQ is Rs. 2285250 also with using of EOQ cost saving in material is 70 %.

Total investment cost of the material which widely used in SP CONSTRUCTION Case study 2 without use of EOQ is Rs. 83736580 & with use of EOQ is Rs. 44647030 also with using of EOQ cost saving in material is 50 %.

By applying ABC analysis we can easily classified the material which requires more investment & by using EOQ we can easily control or reduce the total investment cost of the material.

The inventory control technique by adopting proper material management system large amount of cost can be reduced in large projects and that saved cost can be used in some small project as our country already running short money.

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.

Failure in managing site inventory will result in cost overrun, delays in project completion and reduce overall project performance.

In the material management also observe the major factors of poor inventory control are Improper management of time, cost and manpower.

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.

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