

TECHNIQUES OF MATERIAL MANAGEMENT AS A COST REDUCTION TOOL IN CONSTRUCTION INDUSTRY

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1. Abstract

The material management is a process, or an art and science put together. It is how a project is designed and how the materials are estimated. It is how materials are acquired and how even the packaging is specified. It is how the delivery schedule is designed. It is how contractors plan use of the materials and how they manage previously used materials. It also includes how waste is managed for use elsewhere rather than being discarded or in landfill.

Materials are one of the major constituents of the construction industry. Depending on the type of project, materials cost usually varies from 40% to 70% of the total project cost, highlighting the importance of materials management.

It has been recognized that material department can contribute effectively to corporate profits, as purchasing is considered a spending function and every rupee saved in buying goes to profit column of balance sheet. It can be noted that the materials function accounts for a major portion of cash out flow in any organization. Therefore, material management is not a simple function but a dynamic discipline, which can contribute greatly to corporate profitability, resulting in the growth of economy.

Enterprise Resource Planning (ERP) packages have been in use for decades, but changes in business and IT strategies are driving implementations, re implementations, and new utilization of existing functionality in current systems. Though most organizations with ERP systems have gained skills in system integration and project management, as well as specific system capabilities, they should not expect an easy time either selecting a team with the requisite skills or completing these typically large projects.

Keywords- material management, cost reduction, cost control, inventory management

2. MATERIAL AND INVENTORY MANAGEMENT

Introduction

Materials Management strives to ensure that the material cost component of the total product cost be the least. In order to achieve this, the control is exercised in the following fields.

1. Materials Planning.
2. Purchasing.
3. Store Keeping.
4. Inventory Control.
5. Receiving, Inspection and Dispatching.
6. Value Analysis, Standardization and Variety Reduction.
7. Materials Handling & Traffic.
8. Disposal of Scrap and Surplus, Material Preservation.

The function of material planning department is to plan for the future procurement of all the required materials as per the production schedule. At the time of material planning, the budget allocated for the materials will also be critically reviewed, for better control.

In the planning phase of any project, one of the fundamental assumption made is that resources will be available as and when required. Effectiveness of any planning and scheduling would depend greatly on the extent to which such an assumption is valid. Management of inventories is therefore a key component of the overall management of a project to ensure the progress of the work as envisaged. Efficient inventory management of a project implies the availability of the right amount of stock at the right place and at the right time.

Materials management is the integrated functioning of the various sections dealing with materials so as to achieve the maximum coordination and the lowest possible expenditure on the materials.

One of the major problems faced by all organizations in construction is the time & cost overrun of the projects. One of the major attribute of this cost and time over run is lack of effective materials management techniques adopted by the organization. Any delay in providing materials not only puts the project behind the schedule, but also lower the moral of the executives and needs additional efforts to timely completion of the project within the cost frame with the given quality standard.

3. METHODS OF INVENTORY MANAGEMENT

3.1 Objectives of Inventory Management

Inventories are stock of materials of any kind stored for future use, mainly in the production process. The ultimate objective of all manufacturing controls is to realize a profit through the operation of the business. A more restricted objective of the control of material is to satisfy the customer by meeting the schedule for deliveries. Failure to deliver order on time is one principal cause of loss of business and customers. Effective control of the material throughout the manufacturing cycle reduces the chance of this problem arising. In any consideration of manufacturing, it is plain that as material flows through the system, it is subjected to starts and stops. Material must wait for machines or materials handling equipment to become available and must be ordered in advance of production and stored in a warehouse or storage area. Inventories are thus a necessary part of the contemporary manufacturing environment, and they must be managed if profit is to accrue. It should be noted, however, that the introduction of elements of computer-integrated manufacturing has reduced, to some extent, manufacturing management's dependence on some type of inventories. In addition, the Japanese concept of "just-in-time" production scheduling may reduce manufacturing's dependence on inventories.

3.2 Inventory System

In this system, multiple stores can be controlled under a single administrative system. Items are grouped into different groups based on their usage for better administrative purpose. In order to control the store wise stock of the items, the stock details of items are maintained in various stores of the administrative unit. This system provides the provision to view the quantity of items in the stock graphically.

Stores issue requisitions should be raised and sanctioned before issuing items from the store. To purchase items to the stores, purchase requisitions are to be raised and sanctioned. Damaged goods can be returned and the stocks are updated accordingly. Stock adjustments are done, to keep the system wise stock and the actual physical stock of items in the store tallied. The voucher details of this system can be posted to the General Ledger System based on various posting types on a daily basis.

3.2.1 Main Features of Inventory System

The Inventory System automates the functions in a store. Issue and purchase of items, keeping stock of items, etc. are the main functions of this system.

The main features of this system are listed below:

1. This system maintains the details of stores which include the receipt, issue and adjustment of stock materials.
2. Facilitates multi stores under a particular administrative unit.
3. This system helps you to define multiple stores that come under a single administrative unit. Parent stores as well as sub stores can be defined in this system.

3.3 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 cost whilst also providing a mechanism for identifying different categories of stock that will require different management and control. 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. These bands are called ABC codes.

ABC codes -

1. "A class" inventory will typically contain items that account for 70% of total value, or 10% of total items.
2. "B class" inventory will have around 20% of total value, or 15% of total items.
3. "C class" inventory will account for the remaining 10%, or 75% 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.

3.4 Just in Time Technique

Just-in-time (JIT) is an inventory strategy that strives to improve a business's return on investment by reducing in-process inventory and associated carrying costs. To meet JIT objectives, the process relies on signals or Kanban between different points in the process, which tell production when to make the next part. Kanban are usually 'tickets' but can be simple visual signals, such as the presence or absence of a part on a shelf. Implemented correctly, JIT can improve a manufacturing organization's return on investment, quality, and efficiency. Quick notice that stock depletion requires personnel to order new stock is critical to the inventory reduction at the center of JIT. This saves warehouse space and costs. However, the complete mechanism for making this work is often misunderstood.

3.4.1 Different approaches in JIT In short, the just-in-time inventory system focus is having “the right material, at the right time, at the right place, and in the exact amount”, without the safety net of inventory. The JIT system has broad implications for implementers.

3.4.2 Environmental concerns

During the birth of JIT, multiple daily deliveries were often made by bicycle. Increased scale has required a move to vans and Lorries (trucks). Cusumano (1994) highlighted the potential and actual problems this causes with regard to gridlock and burning of fossil fuels. This violates three JIT waste guidelines:

1. Time—wasted in traffic jams
2. Inventory—specifically pipeline (in transport) inventory
3. Scrap—fuel burned while not physically moving

3.4.3 Price volatility

JIT implicitly assumes a level of input price stability that obviates the need to buy parts in advance of price rises. Where input prices are expected to rise, storing inventory may be desirable.

3.4.4 Quality volatility

JIT implicitly assumes that input parts quality remains constant over time. If not, firms may hoard high quality inputs. As with price volatility, a solution is to work with selected suppliers to help them improve their processes to reduce variation and costs. Longer term price agreements can then be negotiated and agreed-upon quality standards made the responsibility of the supplier.

3.4.5 Demand stability

Karmarker (1989) highlights the importance of relatively stable demand, which helps ensure efficient capital utilization rates. Karmarker argues that without significantly stable demand, JIT becomes untenable in high capital cost production. In the U.S., the 1992 railway strikes caused General Motors to idle a 75,000-worker plant because they had no supply.

3.4.6 Transaction cost approach

JIT reduces inventory in a firm. However, a firm may simply be outsourcing their input inventory to suppliers, even if those suppliers don't use JIT (Naj 1993). Newman (1993) investigated this effect and found that suppliers in Japan charged JIT customers, on average, a 5% price premium.

3.4.7 Benefits of JIT

Main benefits of JIT include:

- Reduced setup time. Cutting setup time allows the company to reduce or eliminate inventory for "changeover" time. The tool used here is SMED (single-minute exchange of dies).
- The flow of goods from warehouse to shelves improves. Small or individual piece lot sizes reduce lot delay inventories, which simplifies inventory flow and its management.
- Employees with multiple skills are used more efficiently. Having employees trained to work on different parts of the process allows companies to move workers where they are needed.
- Production scheduling and work hour consistency synchronized with demand. If there is no demand for a product at the time, it is not made. This saves the company money, either by not having to pay workers overtime or by having them focus on other work or participate in training.
- Increased emphasis on supplier relationships. A company without inventory does not want a supply system problem that creates a part shortage. This makes supplier relationships extremely important.
- Supplies come in at regular intervals throughout the production day. Supply is synchronized with production demand and the optimal amount of inventory is on hand at any time. When parts move directly from the truck to the point of assembly, the need for storage facilities is reduced.

4. METHODS OF MATERIAL MANAGEMENT

4.1 Objectives of Materials Management

- To reduce working capital requirements through proper and scientific inventory control.
- To achieve the right quality in manufactured goods and to increase their competitiveness in the market.
- To save foreign exchange through import substitution and economizing on foreign purchases.
- To stabilize and reduce prices of manufactured items.
- To conserve materials and thereby contribute to the economical use of national resources.

4.2 Unit Contract System:

The Unit Contract System facilitates the functioning of the contractors working for a company or organization. The personal details and the areas of specialization of the contractors can be defined through this system. You can tag the specified contract type with the job groups, departments and related criteria. Rate list can be prepared for various contractors for a specified period. You can define the materials that can be used for the various job groups or job services through this system.

The job requests will be raised for various jobs or job services from the different departments of the company. A contract will be prepared for the sanctioned job or job service requests. The work progress is

recorded for the sanctioned contracts and work progress certificate is prepared based on the work progresses recorded. Based on the work progress certificates, the payment advice note is created and payment is made to the contractors. The status for the contractors can also be recorded through this system. The penalty amounts which were kept on hold can be released for the contractors.

You can generate checklists, which gives you a complete list of all the details you had entered through the options of this system. Various other reports containing the contract details can also be generated through this system.

4.2.1 Main Features of Unit Contract System

This system facilitates the functioning of the contractors working for the company. The major features of this system are:

1. The specialized area and contractor base of contractors can be specified through this system.
2. It is possible to tag the specified contract type with job groups, department and the related criteria. Depending on the mapping, you can easily identify the requirements of the contract.
3. A contract rate list can be created related to a job group or job service, for the specified contractors.

4.3 Fixed Quantity Order System

The Fixed Quantity Order System facilitates the systematic processing of the purchase orders to the suppliers. After receiving material requisitions from various locations the system combines and sanctions the various purchase requisitions. After sanctioning the purchase requisition, tenders or quotations are called. The tenders are then evaluated and processed to prepare the price comparison statement and routine price list. The purchase order or contract is created through this system. Different purchase procedures (purchase types) are followed in purchase department to meet the requisitions coming from estates as well as departments.

The main intention of the package is to control the purchase of items in the company by inspecting the purchase requisitions and the tenders. This system receives invoices for the materials provided by suppliers. The purchase department prepares the purchase ledger on a monthly basis to credit the suppliers and sends it to finance department. The stock ledger and purchase ledger reconciliation is done in the purchase department through this system. The system can generate all relevant reports and checklists which are necessary for evaluating various purchase order related details.

4.3.1 Main Features of Fixed Quantity Order System -

The purchase order system facilitates the functioning of purchase department in the organization. The main features of this system are listed below:

1. The different suppliers providing materials to the company can be defined and categorized, according to the type of material they supply.
2. You can define the items handled by the purchase department. The items can also be categorized based on their type or the department in which they are used. These items can be registered against corresponding suppliers.
3. This system enables to handle different types of purchase such as Tender Based, Routine Price List, Repeat Order Purchase and Direct Purchase. Purchase type can also be local or import.
4. You can set sanctioning authority for various documents and each authority is restricted to sanction limited transaction amounts specified in the system.

4.4 Codification

One of the pre-requisites of classification and codification is to know basic nature and characteristics of all materials used in an enterprise and classify them in broad categories, and then to group and sub-group them in logical progression of kinds, types, sizes. As for example, raw materials, semi-processed materials, mechanical (products and equipment), electrical (products and equipment), chemicals (allied products and chemical processing equipment), laboratory, office (equipment and supplies) etc. can be classified, grouped and sub-grouped.

After the broad classifications as to their nature and use, a code or symbol is allotted to each of them. The code or symbol so allotted should be simple, flexible and it should be easily adoptable in order to exploit the full advantages of codification.

The following systems of codification are commonly found:

1. Alphabetical System- Under this system, 'alphabets' become the basis and codes are allotted to each item in alphabetical order. Each item is grouped according to its nature, use, etc. and the first alphabet of the name of the material is the starting point of codification. Subsequent sub-alphabets are used depending upon other characteristics of the material in question.

2. Numerical System - Against-fee alphabetical system, the numerical system is based on numbers, either simple numbers, block numbers or dash/stroke numbers

3. Brisch System - This system is similar to the numerical system described above. Noted for its comprehensive nature, it lends itself to easy adoption. A 7-digit numerical code is assigned to each item with digital significance by virtue of their position and value. It works in three phases:

(a) The materials are grouped into suitable categories.

(b) After preliminary identification and grouping, materials are further sub-divided according to their class characteristics as under decimal system.

(c) Then by establishing differences at various levels of classification, they are again sub-divided at a still lower classification level.

The main objective is to describe the material in greater details with less use of numbers, which permits accurate and unambiguous identification. The 7-digit code is not rigid; it may be varied as per requirement.

4. Kodak System - Developed by the Eastman Kodak Company of New York, USA, this system makes use of all the good points discussed above and, therefore, it is versatile in application and operation. Its fundamentals are based upon the numerical system of codification, but in place of using decimals it uses hyphens. The basis of primary classification is not based upon the nature, use and other characteristics of materials, but upon purchase category, i.e. grouping is done on the basis of group source of supplies. Then numerical codes are allotted to each group and further sub-grouping is done as usual. It uses a ten-digit, all numerical numbers composed of three-group digits, separated by hyphen, thus: XXX-XXXX-XXX, three, four and three Alphabets are avoided in order to facilitate accounting and recording on punch-card system.

5. ENTERPRISE RESOURCE PLANNING (ERP)

Enterprise resource planning (ERP) is an integrated computer-based system used to manage internal and external resources including tangible assets, financial resources, materials, and human resources. It is a software architecture whose purpose is to facilitate the flow of information between all business functions inside the boundaries of the organization and manage the connections to outside stakeholders. Built on a centralized database and normally utilizing a common computing platform, ERP systems consolidate all business operations into a uniform and enterprise wide system environment.

An ERP system can either reside on a centralized server or be distributed across modular hardware and software units that provide "services" and communicate on a local area network. The distributed design allows a business to assemble modules from different vendors without the need for the placement of multiple copies of complex, expensive computer systems in areas which will not use their full capacity.

Enterprise Resource Planning (ERP) is software driven business management system, which integrates all facets of the business, including banking, manufacturing, sales, and marketing. The business environment has become increasingly complex and the marketplace has changed from local to global. Management is under constant pressure to improve competitiveness by lowering operating costs and improving logistics. Organizations therefore have to be more responsive to the customer and competition. ERP as a business solution aims to help the management by setting better business practices and equipping them with the right information to take timely decisions.

6. RADIO FREQUENCY IDENTIFICATION (RFID)

In 1945, Leon Theremin invented an espionage tool for the Soviet Union, which retransmitted incident radio waves with audio information. Sound waves vibrated a diaphragm, which slightly altered the shape of the resonator, which modulated the reflected radio frequency. Even though this device was a covert listening device, not an identification tag, it is considered to be a predecessor of RFID technology, because it was likewise passive, being energized and activated by electromagnetic waves from an outside source.

Similar technology, such as the IFF transponder invented in the United Kingdom in 1915, was routinely used by the allies in World War II to identify aircraft as friend or foe. Transponders are still used by most powered aircraft to this day. Another early work exploring RFID is the landmark 1948 paper by Harry Stockman, titled "Communication by Means of Reflected Power" (Proceedings of the IRE, pp 1196–1204, October 1948). Stockman predicted that "Considerable research and development work has to be done

before the remaining basic problems in reflected-power communication are solved, and before the field of useful applications is explored."

7. CONCLUSION

Effective use of Enterprise Resource Planning (ERP) in materials management, in construction projects is essential as a cost reduction tool. Aspects of Enterprise Resource Planning (ERP) & Radio Frequency Identification Device (RFID) as material management techniques can be adopted in construction industry.

An ERP implementation presents a vast range of business challenges. It takes labor and knowledge to address these quickly and with leading-practice approaches. Its one thing to use and maintain an ERP system on a day-to-day basis, and entirely another to rebuild a system or start from the beginning. Time is of the essence, since implementations are disruptive and because organizations seek to reap the benefits of a system as soon as possible, while maintaining or improving controls and regulatory compliance. For these reasons, it pays to select a knowledgeable and resourceful team that can understand your needs, maintain focus on achieving planned benefits, and determine effective ways to achieve your goals.

RFID technology is being implemented in various industries and proving to be very beneficial to data retrieval and storage because it can increase effectiveness and efficiency. In the construction fields, this technology is in the research and pilot study stage. Both the long-range and short-range RFID systems researched and tested provide benefits/solutions to state transportation departments depending on the type of asset information intended to be stored and the purpose of the information for the department's asset management division.

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