

Comparative Study of Radio Frequency Identification Technique with Conventional Technique

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Abstract— Material management is a vital function for improving productivity in construction projects. The management of materials should be considered at all the phases of the construction process and throughout the construction and production periods. The control of materials is a very important and vital subject for every company and should be handled effectively for the successful completion of a project. Materials account for a big part of products and project costs. The cost represented by materials fluctuates and may comprise between 20-50% of the total project cost and sometimes more. Some studies concluded that materials account more than 60% of the total project cost. Many construction projects apply manual methods, not only for the tracking of materials, but also for materials management as a whole and this involves various techniques and this leads to the problematic situations with many human errors. So a study is made to handle the material on site by Rfid method and cost and time parameter is considered to compare with conventional methods.

Key words: Material Management, Construction Materials, Radio Frequency Identification Technique (Application and Study)

I. INTRODUCTION

The construction industry is the second largest industry in India after agriculture. It accounts for about 11% of India as GDP. It makes significant contribution to the national economy and provides employment to large number of people. The management of materials should be considered at all the phases of the construction process and throughout the construction and production periods. This is because poor materials management can often affect the overall construction time, quality and production time. It is important for planning and controlling of materials to ensure that the right quality and quantity of materials and installed equipment are appropriately specified in a timely manner, obtained at a reasonable, cost, and are available when needed. The cost represented by materials fluctuates and may comprise between 20-50% of the total project cost and sometimes more. Some studies concluded that materials account more than 60% of the total project cost. [2] The material management system attempts to insure that the right quality and quantity of materials are appropriately selected, purchased, delivered and handled on site in a timely manner and at a reasonable cost. The problematic mostly occurring in the management of material is related to the shortage, availability, supply chain, inventory, handling, and the storage of material. To overcome this error and problematic, real-time information visibility and traceability is highly desired and Radio Frequency Identification (RFID) technology can be implemented.

Material management is a scientific technique, concerned with planning, organizing and control of flow of materials, from their initial purchase to destination.

A. Material management problem

The material management system attempts to insure that the right quality and quantity of materials are appropriately selected, purchased, delivered and handled on site in a timely manner and at a reasonable cost. The problematic mostly occurring in the management of material is related to the shortage, availability, supply chain, inventory, handling, and the storage of material.

- 1) Human / Manual error.
- 2) Lengthy process to maintain Stock Registers.
- 3) Details cannot be found easily.
- 4) Accuracy is less
- 5) Difficult to take track record of stock.
- 6) Easy updating is not possible.
- 7) Storage location of material cannot be found.
- 8) Requires more time.
- 9) Communication problem.
- 10) Requires Lock and key place to keep the registers.

B. Objectives of material management

Efficient material planning.
Buying or purchasing.
Procuring and receiving.
Storing and inventory control.
Supply and distribution of material.
Quality assurance.

II. LITERATURE REVIEW

Rohan J. Madgi, Prof. Shashank.el.al (2018) Discussed that In any infrastructure projects the major constituent is the material where in it involves more than 60% of the total cost of project, poor planning and control of material, lack of material when needed, poor identification of material, re-handling and inadequate storage cause losses in productivity and overall delays that can indirectly increase total project cost. Techniques such as EOQ analysis, ABC analysis, S-curve analysis, VED analysis, HML analysis etc. were developed for quantity and quality analysis.

Eleni Iacovidou.et.al (2017) had written a research paper on the use of smart technologies in enabling construction component reuse preliminary assessment of the strengths, weaknesses, opportunities and threats of the RFID technology is presented in order to depict its current and future potential in promoting construction components' sustainable lifecycle management, while emphasis has been laid on capturing their technical, environmental, economic and social value. Author suggests that the collection of the right amount of information at the design-construction-

deconstruction-reuse-disposal stage is crucial for RFID to become a successful innovation in the construction sector.

S. Prakash Chandar.et.al (2016) had written a research paper on the topic developing Of RFID Automation Technique. The problematic mostly occurring in the management of material is related to the shortage, availability, supply chain, inventory, handling, and the storage of material. Mostly to record and exchange information related to the materials within a supply chain and inventory which is error-prone, inefficient and time consuming. To overcome this error and problematic, real-time information visibility and traceability is highly desired and Radio Frequency Identification (RFID) technology can be implemented for this purposes.

Mohammed Azhar Khan, Mohammed Irfan Qureshi.et.al (2016) Inventory management is a science primarily about specifying the shape and percentage of stocked goods. It is required at different locations within a facility or within many locations of a supply network to precede the regular and planned course of production and stock of materials. The use of software for managing the inventory will ease the work of the storekeeper as well as give a brief overlook on management to the Administration. Thus we have developed software on EOQ model which creates a matrix of ABC and FSN and prioritizes the materials. The software not only runs the matrix but also gives real time access by knowing the demand and lead time. Using this technique, the ongoing demand of materials can be met without any delay, at optimum cost. Thus the cost effectiveness is achieved.

Nawaj Kalim Hannure and Sushma Shekhar Kulkarni (2014) He discussed Comparative Study of Traditional Material Management and Material Management with ICT Application or management of a productive and cost efficient site, efficient material management is very essential. Research has shown that construction materials may constitute more than 50% of the total cost for a typical construction project. Therefore the proper management of this single largest component can improve the productivity and cost efficiency of a project and help to ensure its timely completion. One of the major problems in delaying construction projects is poor material management. The material management system attempts to insure that the right quality and quantity of materials are appropriately selected, purchased, delivered and handled on site in a timely manner and at a reasonable cost. This paper contains the different methods used by the construction companies and also describes the main results of survey carried out in Pune in different construction companies for their current material management process.

Dr.G.Brindha (2014) He stated Inventory is essential to provide flexibility in operating a system. The inventory can be classified into raw materials inventory, in-process inventory and finished goods inventory. The raw materials inventories remove dependency between suppliers and plants. The work-in-process inventories remove dependency between machines of a product line. The finished goods inventory removes dependency between plant and its customers/market. Inventory management is one of the important components of working capital management. It involves the progress of providing continuous flow of raw

materials to production department. More than 60% of the working capital will normally be invested in the inventory. There can be disadvantage in holding either too much or too little inventory. Therefore, inventory management is primarily concerned with obtaining a correct balance between these two extremes. Decisions relating to inventory are taken primarily by executives in production, purchasing & marketing departments. Usually raw materials policies are shaped by purchasing & production executives and finished goods inventory policy is evolved by production and marketing executives. Yet, as inventory management has important financial implications the financial manager has the responsibility to ensure that inventories are properly monitored and controlled.

Ville Hinkkax.et.al (2013) had written a research paper on RFID tracking implementation model for the technical trade and construction supply chains in the journal of Automation in Construction, Elsevier. In this paper Author states that RFID tracking implementation model for technical trade and construction industries. The approach for building feasible model was Technology Acceptance Model. The model design was based on the research project, where 16 manufacturing and wholesaler companies of technical trade were involved, and survey where customers of these manufacturers and wholesalers were interviewed. Author also states various advantages of implementation of RFID technology.

Javad Majrouhi Sardroud (2012)⁽¹³⁾ Had written a research paper on Influence of RFID technology on automated management of construction materials and components In this paper Author states that that even though construction materials and components may constitute more than fifty percent of total project costs, existing methods for managing them still depend on human skills. This traditional data collection is time and labor-intensive, error-prone, and unreliable due to the reluctance of workforces to monitor and record the presence of large numbers of material. Automating the task of identifying and tracking construction materials can provide timely and accurate information on materials available to the manager. Author investigates a new approach for integrating the latest innovations in ADC technologies for real-time data collection in construction. In this approach, the combination of Radio Frequency Identification (RFID), Global Positioning System (GPS), and General Packet Radio System (GPRS) technologies can facilitate extremely low-cost, infrastructure-free, and easy-to-implement solutions to uniquely identify materials, components, and equipment.

Narimah Kasim.et al (2012) Had written a research paper on RFID technology for material management in construction projects. In this project the poor material management can affect the overall construction time, quality and budget. Generally the material management information is shared by papers which are error prone. They have discussed the materials management on construction projects and potential to employ RFID in materials management practices. For large projects material management, complexity always increases. According to them the ICT can give good facility for these large projects. Process of material management they have taken interview and questionnaire survey of A class contractors in Malaysia. The questionnaire survey was taken on implementation of ICT and interview

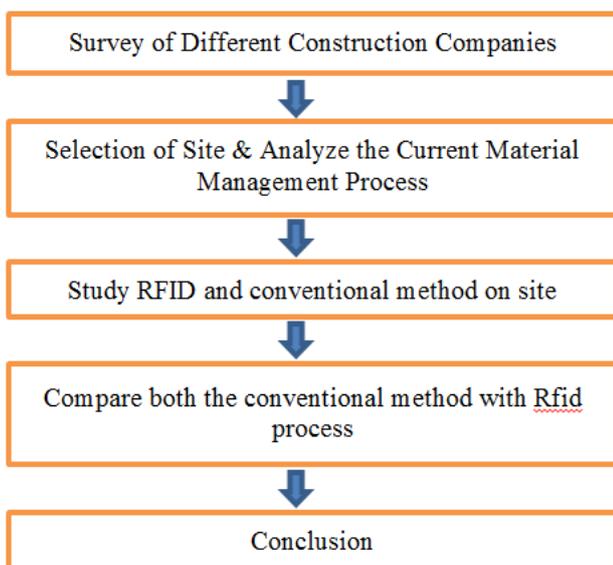
was taken on acceptance of ICT for material management and found that, main barrier of implementation of ICT is high cost and there was just average level of acceptance of ICT by the industries. In construction industries, for material management Microsoft office and handheld devices are widely adopted but bar code and RFID tools are not adopted.

Chetna M. Vyas.et.al (2011) Had written a research paper on construction materials management. In this paper author studies the process of material management i.e. planning, purchasing receiving, inspection, stacking and storage, issuing material. They have taken survey of material management in Ahmadabad of 3 known builders. They found that there should be centralized material management team co-ordination between the site and the organization. In construction industry there should be proper control, tracking and monitoring of the system is required and also awareness & accountability should be created within the organization. Study was to find the voids created by the absence of proper material management on construction sites. 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.

A. Objectives of the Study

- 1) To survey different residential construction companies for studying and analyzing the present practices of material management.
- 2) To examine how many construction industries use RFID system for material management.
- 3) To study conventional method process using case study of kolte patil group of construction and Ashoka buildcon Ltd.
- 4) Apply & analyze the effect of RFID System on Material Management.
- 5) To compare conventional and RFID System applied for material management process.

B. Methodology



C. Survey of different companies

Sr. No	Name of the company	Material Management process
1	Kolte patil pvt ltd	Conventional
2	Ashoka Buildcon Ltd	RFID
3	Supreme Universal Pvt. Ltd	ERP/ SAP
4	Relicon Pvt.Ltd	Conventional
5	Elite Landmarks.	Conventional
6	Kalpataru constructions	Conventional

Table 1: Survey of different companies

For comparing the work method and studying the rfid process two companies were taken and data collected to analyses the how the time, cost and productivity can be increased by making the change in material management process and making the entire process smooth and easy.

D. Site selection for detail study

- 1) Ashoka buildcon Ltd Nasik
Material management process: - Rfid
- 2) Kolte patil Group Pune
Materail management process: - conventional method(EOQ)

III. RFID TECHNIQUE

Radio Frequency Identification is the next wave in the evolution of computing. Essentially, it's a technology that connects objects to Internet or databases, so they can be tracked, and companies can share data about them. Because of its ability to identify and track objects, RFID is being used for diverse applications in aviation, construction and facility management, health, retailing, logistics or security, among others. There are multiple components for using RFID technology to track construction materials.

Thus, an electronic exchange of information is created in this research, which provides real-time information and wireless communication among all players, such as upstream parties and downstream parties to support project managers of each partner in monitoring and controlling progress in construction. The collection data and information is readily transferred to the construction site and project manager can access through Microsoft Project (MS Project) for modeling and scheduling of the material.

The Organizational Structure in MM is made up of following Organizational Levels:

- Client.
- Company Code.
- Plant.
- Storage Location.
- Purchasing Organization.
- Purchasing Group.

Time and date wise transaction is made so as to have transparency with concern parties. The ware house material is traced. Labor daily assessment sheet is made and bill can be generated easily. The product or material is given special codes and they are scanned at the entry points every time and thus the material received on site is recorded.

SR.NO	NAME OF MATERIAL	TAGS
1	CEMENT	
	ULTRA TEC CEMENT	
	JK CEMENT	
	BIRLA GOLD	
2	TMT Steel	
	TATA (FE500)	
	JINDAL (FE500)	
	JINDAL (FE415)	

Table 2: Material Codes

A. Advantages of RFID

- Can easily find out exact consumption of materials
- Can easily get stock of materials and locations of materials.
- Accuracy increases.
- By only one click, one can easily get all details.
- It can be useful in planning and procurement of materials.
- Wastage of materials get reduced.
- Work becomes easy.
- Manual errors get reduced.
- Time can be reduced for management of materials
- 3.2 Disadvantages of material management in rfid
- High initial cost.
- Need technically skilled workers.
- Estimation department is to be required Strong.
- Not affordable for small construction companies.

IV. CONVENTIONAL MANAGEMENT

The estimated quantities are procured from the purchase department as per demand of site. The item and there quantity which are mainly required on the site are much. Each time the material used and material order is recorded so as to keep eye on inventory control. The amount of cement bags consumed on site is prepared. The separate cost wise and quantity wise excel sheet is made and thus the record is maintned.



Fig. 1: Conventional method Recording

A. Advantages of Conventional material management process.

- For small site it is beneficial.

- If only one project is going on
- In Construction Company if only one project is going on than it is beneficial.
- Unskilled workers or non-technical person can carry out.
- Less cost and it is easy to understand.

B. Disadvantages of Conventional material management.

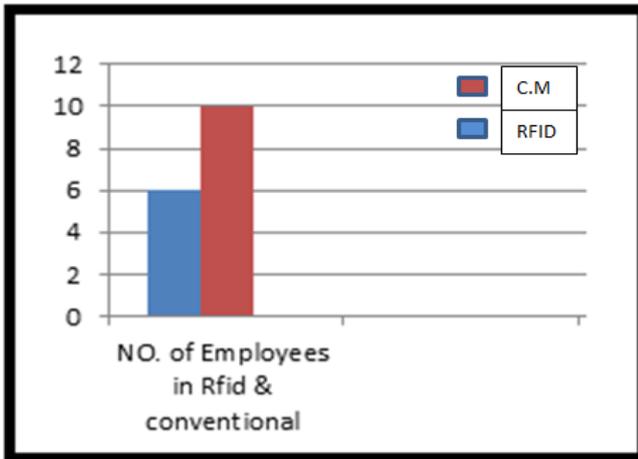
- Paper work increases.
- Manually error occurs.
- Difficult to find details.
- Not easy to find updates.
- Missing of papers occurs.
- Requires more Manpower.
- Time required for maintaining register's is more.

V. COMPARISON BETWEEN CONVENTIONAL MATERIAL MANAGEMENT SAP PROCESSES

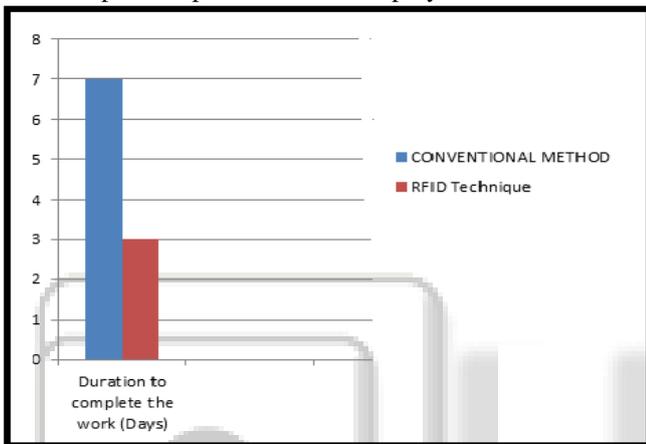
	Conventional Management Method	RFID Management Method
1	Manually Oriented	System Oriented
2	Possibilities of Human Error	Operation is Error Free
3	Process is tedious	Process is fast
4	Requires more time for approvals	Requires less time for approvals.
5	Computer knowledge illiterate person can work.	Computer Knowledge Literate person required.
6	Accuracy is less	Accuracy is high
7	Requires more time for finding details.	On a single click details are obtained
8	Less initial cost	Initial cost is high
9	Affordable for small construction companies whose turnover is below 100 Cr.	Affordable for construction companies whose turnover is above 100 Cr
10	Difficult to track inventory	Easy to track inventory
11	Wastage of papers.	No wastage of papers
12	Data is remotely stored	Data is centralized.

VI. RESULTS AND DISCUSSIONS

Material management is very important branch for any construction company. Generally material management is carried out manually in construction companies. To adopt such software for material management the companies turn over must be more than 100 cores. Then only it becomes economical. But to achieve a profit there is need to change process of material management. The project manager MR yogesh Patil has a 15year experience of real-estate projects and working for Ashoka buildcon from since last 6yrs. The overall project cost is around 80cr and it get tuff job to have control over the material if it is managed by conventional method so to have better management software company installed Rfid. There is tremendous scope after the application of Rfid the graphs can be plotted to showcase the details properly.



Graph 1: Represents No.of Employee for Process



Graph 2: Represents No.of days for a Particular Task

Thus The work done by the conventional method and Rfid method is of great benefit as the task is completed in very few days as graphical representation shows. Thus it can be stated that less the number of employee less the time is required to complete the work ultimately the cost is reduced in overall project. As construction material constitutes more than 60% of the total cost of the project, so every construction company carries material management process. The 30-40% of cost is directly controlled because of material wastage and proper planning and accurate quantity of material.

VII. CONCLUSIONS

In survey it was found that every construction company carries material management. Many of construction firms were using conventional material management method. When we compare the material management by conventional method and by Rfid application, the rfid application saves considerable cost, when we calculate for the whole project. . By implementing rfid Technique in material management we can effectively minimize human errors. It reduces administrative time considerably and helps for planning of material procurement effectively. There are rare construction companies which can adopt technique for material management. The main barriers of implementation are its high initial cost of up to 2 Cr. and lack of agreement amongst all the board of directors. Implementation of Rfid is feasible for construction companies whose turnover is above 100 Cr.

which saves approximately 65 % cost on manpower resources & reduces 80 % Time with respect to material management.

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