Implementation and application of Information Communication Technology in Construction Industry for Material Management

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Abstract: In construction industry material management is related to planning, procurement storing and providing the appropriate material of right quality, right quantity at a right place at right time. Material management is carried out in industries to achieve economy, to complete project within time, to reduce wastage, to achieve good quality, to use all the available resources, to minimize chances of delaying or stopping of activities in construction. Traditional approach toward material management on construction projects leads to material waste, cost of which is high, delay in project occurs, and errors occurs. If the construction material is managed properly then economy would gain. The project will be completed within time, with less losses of material. Material management contains mainly 4 process i.e. planning, procurement, logistics and inventory. There should have coordinately and well communicatory material management is very essential. So that the proper management of this single largest component can improve regularity of various performing activities and the economy of a project and help to ensure timely completion of project. One of the major problems in delaying construction projects results in poor material management. This paper contains the different methods used by the construction industries for their material management process. There is need of implementation of new technology for proper communication in material management. The findings showed that there were high numbers of common ICT tools involved at the planning and procurement stage of material management processes while logistic and inventory stage has the lowest adoption of ICT tools. It is also found that modern tracking technologies such as RFID and bar coding system has not been utilized in construction Industries for material management. This was due to the high investments required to purchase the ICT tools and staffs training as well as qualified ICT specialist are needed.

Key Words: Construction Materials; Management Process; Materials; ICT

1. INTRODUCTION

Materials management is a total 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 his requirements in time. This involves materials planning, purchasing, receiving, storing, inventory control, scheduling, production, physical distribution and marketing. It also controls the materials handling and its traffic. The materials manager has to manage all these functions with proper authority and responsibility in the material management department.

2. OVERVIEW OF MATERIAL MANAGEMENT

Shailesh Jayaprapak Pagar, R. V. Devalkar, M.C.Aher (2015) have worked in that area. They have discussed that Small and medium sized constructions present at large part of the construction sector in India. They have taken questionnaire survey and case study to describe how SCMs can improve their performance in material management, to reduce their cost and to improve the project quality through ERP system. In survey they have found that in the construction productivity in India reveals the major causes of the lack in productivity boils down to the improper deposited materials, improper material handling, improper material application and improper material deliveries. The problems in material management will be never ending, it is possible that ICT implementation may be answer to overcome the challenge of materials management of in the construction industry. The dilemmas faced in material management can be overcome by adopting ICT –enabled solution that can help to support the effective material management of material activities. They have found that there should be centralized material management system. The documentation should be proper the tracking of material should be regularly done, computerized system need to be used and use of modern material management technology needs to be done.

Fara Diva Mustapa, Muzani Mustapa, Mohd Saidin Misnan, Syamsul Hendra Mahmud (2012) have worked in the area of material management. They have discussed, material shortage, delay in supply, price fluctuation, damage & wastage, lack of storage space of materials problems which can be overcome with the use of ICT in material management. They have surveyed 10 construction firms those are working for more than 10 years in Sarwak at the different process of material management as well as to determine the requirements needed to increase the usage of ICT in material management. They found that, at the planning
and procurement stage more ICT tools are used than the logistic and inventory. They have found that the utilization of ICT for material management is considered to involve high hardware investment. Especially when other processes such as material logistics and handling requires a greater investment in ICT tools such as bar coding for tracking of materials. Besides the requirements for staff training and qualified ICT specialist on specific software knowledge is needed that makes the process more expensive.

Javad Majrouhi Sardroud (2012) research shows that construction materials and its components constitute more than 50% of total project cost. So, planning and managing materials is very important because it affects the cost and time of project. Generally material management is carried out on traditional method which is error prone and unreliable. ICT can provide timely and accurate information of materials to the project manager. RFID is a wireless sensor technology, based on the detection of electromagnetic signals and radio frequencies, which are used to capture and transmit data from or tag, so RFID identifies greatest technology in 21st century. Three broad categories of materials in a construction project are: bulk materials, engineered materials, and fabricated materials. The first category requires relatively short times for delivery after an order is placed, while the second and third categories require detailed drawings and samples so it requires several months. He has mentioned construction management problems. Safety, cost, accuracy, network, flexibility and scalability, ease of use, ambient environment, ruggedness, time these are the factors should be considered before adopting any new technology. He has discussed the working process of RFID and information of its components. He has mentioned the advantages and disadvantages of RFID and Bar code and how the RFID is effective than bar code technique.

Narimah Kasim, Rozlin Zainal, Alina Shamsuddin, Naadira Che Kamarudin (2012) have discussed that the poor material management can affect the overall construction time, quality and budget. There Paper-based reports are mostly used to record and exchange information related to the materials component within a supply chain, which is problematic, error-prone, and inefficient. They have discussed that generally, emerging technologies such as wireless system, bar-coding and RFID are not being adequately used to overcome human error and are not well integrated with project management systems to make the tracking and management of materials easier and faster. Thus, the study seeks to identify the potential employment of that technology focusing on RFID for materials management in construction projects. 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.

3. PROBLEMS IN MATERIAL MANAGEMENT

As basically in material management quick identification of required material at the time its usage requirement, properly storage accommodation of construction material on site, many operational problems at the time of working has been recognized in Indian construction industry. Based from the problems pertaining in ICT usage in materials management, this survey is designed to identify the different types of ICT applications used among construction firms at different process of materials management. It looks at the overview of materials management process and the problems of applying it within the construction industry.

4. SURVEY METHOD AND DATA COLLECTIONS

Qualitative research method was adopted to address the objectives of the study. Structured open-ended interviews is conducted to those who responsible for materials management within the construction firms. Ten respondents were managed to be interviewed to understand the background of the company and also the types of ICT applications used at different materials management processes. The requirements towards increasing the usage of ICT in materials management were also sought.

4.1 Different ICT Tools Used In Planning Stage
4.2 Different ICT Tools Used In Procurement Stage

Result:
1) 100% companies were using Microsoft excel, printer, laptop, PC, smart phone, Microsoft word type ICT tools in procurement stage.
2) 20% companies were using SAP, ERP software type of ICT tools in procurement stage.

4.3 Different ICT Tools Used In Logistic Stage

Result:
1) 100% companies were using Microsoft excel, printer, laptop, PC, smart phone, Microsoft word type ICT tools in procurement stage.
2) 20% companies were using SAP, ERP software type of ICT tools in procurement stage.
Figure 3. ICT tools used in logistic stage

Result:
1) 100% companies were using Microsoft excel, smart phones, PC, Microsoft word type ICT tools in logistic stage.
2) 40% companies were using scanner, printer type of ICT tools in logistic stage.

4.4 Different ICT Tools Used In Inventory Stage

Result:
1) 100% companies were using Microsoft excel, PC type ICT tools in inventory stage.
2) 20% companies were using fax machine type of ICT tools in inventory stage.

5. DISCUSSION

After completion of questionnaire survey, following outcomes commemorated regarding material management system from the various construction companies.

5.1 Benefits of manual material management process
- For small site it is beneficial.
In Construction Company if only one project is going on then it is beneficial Unskilled workers or non technical person can carry out.

- Less cost.
- It is easy to understand.
- It requires less man power.

5.2 Disadvantages of Manual Material Management Process
- Paper work increases.
- Manually error occurs.
- Difficult to find details.
- Not easy to find updates.
- Missing of papers occurs.

5.3 Benefits Of ICT Technique In Construction
- 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.
- It is easy to communicate or share the information regarding materials.

5.4 Methods adopted for material management system in construction industry
From the surveyed construction companies only four companies are using software for material management process and remaining sixth companies are carrying out their material management manually.

6. CONCLUSIONS
- In four companies, material management is carried out by using software like SAP and ERP and remaining six companies are carrying out material management by traditionally.
- Main barrier of implementing information communication technology is initial high cost.
- Not a single construction company is using bar code and RFID technique for material management.
- High numbers of common ICT tools involved at the planning and procurement stage of materials management processes while logistic and inventory stage have the lowest adoption of ICT tools.
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REFERENCES