Application of IT in Supply of Construction Material Procurement

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Abstract- *Construction is one of those industries of the World which require fund in bulk. Investment of any project determines the strategy of the work and more than 60% of the total cost is only used in the material and dependent upon the type of project. But, delay in the material supply can affect the project time as well as project capital. Also the wastage of the raw material affects the fund highly. Construction waste is a serious problem in construction industry.*

Effective construction procurement management is a key to success for a construction project. The procurement management on the construction site plays very important role to minimize the losses, either due to wastage or delays. It involves considering whether to procure, how to procure, what to procure, how much to procure, and when to procure. This paper shows scope of construction procurement management with control on construction wastage and delays.

An app (software) is proposed which done their work with Information Technology (IT) and image processing in the construction procurement and its management. It gives the real time information about the supply of procurement, and also control on the procurement wastage.

Keywords- Procurement Management, Procurement Waste, Construction Materials, Cost Control, Information Technology (IT).

I. INTRODUCTION

Construction industry is one of the most complex industries in the world. There are a multitude of issues which the construction industry is facing. Hampson [1] argues that construction performance affects productivity across all sectors of the economy. According to Ortiz [2], "the construction industry is one of the most sensitive activities within any country's economy". So, by the forces of globalization and strong competition in all sectors of the economy, the construction industry is looking to overhaul its business in order to improve performance [3]. According to Horman and Kenley [4], improving performance has two key components: "doing it more effectively and doing it more efficiently". Effectiveness refers to the process of maximizing value of the product, whereas efficiency refers to the process of minimizing or eliminating non-value adding items in the production line [3]. Procurement management is a unique process of identifying which project needs can be best met by procuring material or services outside the project organization and should be accomplished during the scope definition effort. In the 1990s procurement experts and practitioners were involved mainly with debating the more strategic issues such as trust, negotiation, privatization, market liberalisation. In the late 1990s some wider issues relating to procurement began to emerge, i.e. those procurement systems/strategies that looked at the whole life cycle of the project, rather than just cost and time criteria [5]. Recent reports also acknowledge that the 'softer' skills of persuasion, collaboration and alignment are required by the industry in order to best incorporate value creation and best practice procurement [6].

Moreover, the performance of the construction industry is continuously increasing by the application of different techniques in different sectors of construction. During any construction project the three inter-related factors of time, money, and quality need to be controlled and managed. Successful completion of projects requires all resources to be effectively managed. Materials management is considered as a means to achieve better productivity, which should be translated into cost reduction. Effective Construction Management process is a key to success of a construction project. And the Procurement Management is the main component of the construction management due to construction material constitutes a major cost effective component in any construction project. The total cost of material may be more than 50 to 60% of the total cost. The goal of procurement management is to ensure that the materials are available at their point of use when needed hence, efficient procurement of material represents a key role in the successful completion of the work [6]. Different methodology and techniques are used from many years, and continuously, they enhanced their productivity. It is important for the contractor to consider that there may be significant difference in the date that the material was requested or date when the purchase order was made, and the time, at which the material will be delivered, thus procurement delivery on time is act as the basic requirement for the project management.

"Procurement management is defined as, "the process to provide right material at right place at right time in right quantity so as to minimize the cost of project" [6]. Procurement management is concerned with the planning, identification, procuring, storage, receiving and distribution of material. The responsibility of Procurement management Department for the flow of material from the time the material is ordered, received, and stored until they are used is the basic responsibility of material management [6]. Materials represent a major expense in construction, so minimizing procurement cost improves opportunities for reducing the overall project cost. If materials are to be purchased too early, capital may be held up and interest charges incurred on the excess of inventory of materials. Delays and expenses may be incurred if material required for particular activity. Ensuring a timely flow of materials is an important concern of Procurement Management [6]. Now the need of the successful management of construction materials is rise, which is based on real time information and updated through information technology, which processed to construction materials management software. The aim of the paper is to enhance the construction procurement management and procurement waste management with the application of information technology through the use of App.

Procurement Management is a network of interconnected people, internal and external of the organization involved in the supply of raw material of required quantity for the sites. It spans all movement and storage of raw material. Effective procurement management should result in a project delivered on time, to cost and to the desired quality.

During the last decade, many researchers have emphasized the benefits of procurement management philosophy to the construction industry in order to improve the performance of construction and reduce large waste caused by inefficient management and control [7]. However, there are limited models that deal with the entire process of construction procurement management, starting with pre-design decisions and their impact on cost and time and ending with monitoring and inspection purposes on construction site [7].

Procurement management software (PMS) has following objectives:

- Control in Storage ,
- Quality and assurance,
- Zero wastage of the material,
- Improved efficiency of working,
- Reducing overall cost of the material.

A closer look at the construction industry shows that a considerable amount of waste produced is rooted in poor management of the material supply. In this regard, the use of information technology (IT) is suggested to achieve better logistics processes, and avoiding delays [8].

Image processing and sensors can provide an effective tool for monitoring resources in the Procurement management. In order to achieve these objectives, this paper proposed a unique system, named "BuildApp" integrates Image Process Sensing (IPS), Load sensors, and geographic information systems (GIS), to control and track the wastage of the procurement and overcome the delays by providing warning signals to ensure the material procurement.

The main focus of this research is on the procurement waste management of a project in which information pertaining to the procurement supply assets is visually monitored. Since the data used in the procurement can be derived from the design phase of the project, the model starts the tracking process by providing a platform to organize data entry. In addition to avoiding mistakes and errors that occur in data entry, it is helpful to ensure data integrity and consistency across various stages. The proposed methodology is described in detail Even though the study mainly concentrates on the flow of materials from the store to construction site (i.e. end user), the success of such an effort will address some aspects of lean construction in terms of efficient use of resources.

II. NEED OF THE PROCUREMENT MANAGEMENT PROCESS

The key component of any construction project will remain centered around either cost, or time or the quality. A good procurement strategy will understand the key drivers and achieve the optimum balance in context of the individual project and the requirement of the organisational strategy. As we plan a proper quantity chart for the material but still wastage induces the quantity of the material. The difference of the value is mostly occurred due to the delays and wastage of the material. To minimize this wastage, the proposed technique is used. One problem is raised on the checking of the raw materials storage and supply for the next day is to analyze the actual demand and exact storage of the material, it will be solve with the help of IT. The focus of proposed app is mainly minimized and controls the wastage of the procurement materials.

III. ANALYSIS OF PROCUREMENT WASTE MANAGEMENT ON SITE

The analysis was done to understand what are all the problems occurring in the company due to the lackness of proper application of procurement management. The solutions that provided in the installation of the sensors and the software program may costly in the beginning, but it will help the construction company for the long time period by providing solutions to the key problems like lack of specification, delay, improper procurement, wastage of procurement, etc. According to the problems that generally occur in the site due to the improper procurement management, will define on the methodology, were have the following factors. Such as:

- Purchase without knowledge of exact quantity,
- Miss-handling of procurement,
- Wrong detail of wastage, etc.

For this purpose, the survey was done by visiting the site. Survey was done and prepared questionnaires accordingly and problems to each stage and sources (mentioned in Data Collection) were analysed and solutions thus were given. The interview was taken from site managers, quality control inspector, project manager, purchase manager and thus the answers obtained from them were categorized into each class of problems. From those classes it was understood that lack of technological implications and scientific approach were lacking with respect to the procurement management. Thus the proposed technique is the form of solution to manage the procurement on the site and control the wastage of the material.

IV. BENEFITS OF USING APP

Implementation of effective procurement management system can gives out following benefits, such as:

- Quality control,
- Better handling of material,
- Decreases the problem of shortage or delays,
- Better field material control,
- Reduction in duplicated orders,
- Improvements in project schedule,
- Reducing the overall costs of material,
- Complete utilization of the procurement,
- Material is on time.

In recent years, with the increasing level of competition in the global construction market, several research efforts have focused on the application of information technology (IT) as away to improve the integration process of construction procurement management [7]. The efficient procurement of material represents a key role in the successful completion of the work. Procurement management of materials with this technique can reduce costs like delays in planning and control on material, lack of material when needed, poor identification of material, re-handling and inadequate storage cause losses in labor productivity and overall delays that can indirectly increase total project cost.

V. METHODOLOGY

The research design used in this paper is analytical in nature and the procedure using which the Researcher has to use facts or information which is already available. Data collection is divided into two parts such as:

1. Primary source, &
2. Secondary Sources.

1. Primary Sources:

- Literature Review: To know the current practices of Construction procurement management, literature review has been carried out thoroughly.
- Interviews: In order to find the observations, Interviews have been carried out with Project Manager, Billing Engineer & Store In charge.
- Site Engineer: This is a very important source of primary data because the Site Engineer observes and controls the wastage of the material, manually.

2. Secondary Sources:

- MRN: MRN means “Material Requisition Note” is that source which gives an idea about requirement of material.
- Ledger Register: This provides the information regarding the order of material and Cumulative quantity of material till date.
- Daily Material Report: This report gives information regarding daily material consumption & stock available for further use for the project.
- Running Amount Bill: This is very important source of secondary data which gives the actual executed quantities required for the project.

There are two type of data required for the operation of the App of procurement management. These are as:

a) Qualitative Analysis Data:

It’s carried out using software for analyzing planned and actual material consumption. It shows the comparison of planned and actual cost for material. To know the effect of material storage before execution of project, the

qualitative analysis information regarding planned and actual materials is done by software.

b) Quantitative Analysis Data:

It checks the quantity of the raw material day to day by the sensors, and transfers the data to the central system from where everyone gets the latest information about the construction site.

VI. FLOWCHART OF PROCUREMENT MANAGEMENT WORKING

Procurement management process initiates from need generated on site. Then this information conveyed to store department and material is ordered in the store. The store keeper check out size/quantity of the material in the software (proposed technique). Send/issue the materials and are received at site and inspection is carried out. This process is shown in the fig 1. All the above process is done through the "BUILDApp".

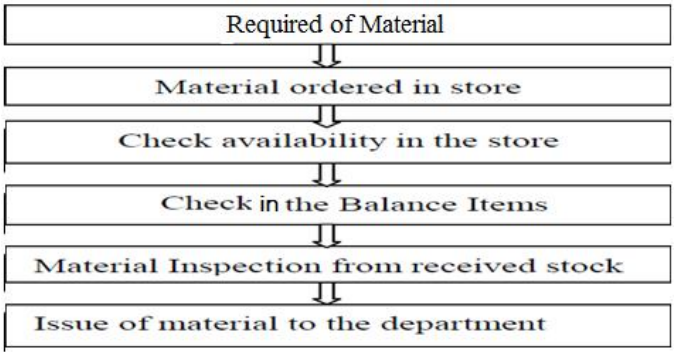

Fig 1: Process of the Procurement waste management

Working Process:

Material management is not just a concern during the monitoring stage in which construction is taking place. Decision about raw material delivery or quantity of storage as well as procurement may also be required during initial planning and scheduling stage. During execution, inventory control technique should be monitored periodically so as to maintain the flow of material as to avoid the delays. It also important to communicate with client, consultant, engineer, contractor, procurement manager or contractor, on a same level (without dilution) as shown in fig 2. All the information regarding the construction site, and to maintain sufficient stock of raw material in period of short supply, to protect inventory against deterioration and control investment in inventories, this App is used which shows the real-time information is carried out and keep it in an optimum level to overcome the problems of stock out as well as wastage. Client, Consultant, Engineer, Contractor, Procurement Manager or Contractor get information about the construction site through app, at anytime from anywhere without interpretation of others (shown in fig 3).

Fig 2: Online communication

Fig 3: Pictures of Construction site shown by the app

VII. CONCLUSION

Purchasing is obtaining of materials of the right quality in the right quantity from the right source, delivered to the right place at the right price (as shown in fig 4), this software help in searching the quality material at a right time. Presently, also various software is used for material procurement in big scale projects which are too much costly. This proposed app can mange in any type of construction site

to overcome the delays and wastage of the construction material.

Before any execution of project all detailed drawing, planning and scheduling are needed to be upload on the app, and easily find out the real time required quantity.

The entire officer's connected simultaneously with the site, and gives his views and ideas from anywhere. This system is easy and cheap for any site.

Fig 4: Conclusion figure

REFERENCES

[1] Hampson, K. "Construction Innovation in the Australian Context. Paper read at International Workshop on Innovation Systems and the Construction Industry", at Montreal, Canada in 1997.

[2] Ortiz, Gonzalo "Esquema de la Historia Económica del Ecuador en el Siglo XX. Revista Gestión 67 (1):45-61 in 2000.

[3] Efficient material delivery and site management, A lean construction perspective Case study at Statsbygg by Daouda Dao and Bernt H. Follestad in Molde, 2009.

[4] Horman, M., and R. Kenley, "The application of lean production to project management", Paper read at Proceedings of the Fourth Meeting of the International Group for Lean Construction (IGLC-4), at University of Birmingham, UK in 1996.

[5] NEDO. "Thinking about Building, Building Economic Development Committee, London in 1985.

[6] Rowlinson, S.M., and Newcombe, R., "Comparison of Procurement Forms for Industrial Buildings in the UK", the 4th International Symposium on Organisation and Management of Construction, University of Ontario, Canada in 1984.

[7] B. Omar, T. Ballal, Intelligent wireless web services: context-aware computing in construction-logistics supply chain, Vol. 14, in: ITcon, 2009, pp. 289–308.

[8] Thesis, "A CONSTRUCTION MATERIALS MANAGEMENT SYSTEM FOR GAZA STRIP BUILDING CONTRACTORS" by Eyad Abed El-Qader Al Haddad, from "The Islamic University of Gaza" Gaza, Palestine in December 2006.

[9] "Integrating BIM and GIS to improve the visual monitoring of construction supply chain management", by Javier Irizarry, Ebrahim P. Karan, Farzad Jalaei in Elsevier.

[10] McDermott, P.(1999) Strategic and emergent issues in construction procurement, in Procurement Systems: A Guide to Best Practice in Construction, E&FN Spon, London.

[11] McDermott, P. (2006) Think Piece: Policy through Procurement? In The Future of Procurement and its Impact on Construction, a workshop of Joint Contracts Tribunal & the University of Salford, 19/07/06.Male (2003).

[12] Miller G, Furneaux C, Davis P, Love P & O'Donnell A (2009) Built Environment Procurement Practice: Impediments to Innovation and Opportunities for Changes, Curtin University of Technology, Report for Built Environment Industry Innovation Council, Australia.

[13] MATERIAL MANAGEMENT IN CONSTRUCTION – A CASE STUDY by T. Phani Madhavi1, Steve Varghese Mathew, Roy Sasidharan in IC-RICE Conference Issue, Nov-2013, in IJRET ISSN: 2319-1163, http://www.ijret.org.