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A Developed Management System for Site Usage of Construction Materials

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Abstract – Good project management is essential. In many developing countries construction alone accounts for about 10 percent of gross national product, and 50 percent or more of the wealth invested in fixed assets. Material management is a management system that integrates purchasing, shipping and material control from suppliers. Based on those definitions, generally materials management can be defined as a process of planning, executing, and controlling the right source of materials with the exact quality, at the right time and place suitable for minimum cost construction process. Capability to coordinate and integrate purchasing, shipping and material control from suppliers is required for material cost control. The case study which is selected for this project of Godrej Rejuve at Keshavnagar Pune of RCC Building. First phase gives the Qualitative information regarding deviation in planned and actual materials in terms of S curve analysis using MSP tool and reasoning over the deviation is essential to know the effect of material planning before execution of project.

Key Words – Project Management, Material Management Minimum Cost Construction RCC Building

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I. INTRODUCTION

Constructions projects are one of the most common activities we encounter in our lives, yet it is also known as one of the most difficult humankind endeavors. As a matter of fact, each project consists of sophisticated and complex processes which need to be carried out by different individuals of different professionals, who have special set of skills and knowledge. All the talent and skills have to be channel towards a common goal to producing the project. To accomplish this goal, time and money are required. At the end these construction projects, provide us with facilities that are useful, functional, visually pleasing and enjoyable to occupy. This journey is called the project delivery process. Effective delivery is all about the control and management of uncertainty. Therefore, one needs to identify the uncertainty related to the project and sculpt the best strategy to deliver the project so that the chances of success are increased.

1.1 Aim Scope and Objectives

The aim of this research project is to develop mechanism to improve materials Management on construction projects through the integration of materials tracking and resource modelling system. The specific objectives of the research include:

1. To review existing literature on materials management processes in construction projects;
2. To review current industrial practice in materials management and to establish key problem areas and elements of good practice;
3. To establish the requirements for integrating materials management and resource modelling in project management systems (i.e. real-time materials tracking);
4. To develop and evaluate a prototype system for integrating materials management and resource modelling.
5. To investigate requirements necessary for effective use of the system, such as Skills and knowledge requirement.

1.2 Research Problem

The materials management co-ordinates various departments of manufacturing concern. Since the cost involved in manufacturing has maximum investment in the materials. It is about 55% to 65%

of the sales value as has been investigated by the Directorate of Industrial Statistics during 1954-57 in India. As soon as materials are purchased and brought by the organization, its value goes on increasing as the other costs as required for ordering the materials, carrying the materials in inventory, its maintenance and handling charges must be assigned to the cost of materials before it enters in to a product or transformed in to some other form. In order to economize all the costs of materials management company has to adopt definite method of deciding the quantity of materials to be ordered, quantity to be stored as inventory and work in process inventory. In order to reduce the material cost and all other costs stated above, there has to be some efficient and effective materials management techniques, which must be dynamic to adjust with changing demand and production.

II. LITERATURE REVIEW

Materials management is defined as a management system that is required in planning and controlling the quality & quantity of the material, punctual equipment placement, good price and the right quantity as required. Material management is a management system that integrates purchasing, shipping and material control from suppliers. Based on those definitions, generally materials management can be defined as a process of planning, executing, and controlling the right source of materials with the exact quality, at the right time and place suitable for minimum cost construction process. Capability to coordinate and integrate purchasing, shipping and material control from suppliers is required for material cost control.

2.2.1 Thomas Paul, Binu P [May 2018][1]

Construction material management is generally recognized to be the integrated coordination of material take off, purchasing, receiving, warehousing and distribution. When these functions are not properly managed, material shortage, surplus, and cash flow problems may likely to occur. The non-availability of materials of required quantity and quality may result in labour delays, thereby affects the total project duration, cost and productivity adversely. The construction materials and equipment may constitute more than 60% of the total cost of a typical construction project. Therefore, the proper management of single largest component can improve the productivity and cost efficiency of a project. For a productive and cost-effective site, efficient material management is very essential. So, the aim of study is to determine the most influencing factors in management of materials and constraints regarding the usage of material managing software in construction sites. A total of 25 construction companies were selected for the study. An open-ended questionnaire was prepared by incorporating most important factors and constraints identified through detailed literature reviews and site visits. Based on the results obtained a computational system was developed for material management.

2.2.2 Kashid Sumit D, Kolhe A. R. [April-2018][2]

India is rapidly developing the country and construction industry is lagging behind in use of information technology as compared to other major industries in the country. Results suggest that materials which are being used for construction costs around 5060% of total project cost, Advance systems which are existing today are have some limitations to manage its flow and control its wastage. Even today material management at construction sites are carried out by some traditional methods and heavily depends on human skills. The Main hurdle of material management in use of ICT is shortage of user-friendly software.

2.2.3 Nazar Mohammad, Rishabh Mahure [April 2018][3]

The study shows that most of contracting companies are still managing construction materials manually. Shortage of user-friendly construction materials software packages and lack of qualified personnel in using computer-based materials management systems are considered the main obstacles in using computer in construction materials management. The researcher explores Microsoft Excel capabilities and utilizes these capabilities in developing a Construction Materials Management. Microsoft Excel is used in developing CMMS, as most companies in Afghanistan are familiar with it. Full description of CMMS has been given with detailed implementation procedures. CMMS has been evaluated to test its suitability to local practice. Evaluation of CMMS has addressed both conceptual and practical issues. One of the main recommendations of this research is to encourage local contracting companies to have a construction materials management software package and use it in determining the required quantities of construction materials in order to get materials in time and required quantities, save time and minimize error.

2.2.4 Pratik P. Sarowar et.al [2018][4]

Materials management is an important element in project planning and control. Materials represent a major expense in construction projects. It is reported that materials and required equipment's make 70% of the total project cost. Improper handling and management of material on the site adversely affects the cost of the project. Materials management is an important function in order to improve productivity in construction projects.

This makes it necessary to implement material management practices on large projects. India is a developing country and bringing it in the line of developed countries, main focus is paid on infrastructure development. Numerous large projects

such as metro rail, tunneling, construction of big malls is in progress. Hence it becomes necessary to study and implement material management practices. A properly implemented materials management program can achieve the timely flow of materials and equipment to the jobsite, and thus facilitate improved planning, increased labour productivity, better schedules, and lower project costs. This paper focuses on different material management practices adopted on sites and discusses their advantages and disadvantages affecting the economy of the project.

2.2.5 Harshal M. Patil, G.C. Sarode [Oct. 2016][5]

Construction industry is very vast and is bifurcated into many areas such as building, bridges, roads and highways, railways, tunnels, dams and bandharas, etc. Every project is unique and every decision related to control on expenses is unique too. Cost of material for the project is more than 50%. So, we have to focus on material management. Material management is not limited to control on waste but it started from supplier's selection to quality of materials, its price, requirement as well as availability, financial strength, its transportation and storage too, etc. like lots of factors have included in it. This paper presents the review on how material management has been done in construction industry.

2.2.6 Sachin S. Pal1, Prof. Himanshu Ahire [Jul.-Aug.2016][6]

Materials management is a critical component of the construction industry. As such, organizations need to understand the effects of proper materials management techniques on the effectiveness of project execution. A properly implemented materials management program can achieve the timely flow of materials and equipment to the jobsite, and thus facilitate improved work face planning, increased labour productivity, better schedules, and lower project costs. Materials management is an important function in order to improve productivity in construction projects. It is defined materials management functions which include planning and material take off, vendor evaluation and selection, purchasing, expenditure, shipping, material receiving, warehousing and inventory, and material distribution. In this project we have prepare scheme of material management in the construction industry for building project. Also conducting survey of industry and determine the various format for construction material management also discussing the tracking system of material management in the industry and also discuss the software technology developed for proper management are discuss.

2.2.7 A. A. Gulghane, P. V. Khandve [April 2015][7]

In recent treads a wide range of building materials is available for the construction of civil engineering structures. The total cost of materials may be up to 60% or more of the total cost incurred in construction project dependent upon the type of project. Effective construction materials management is a key to success for a construction project. Construction waste is another serious problem in construction industry. A large and various types of construction waste with different characteristics are created at all the stages of construction. Construction industries have a larger part in contributing environmental problems. The economic and environmental benefits must be gained from construction waste minimization. This paper presents a review on systematically investigation of the management of construction materials and construction waste, material management techniques, control of construction waste and existing situation of construction management and construction waste in the industry.

2.2.8 Lingguang Songa, Tanvir Mohammed et. al. [2015][8]

In industrial construction, each fabricated material item such as a steel piece or a pipe spool is a unique building element. They are typically staged in a large laydown yard before final on-site installation. Manually tracking and locating each particular item in a large laydown yard can be very time consuming, and excessive man hours spent in this process can negatively impact on field installation activity and overall project performance. This study developed a robust and accurate yet cost effective material tracking and locating solution based on mature tracking technologies. The proposed solution features a handheld computer equipped with barcoding and GPS technologies for laydown yard material tracking and fast retrieval in a cost-effective manner. The device scans item barcodes when the item is unloaded in the yard and, meanwhile, captures the GPS coordinates along with the item image, and stores these data in a central database. For material retrieval, material lookup through the database provides geographical location and images of an item, and navigation function gets the crew to the item in a shorter duration. To validate the accuracy of GPS and practicality of this solution, various handheld computing devices with built-in GPS functions were tested by comparing their GPS recordings against the true coordinates of selected geological survey benchmarks. The accuracy is measured by the distance between the true coordinates to the device-recorded coordinates using Vincenty's formula. A prototype system consisting of a mobile device and a software module was developed, and the achieved GPS accuracy is within 3 meters. While the proposed solution has the potential to significantly improve material tracking efficiency, its low initial and operating costs and robust performance make it practical to use in a wide range of projects.

2.2.9 T. Phani Madhavi et. al. [Nov. 2013][9]

The objective of the present study is to understand about all the problems occurring in the company

because of improper application of material management. In construction project operation, often there is a project cost variance in terms of the material, equipment's, manpower, subcontractor, overhead cost, and general condition. Material is the main component in construction projects. Therefore, if the material management is not properly managed it will create a project cost variance. Project cost can be controlled by taking corrective actions towards the cost variance. Therefore, a methodology is used to diagnose and evaluate the procurement process involved in material management and launch a continuous improvement was developed and applied. A thorough study was carried out along with study of cases, surveys and interviews to professionals involved in this area. As a result, a methodology for diagnosis and improvement was proposed and tested in selected projects. The results obtained show that the main problem of procurement is related to schedule delays and lack of specified quality for the project. To prevent this situation, it is often necessary to dedicate important resources like money, personnel, time, etc. To monitor and control the process. A great potential for improvement was detected if state of the art technologies such as, electronic mail, electronic data interchange (EDI), and analysis were applied to the procurement process. These helped to eliminate the root causes for many types of problems that were detected.

2.2.10 Ashwini R. Patil, Smita V. Pataskar [Oct 2013][10]

The efficient procurement of material represents a key role in the successful completion of the work. Poor planning and control of 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. Effective management of materials can reduce these costs. This paper is written to explore the current practices of Material Management so this study is conducted in two phases, First phase gives the Qualitative information regarding deviation in planned and actual materials in terms of S curve analysis using MSP tool and reasoning over the deviation is essential to know the effect of material planning before execution of project. Various comments on S curve analysis have given in terms of problems of administrative causes, consultant's causes, contractor's faults, and unavailability of resources. These major reasons of changes represented in terms of pie chart. To maintain sufficient stock of raw material in period of short supply, to protect inventory against deterioration and control investment in inventories and to keep it in an optimum level an inventory control technique such as ABC and EOQ analysis is carried out in second phase of study to overcome the problems of stock out.

2.2.11 Nabil Ibrahim El Sawalhi, Mahmoud Mohammed Abu El- Al Kass [Oct 2012][11]

Effective construction materials management process is one of the success factors of a construction project. Successful management of construction materials has to be based on and updated information and processed utilizing a well-designed construction materials management system. This research is to explore the local practices used in construction materials management and develop a construction materials management system to facilitate the management of construction materials mainly in the building construction. A survey questionnaire supported by interviews was used to explore the local practices used in construction materials management. Seventy questionnaires were distributed to contractors of first; second, and third class, forty - eight questionnaires were received and analyzed. All contracting companies are interested in using some techniques for managing construction materials such as building archive for previous projects about the cost of materials to save effort and minimizing errors. Most of contracting companies stated that the main obstacles in using computer in construction materials management are shortage of user-friendly computer program and lack of awareness about the importance of computer program.

2.2.12 Fara Diva Mustafa, Muzani Mustafa [Dec2012][12]

Construction materials management plays a significant role in the success and profitability of construction projects. Some of the problems relating to materials management are materials shortages, delays in supply, price fluctuations, damage and wastage, and lack of storage space. To overcome the problem, the advent of ICT has been largely exercised in developed countries to aid and improve construction materials management. Overall, there are five processes involved within the materials management, namely planning, procurement, logistics, handling, stock and waste control processes. Studies have shown that the use of ICT in managing the materials on site has not fully utilized by many construction firm's despite of the potential benefits. This is due to some barriers faced by the construction firms in adopting the ICT. This research was carried out to investigate the adoption of ICT among the construction firms in Sarawak at the different process of materials management as well as to determine the requirements needed to increase the usage of ICT in material management. Qualitative approach has been chosen to conduct the research where face-to-face semi-structure interviews was carried out among ten selected construction firms registered with CIDB. Content analysis was done to analyse the transcribed interviews to determine the themes. The findings showed that there were high numbers of common ICT tools involved at the planning and procurement stage of materials management processes while handling and waste and stock control stage have

the lowest adoption of ICT tools. It was also found that modern tracking technologies such as RFID and bar-coding system used in developed countries has not been utilized and can be considered as non-existence in construction firms' materials management. According to the respondents, this was due to the requirements needed to purchase the ICT tools such as high investment on the hardware, staffs training and qualified ICT specialist on specific software knowledge and technology testing on automation or wireless technologies.

2.2.13 Khyomesh V. Patel, Chetna M. Vyas [May 2011][13]

This paper is written to fill a void created by the absence of proper materials management on construction sites. To managing a productive and cost-efficient site efficient material management is very essential. Research has shown that construction materials and equipment may constitute more than 70% 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 ensure its timely completion. One of the major problems in delaying construction projects is poor materials and equipment management. This paper describes the main results of survey carried out in Ahmedabad that investigated the material management of 3 well known builders of Ahmedabad.

2.2.14 Emad Elbeltagi, M. ASCE et. al. [July/August2004][14]

The layout of a construction site plays a major role in the safety and productivity of operations, particularly when site space is restricted. As construction evolves, however, the site layout may need to be dynamically reorganized at various schedule intervals to accommodate operational needs. As opposed to considering only productivity issues during site planning, this paper presents a layout planning approach that considers both safety and productivity. First, safety issues on construction sites are discussed and the factors that contribute to unsafe sites are outlined. A procedure for optimum layout of temporary facilities is then developed in integration with a scheduling tool. Four aspects are considered during site-layout planning: defining the safety related temporary facilities needed on construction sites; defining proper safety zones around the construction space; considering safety in determining the optimum placement of temporary facilities on the site; and utilizing parts of the constructed space as temporary facilities to relieve congestion on restricted sites. A case study is presented on a prototype system to demonstrate the benefits of the proposed approach.

III. RESEARCH METHODOLOGY

In this research, few data collection methods were used, including observation, documentation, interviews, questionnaires and documentation analysis. The good design of the questionnaire was to obtain good results. The methodology for the research includes. The project study involved two stages. The primary data was gathered through a Literature survey targeted by web searches and review of eBooks, manuals, codes and journal papers. After reviewing the problem statement is defined and model preparation is taken up for detail study and analysis purposes. This project execution follows the flow chart given below:

The following flow chart describes the layout of this project briefly:

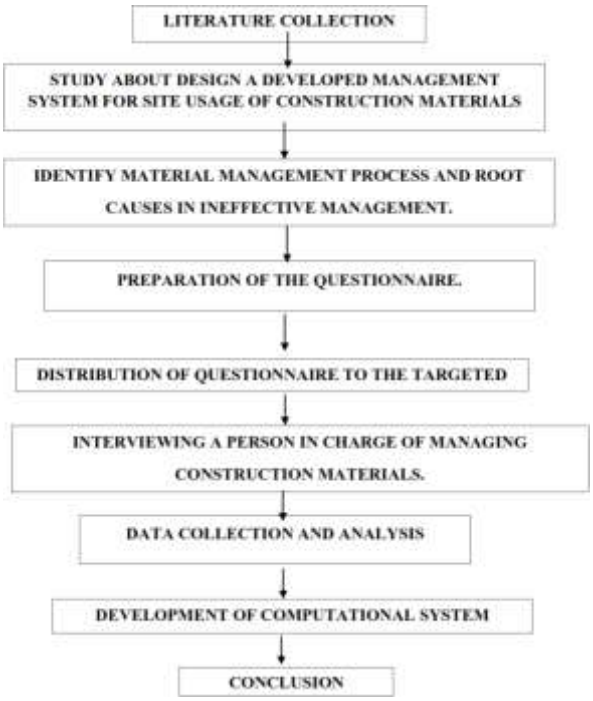

Fig 1: Methodology

IV. PROBLEM STATEMENT

The case study which is selected for this project of Godrej Rejuve at Keshavnagar Pune of RCC Building. The research approach, which is the combination of both the qualitative and quantitative methodologies were adopted in this research. This research has the advantage of gaining a stronger research design and achieving more valid and reliable findings. As such, semi-structured interview, questionnaire survey and literature reviews were the methodologies conducted to carry out the objectives of the research. Accordingly, it is believed that a deeper and more detailed quality of information could be obtained with interview opted as the methodology instrument whereas questionnaire survey could cover a broad range of the study in fulfilling both objectives the methodology adopted was preparing questionnaires and allocating marks for each, by categorizing them into each of their subsystem problems, such as supply, materials and equipment, weightages were given substantially.

Then, based on this the solutions were offered in the form of cause – effect diagram and flow charts, graphs were also prepared, depicting problems such as delay, lack of specification, excess and lack of inspection. The research approach, which is the combination of both the qualitative and quantitative methodologies were adopted in this research. This research has the advantage of gaining a stronger research design and achieving more valid and reliable findings. As such, semi-structured interview, questionnaire survey and literature reviews were the methodologies conducted to carry out the objectives of the research. Accordingly, it is believed that a deeper and more detailed quality of information could be obtained with interview opted as the methodology instrument whereas questionnaire survey could cover a broad range of the study in fulfilling both objectives. The experimental analysis consists of theories and practical consideration of the concepts. Therefore, the work can be classified as site management, inventory controlling, purchasing procedure, cost, and procurement and tracking etc. Basically, this research is divided in two parts such as first one Qualitative analysis & second Quantitative analysis. Qualitative analysis: This analysis is carried out using MSP software for analyzing planned and actual material consumption through S curve analysis. Reasoning over the deviations curve is the s shaped graph produced by the cumulative expenditure of certain parameters (man-hours cost) against time and it is the representation of project path. This analysis is carried for comparison of planned and actual cost for material.

V. RESEARCH GAP

The review of the study indicates that there are numerous research efforts found on Design A Developed Management System for Site Usage of Construction Materials. It was found that less numbers of research works were conducted on Design A Developed Management System for Site Usage of Construction Materials. Research is to explore the existing common practices in construction projects & to apply inventory control technique so as to analyse the effect of material management on constructions projects. It is observed from necessary to establish harmony and good co-ordination between all the employees of material management department and this department should have good coordination with the other departments of the organization to serve all production centers. From the available literature review, it is noted that significant research has been done to analyse the factors that affect the management in the construction industry but there is a lack of work for analysis in Pune region.

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