A Literature Review on Project Management System

Haseena V[1], Shaheer K[2]

[1]PG Scholar, Department of Civil Engineering, APJ Abdul Kalam Technological University,
Cochin College of Engineering and Technology, Valanchery, Malappuram, Kerala

[2]Assistant Professor, Department of Civil Engineering, APJ Abdul Kalam Technological University,
Cochin College of Engineering and Technology, Valanchery, Malappuram, Kerala

Abstract: *Project management has been considered very important by many scholars in recent years. Project management in construction is under researched and is a relatively new concept in India with limited amount of researches addressing the subject and many projects have failed to achieve desired outcomes. A successful construction project management can be carried out only through effective project management system. The integration of time and cost management of construction projects has been recognized as the most effective way for close management. It has been not effectively used due to the presence of a large quantity of data with many complex interrelationships. As business become increasingly become dependent on information technology on their operations, project managers find pressure under themselves to remain innovative and go forward to deliver quality projects, on time and within project constraints. Some organizations still find it hard to plan and track project components, stake holders and resources. Additionally project managers, team members and customers do not communicate frequently to share their expert opinions. To this end, with the advent of information technology, there has been an increase in the demand for software that makes jobs easier for people. Thus a computer solution for an existing problem using software will have a higher potential for application. This work has aimed to put emphasis on information modeling, i.e., representation of construction process in data to facilitate exchange and interoperability of information. This paper presents a study on project management system, challenges confronting project management, need of monitoring and control in project management system, influence of information technology on project control, database management system, web-based project management system.*

Keywords: Construction management, Construction industry, Database, DBMS, Internet, Project management, Software, Web-based

1. Introduction

A project can be simply defined as a task to be completed within a given time period. Projects can be grouped into three major categories; Industrial projects, Manufacturing projects, Management projects. Projects may differ in scale, but there are some notable characteristics that each project has, these characteristics may include;
1) Projects are to be completed within a specified time period.
2) Projects have specific, measurable, achievable, and realistic objectives.
3) Projects are completed within a specified budget.

Project management is the employment of knowledge, expertise, tools and methods to project activities that satisfy project requirements. The term project management is used to describe an organizational approach to the management of ongoing operations. The key successful project is the planning. All the detailed planning work for different aspects of the project is integrated into one single plan known as project management plan.

2. Literature Review

2.1 What is a Project Management System?

Project Management (PM) is defined as the application of knowledge, skills, tools, and techniques to project activities in order to meet stakeholder needs and expectations from a project.

Project Management Institute (PMI) in their PMBOK GUIDE defines project management system as software that has the ability to help strategize, organize, and manage resource streams and develop resource approximations. Depending on the complexity of the software, resource breakdown structures, resource availability, resource rates and various resource calendars can be defined to assist in optimizing resource utilization.

There are different types of project management systems are used to handle projects .They are unique in operation, depending on the kind of project one is managing. Mohamed, A (2016) explained five types of project management systems .Those are as follows:
1) A desktop management is implemented as a programmed that runs on the desktop of a particular user. Users and organizations can purchase it as a desktop package. The advantage of this type is the highly responsive and graphically-intense user interface.
2) A web-based project management system is implemented as a web application to be accessed via a web browser, or an extranet. It is multi-user and can be accessed from any computer without installing the software. They are usually less responsive than desktop applications, and users can not access project information if they are offline.
3) A personal project management system is designed for handling simple or home projects. It usually has a simple interface, and mostly overlaps with single user systems.
4) A single-user project management system is programmed with the conjecture that only one used will ever need to work on the project plan at once. This may be used in

small firms, or where only a few people are associated in top-down project planning. Desktop applications are commonly classified in this category.

5) A collaborative or client server is specially designed to support multiple users. It easily allows the multiple users who are working on different parts of a project at the same time. It incorporates multiple collaboration tools so that users can share knowledge and expertise.

The other method of project management system includes:
- Registers
- Telephonic communications (manager to employee, manager to contractor, manager to supervisor, etc)
- Face-to-face communications

2.2 Challenges Confronting Project Management

Olateju et al. (2011) enumerated obstacles facing the implementation of project management in public agencies in developing countries as lack of project management knowledge, change of authority, lack of leadership commitment, bribery and corruption, low level of professional training in PM, and rigid organizational structure. Nwachukwu and Emoh (2011) evaluated constraints facing project management implementation such as inadequate communication, undefined project mission, lack of management support, lack of project scheduled plan, non-involvement of clients, poor personnel selection, low technical know-how, poor monitoring and feedback system and poor conflict management. In developing countries, such as Nigeria, the constraints are peculiar to each society in terms of its economic, political and administrative system. However, Abbasi et al., (2000) and Sukhoo (2004) emphasized that project management practices in developing African countries is at infancy which is partially due to shortage of skilled staff, difficult economic and social conditions, weak political institutions, deeply rooted cultural and religious beliefs. Abass and Al-Mharmah (2000) stated that a major constraint facing construction project management practices is difficulties in communication with other professionals. While, PMI (2008) suggested an open and effective communication system in achieving high team performance among project team stakeholders. Iman and Siew (2008) stated that when project requirements such as time and budget are met, but fails to meet the client's needs, a project is said to have failed. It identified the absence of client involvement as a major cause of project failure. Love (2002) explained that clients demand for earlier completion of designs and contract may influence the quality of documents produced, as errors and omissions may emerge that can result in rework, causing cost and schedule overruns. A. O. Ogunde et.al (2017) listed challenges confronting project management through a case study conducted on Nigeria. A number of challenges faced in project management in the construction practice were divided into six sections based on the contributions namely PM, client, consultant, supplier, construction team and external factors. The main challenges identified in the study include;
- Passive participation from the PM
- Lack of Client involvement in making decisions
- Provision of substandard materials

- Design error
- Lack of effective communication
- Poor treatment of workforce

On construction projects, one or all of these challenges are mainly witnessed which would cause different issues of cost overrun, delay, time overrun, abandonment, disputes etc. The study revealed that the construction project manager needs to give active and full participation of construction projects in order to efficiently and effectively tackle the daily challenges that may occur on such construction site.

2.3 Need of Monitoring and Control in Project Management System

PMBOK (2013) discussed the project management life cycle. It consists of four phases;
- Initiation
- Planning
- Execution
- Closure

In order to ensure success of the project, effective monitoring and control is required throughout these phases.

PMBOK (2013) suggested that regular monitoring is necessary to maintain good control of the project performance. Regular monitoring means that various activities throughout the project life cycle should be evaluated and reported at regular intervals in terms of time, finance and quality. These regular intervals may be daily, weekly, monthly or annual. The daily reports present the actual manpower and equipment available at site, material deliveries and work executed on that particular day. In the weekly reports, identify the SPI and CPI, comparative analysis of actual versus planned activities, potential risks and strategic decisions required from client or senior management. In addition, hold weekly and monthly project review meetings between the client, consultant and contractor in which the current status of the project is reviewed and necessary decisions are taken to ensure that the project stays on the path to success.

On the basis of these weekly and monthly meetings where the progress reports are discussed, the areas of concern are highlighted. Delayed activities, status of approval of materials and IFC drawings, quality of work and safety reports are analyzed. The reasons are discussed and mitigation steps are taken. This part constitutes the SLL phase. In the next phase, i.e. DLL, all this working goes to the monthly meeting which is held at the senior management level. Here, the top management reviews whether any of the issues are pertaining to the organizational system and if required; they approve changes within the system to ensure better performance in future projects.

Easterby-Smith et al. (2000) suggest that in order to improve the performance of an organization in its future projects, it is necessary to carryout post-project reviews of past projects so that a database may be developed which is accessible to all project teams for ready reference and learning purposes.

2.4 Influence of Information Technology on Project Control

Aaron. A.Izang et al. (2016) mentioned the tendency of project managers to remain innovative and go forward to deliver quality projects, on time and within budget constraints. With the advent of information technology, there has been an increase in the demand for software that makes sthat makes jobs easier for people. He introduced a web-based software project management system for project control which solves the problem of unity and lack of communication.

2.5 Database Management System

Md. Ashraful Islam et.al (2017) discussed various advantages and disadvantages of DBMS. According to him DBMS are critical component of modern computing of research and development in both academia and industry. C.S. Pan and M.L. Zymbler discussed open source database management systems.

2.6 Web-Based Project Management System

The application of DBMSs for project control has been explored by a number of researchers.

William J Rasdorf and Mark J Herbert (1990) presented a Construction Information Management System(CIMS) for the control of information used by project management. CIMS integrates scheduling, cost, inventory and document control application programs with a central Database Management System using stand-alone software,a DBMS programming language and a spread sheet. Abudayyeh(1991; Abudayyeh and Rasdorf, 1993) developed a DBMS to support automated cost and schedule control functions. He used the work package model to represent the project data. His system, however, only supports the application of earned value for progress reporting. The earned value method (Canadian General Standards Board, 1999, Department of Defense, 1967) integrates time and cost to overcome the limitations of traditional control methods, which use cost as the only indicator for the performance of a task. The method is widely accepted as an integrated project control tool(Fleming and Koppelmam, 2000). However this method only tracks cost and schedule variances, and neither supports reasoning to explain unacceptable performance nor advices on possible corrective actions. Diekmann and Al-Tabtabai (1992) presented a knowledge based approach for project control.Fayek et al. (1998) proposed a prototype rule-based expert system to improve project control.

A.A.D.A.J Parera and K.Imriyas(2004) conducted a research to establish the feasibility of the use of MS Access[TM] and MS Project[TM] to provide an integrated time and cost management information system encompassing estimating, scheduling, cost control, resource monitoring and costing and financial control.

Osama Moselhi and Sabah Alkas (2006) developed a web-based DBMS to support project control. The work package model is utilized to break down project into activities and work tasks. The data structure of the project is represented using the entities-relationship methodology. A relational database stores all of the project data. The earned value method calculates the cost and schedule variances. The internet based platform with three-tier client-server architecture is chosen for system implementation.

Mahamoud M.R. Halfawy and Thomas M. Froese (2007) presented a multi-tier component based framework that aims to facilitate the implementation of modular and distributed integrated project systems that would support multi-disciplinary project processes throughout the project life cycle.

Chassiakos A.P and S.P Sakellaropoulos (2008) presented a web-based system that facilitates construction information and management and communication. The proposed system consists of a relational database and a dynamic data-driven web application. The database contains 32 appropriately designed tables. End users access the database through the internet and can perform certain transactions according to their authorization.

Vacharapoom Banjaoran (2009) suggested a collaborative approach to develop a cost control system for five selected small and medium sized contractors. Ms Access and XML were selected as suitable tools for the development.

Jui Sheng Chou(2010) presented a web-based visualized architecture, design and implementation for assessing project performance by integrating Earned Value(EV) analysis and Database Management System (DBMS).A novel probabilistic Multiple Criteria Decision Making (MCDM) process is applied to identify the optimal software for developing the web-based DBMS based on interviews with domain experts and professional engineers. EV analysis serves as a control technique that helps project managers monitor cost overruns and project delays. Leveraging modern technology, web service enables project managers to access project information without constraints of time or place.

Sang-Chul Kim and Yong-Woo Kim introduced a computerized integrated project management system and report results of a survey on the effectiveness of the system. The system consists of a scheduling system, material management system, labor/equipment system, and safety/quality control system. The backbone system is a scheduling system that adopts a production planning system and a project scheduling system. The lowest level in the scheduling system is a daily work management system, which is linked to each functional management system (i.e. material management system, labor/equipment system, and safety/quality control system). It focused on the material management and scheduling systems to implement a material "pull" system to reduce material inventories on site. Details of material management and scheduling systems are discussed, and a sample application is presented to demonstrate the features of the proposed computer application system.

Lang J.P (2014) introduced an open source software named Redmine that provides budgeting, collaboration,

customization, issue tracking, learning, support, notifications, resource management and traditional management for small or medium businesses. Asana is asoftware that puts tasks and conversations together to help teams manage projects and rely less on mail.

Aaron A.Izang et al. (2016) further developed a web-based software project management system,that fully monitors project progress, allocate tasks, creates milestones and provides an avenue for stakeholders to track project progress during its development phase. WAMP was used for the development of web-based project management system which has the following:

- Windows operating system
- Apache web server
- MySQL to create the database for the application using PHP MyAdmin

HTML, CSS, Jquerry, Ajax and JavaScript was used to design the web pages.

3. Summary and Conclusions

Efficient project management is a primary mechanism for the construction industry to increase its productivity. As construction projects become larger and complex, an efficient way to provide such information is through the use of information management systems.

The study suggested that a regulatory system be put in place to inspect, monitor and control challenges of project management. It is recommended that a web based project management system should be developed wherever the need to manage projects efficiently arises.

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Author Profile

Haseena V received the B.Tech degree in Civil Engineering from College of Engineering Pathanapuram under Cochin University of Science and Technology in 2015. She is now with PG programme in Construction Engineering and Management.