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PROJECT MANAGEMENT INFORMATION SYSTEM IN CONSTRUCTION INDUSTRY: A REVIEW

Pranavraj Zambare*, Arun Dhawale

[1]PG Scholar, Department of Civil Engineering, Imperial College of Engineering and Research, Wahagholi, Maharashtra, India

[2]Associate Professor, Department of Civil Engineering, Imperial College of Engineering and Research, Wahagholi, Maharashtra, India

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ABSTRACT

Project management information systems (PMIS) are widely regarded as an important building block and today's project management. The nature of these systems has changed considerably during the last decade they are in fact still developing from single-user single-project management systems to complex, distributed, multi-functional systems that no longer only cover project planning. Information systems research has to date only partly reflected this PMIS evolution. Typical fields of research are algorithms in respect of operation research problems related to project management, the assessment and comparison of commercial project management solutions and corresponding assessment frameworks, the development of prototypes to test new kinds of functionality and research into the usage of project management software systems. Two specific problems are very rarely addressed, PMIS are become increasingly complex. Therefore, firstly, information system designers are facing a growing number of business processes that have to be supported with project management software. Secondly, information system users have difficulties in setting up corresponding organizational systems and selecting corresponding software products PMIS are become increasingly complex. This paper deals with some important literature reviews regarding PMIS.

KEYWORDS: PMIS, Construction Management, Cost, Schedule, Quality

INTRODUCTION

A PMIS provides information so the team has a common understanding of the facts: a prerequisite for collaboration. It's the cheapest way to gather information because it's only done once. And it's the most reliable way to host information because many eyes scrutinize centralized data and mistakes are more likely to be found and corrected. It's the first line of defences against political or legal attack. It's a clear window into the project that leaders can use instead of relying on delayed or biased reports filtered through layers of management. It improves performance because it measures it; it's a report card for both team members and management. And most important, it educates the team and makes better managers because it tells true stories

The voice of authority from a committed owner is essential to a successful PMIS. There's always a bumpy start-up while the team adjusts to the routine discipline of entering and sharing information. Some team members will have a hard time accepting change and will neglect the responsibility to provide input. Initially, there will be glitches in the data that provide targets for criticism. Engineering the human system to maintain timely and reliable information flow is the hardest part. Success requires support from the top brass. Interoperability has been a problem but there is progress. PMIS systems can be interfaced with different software used by other organizations to minimize the chores of data entry.

The PMIS defines the program and the projects: cost, time, scope and quality. It defines the team: people, organizations and their roles. It helps manage agreements: contracts, permits, approvals and commitments. It manages documents. It produces standard and custom reports. It presents vital signs on dashboards. It guides collaboration and communicates best practices with policies, workflow diagrams and document management.

A PMIS is built around documentation and communication of project-specific information so most of the engine is devoted to that purpose. Basic project information includes the project location, a current calendar and the project goals. There may be web cameras that record on-site activities for public relations or for evidence in case of conflict. There may be general public relations web pages with access for the community, users or other stakeholders. The PMIS maintains project status from the initial idea for a new facility to its completion. Such project data may be rolled up for portfolio management and for planning future projects.

As the PMIS develops it will accumulate detailed project information on:

Cost - Each contract and each project will have the budget, estimates, contract amounts, changes orders, contingencies and forecasts of completion cost. There may be a capital plan with projects scheduled over future years. It may include funding sources.

Schedule - There will be a master schedule, design schedules, procurement schedules, global "push" construction schedules, short interval "pull" schedules, closeout schedules, occupancy schedules and commissioning schedules. Or there may be a project-specific calendar so the extended project team can coordinate their work. It may display meetings that the user must attend, show deadlines for the user's work products and send automatic reminders. There may be a user-customized calendar for specific responsibilities.

Quality - Given that most owners choose to define quality as "conformance to requirements," the PMIS may include space programs and other requirements. The PMIS may include procedures for quality control or quality assurance programs, post evaluation data and include checklists to meet regulatory requirements.

The team: people, organizations and their roles - Within the PMIS database there is a simple list of the projects with contact information for each company, its key people and their project role. Since so many people deliver a project it makes sense to have a resource where everyone can find everyone else. And it sure helps to know how they fit into the project. A web-accessible database with that information improves communication. That speeds the project. It also adds to the quality of the work. When starting a new project, it helps to know what companies have done similar work and how they performed.

RELATED WORK

William Li and Xungai Wang, [2016] Along with the recent real estate development in major cities of Australia, sustainable construction is one of the measures being implemented to reduce negative impacts of the construction industry on the environment, society, and economy. However, there is a lack of detailed review of this kind of important studies that is critical to Australian future endeavour. This paper presents a systematic review of a large scale earthwork project and discusses concerns examples under three dimensions. Firstly the environment aspect, factors including remediation of the various type of contaminated and general waste, management of runoff water, dust control, noise and vibration monitoring are showcased; secondly the society aspect, factors including innovated wheel wash facility, CCTV system, drainage protection, and wildlife protection are mentioned; lastly the economy aspect, factors including integrated weighbridge management system, recycling waste water, recycling rock are demonstrated. The research identifies future opportunities such as the innovation of evaluation system, project design framework, finance analysis model, and potentially integration of sustainable construction practise into Australian code of practice.

Ximena Ferrada, et al; [2016] Construction companies are project-based organizations, since much of their knowledge is generated on site, from projects they carry out. In fact, projects are an important source of expert know-how and organizational knowledge, but lessons-learned from them are not systematically incorporated into subsequent projects, evidencing a lack of knowledge management and learning culture in local construction companies. This article describes a research effort that addressed this situation and developed a lessons-learned system to help construction companies to overcome these limitations. A multiple case-study methodology was applied to understand the knowledge and learning realities and needs of three Chilean construction companies. Based on these results, a mobile cloud-shared workspace to support knowledge management was developed. Results show that major concerns of users are associated with how the system acknowledges the particularities of construction projects and how it will be incorporated into daily activities. Main conclusions indicate that (1) companies acknowledge the need to develop a culture of innovation within the organization, (2) users consider the system as a tool that could really contribute to improve the construction project management process, and (3) the system needs improvements regarding database search and the Internet support before being fully implemented in the company as a project management tool.

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Zhen-Zhong Hu, et al; [2016] Several challenges have been found in the current applications of building information modelling/model (BIM) technology in large-scale mechanical, electrical and plumbing (MEP) projects, such as the huge modelling workloads of MEP models and details, untapped potential in supporting cooperative construction management with multiple participants and insufficient functions for intelligent facility management. This paper proposes a multi-scale solution to address the insufficiencies of the current applications in the construction and facility management of MEP projects. Particularly, a practical multi-scale BIM consisting of several macro, micro and schematic-scale information models is described in detail with the required information of the MEP components according to the schema of industrial foundation classes. Based on this model, the paper presents a BIM-based construction management system to provide virtual construction scenes with appropriate scales for various participants to communicate and cooperate, as well as a BIM-based facility management system to share information delivered from previous phases and improve the efficiency and safety of MEP management during the operation and maintenance period. The application in a real-world airport terminal illustrates that the proposed model and two systems can support collaborative construction management and facility management with multi-scale functionalities among participants. This paper proposes a series of feasible models and techniques to promote BIM application in large MEP projects.

Aynur Kazaz and Turgut Acıkara, [2015] The success of a construction project mainly depends on the management of the highly correlated inputs like labour-force, materials and capital. Since labour-force varies from region to region, it contains many uncertainties. Therefore, among these inputs labour force is the most difficult one to manage. In this sense, it is important to determine the factors affecting labour-productivity to manage labour-force effectively. In the literature there are many studies in which the factors were identified from the managers' perspectives. In this study, it was argued that craft workers have the biggest impact on labour productivity and hence, their opinion should also be considered during identifying these factors. According to this argument in this study it was aimed to compare labour productivity perspectives of managers and craft workers. The results revealed that, despite the difference of the priorities of managers and craft workers, the most influential factors that affect labour productivity were grouped under organizational factors.

Barbara Gładysz, et al; [2015] This paper proposes a mathematical model supporting the management of project risk. The model distinguishes between risks which have to be accepted and risks which can be eliminated at some cost, helping to decide which risks should be eliminated so that the customer requirements with respect to project completion time can be satisfied at minimal cost. The model is based on a modification of the PERT method and can be reduced to a mixed linear programming problem. The model is illustrated by means of a real world case concerning a construction project.

Douglas M. Brito and Emerson A. M. Ferreira,[2015] The application of Information Technology (IT) to construction project management (CPM) has become crucial to the completion of projects in accordance with the specifications of time, quality and costs. However, there are difficulties in visualising the planning and work progress in space and integrating information between stakeholders. Building Information Modelling (BIM) can gather necessary information at different stages of a project's lifecycle, including production management. This study aims at discussing strategies for the representation and analyses of a building construction 4D Model for planning and control and evaluating the importance and applicability of 4D Modelling to CPM, based on the survey conducted with the professionals from the Brazilian construction sector using a Google Docs questionnaire. The survey questions comprise the evaluation of potentialities, strategies for representation and analyses, such as the colour use for the differentiation of internal activities and alternatives of physical advance monitoring through the Planned x Realized schedule simulation or visualisation of them on split screen, ending with the evaluation of the 4D Modelling adoption. The results indicate the degrees of importance and applicability of the 4D Modelling regarding the aspects analysed based on professionals vision of construction industry.

M. Braglia and M. Frosolini [2014], Project Management Information Systems (PMIS) are software applications that help managers track projects from their conception to their execution. They provide them with pertinent information and collaborative tools. Currently, most businesses use disconnected instruments which are not designed for managing complex projects. Increases in complexity, both due to the extent of scope and the fact that the users who contribute to the decision making process are physically separated, have led to initiatives that deal with cooperation, teamwork and continuous improvement. This work presents an integrated approach to improve PMIS applicability within the Extended Enterprise. The study regards the definition and the building of a management framework where planning, scheduling, and communicating are made immediate and effective by the adoption of common standards, shared communication and appropriate software tools for the management of whole Supply Chains. The proposed approach has been successfully applied within the shipbuilding industry.

Seul-Ki Lee and Jung-Ho Yu [2012], Among various IT solutions, the internet-based (or web-based) PMIS has been highlighted because of its strong advantages. While not sufficient to insure project success, using PMIS to manage projects has thus become a necessity. Establishing a success model of a specific information system is critical to understand the mechanism of IS success, the various dimensions of IS performance, and the factors and their causal relations in IS success. As one of the key IT applications, the project management information system (P MIS) has played a significant role in construction management processes. While not sufficient to insure project success, using PMIS to manage projects has thus become a necessity. However, research that attempts to establish or apply an IS success model have relatively recently begun to emerge and not many have been carried out as yet. Therefore, the main propose of this study is to develop and validate the ASP-PMIS success model based on the DeLone and McLean (2003) IS success model. A questionnaire instrument was remitted to experienced users (CMs and constructors), and 253 completed questionnaires were retrieved. Using AMOS 18.0, we used Structural Equation Modeling for hypothesis testing. The validated ASP-based PMIS success model can serve as a foundation for positioning and comparing PMIS success research, and can provide users with a useful framework for evaluating PMIS success.

Frederik Ahlemann,[2009] Project management information systems have changed considerably over the last decade. They no longer focus on scheduling and resource management alone. Instead, they have become comprehensive systems that support the entire life-cycle of projects, project programs, and project portfolios. In this context, project-oriented organizations are facing a new challenge: the design, implementation, and operation of project management information systems have become increasingly complex. Numerous processes have to be considered, diverse stakeholder interests taken into account, and corresponding software systems selected. The reference information model presented in this article addresses this challenge and aims to accelerate the set-up of project information systems. Reference information model was developed with the help of 13 domain experts from German and Swiss enterprises. Furthermore, it is based on an analysis of 28 commercial project management software systems. Reference information model has already been applied in several projects and is the basis of the forthcoming German DIN norm for a standardized project management data model.

Pollaphat Nitithamyong and MirosClaw J. Skibniewski [2004], This paper describes research conducted at Purdue University on the identification of factors determining success or failure of web-based construction project management systems, particularly through the use of application service providers utilized by construction firms without in-house expertise to develop such systems for exclusive company use. This paper presented the state-of-the-art of PMASPs for the construction industry, the current business models of PM-ASPs, and their supported features. Examples of systems currently available on the market were demonstrated. The potential benefits and impediments of PM-ASP implementation were also discussed, followed by a review of trends towards the future of PM-ASPs and some existing research related to PM-ASPs conducted by academia. It can be concluded that PM-ASPs present significant benefits to the construction industry, but their successful implementation is still hindered by barriers, for the most part nontechnical. Yet, research conducted to date still either aims to solve the existing technical problems of PM-ASPs or to introduce some new advanced techniques to improve the systems. Most of them ignore that technology push is not the only critical success factor for effective implementation of a new technology such as PM-ASP. Unlike other technologies, PM-ASPs are very much concerned with the exchange of information across the project life cycle, and their successful implementation therefore will not only require a state of readiness within one organization but also within all organizations involved in the construction processes, which makes the successful implementation of PM-ASPs difficult to be planned and managed. In order for the construction industry to successfully embrace PM-ASPs, many factors such as technology, process, people, procurement, legal issues, and knowledge management must be considered equally. Although there have been some studies conducted to identify factors that can foster the successful development and usage of PM-ASPs, all of them are still based on either individual case studies using interview techniques or anecdotal evidence provided by success stories reported in the trade press. There has been no empirical research on a large scale conducted on this topic. As the importance of PM-ASP concept increases, the authors have completed a major research effort to identify common factors across the systems and organizations that can influence the success/failure of PM-ASP implementation efforts.

Peter E.D. Lovea and Zahir Iranib [2003], A prototype Project Management Quality Cost System (PROMQACS) was developed to determine quality costs in construction projects. The structure and information requirements that are needed to provide a classification system of quality costs were identified and discussed. The developed system was tested and implemented in two case study construction projects to determine the information and management issues needed to develop PROMQACS into a software program. In addition, the system was used to determine the cost and causes of rework that occurred in the projects. It is suggested that project participants can use the information in PROMQACS to identify shortcomings in their project-related activities and therefore take the appropriate action to improve their management practices in future projects. The benefits and limitations of PROMQACS are identified.

CONCLUSION

The study until now was performed on analysing and predicting the system manually used to manage the construction work on site. Many researchers derived the logical algorithm to reduce the time and increase the effectiveness of work on site and ultimately deal with the cost effective project. Some questions regarding the output and effectiveness and flexibility to use the system on the site are unanswered. The effectiveness of the designed system in practical usage by studying the case study and comparing cost benefit with PMIS and conventional system.

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