

A Theoretical Study on Various Modern and Advanced Methodologies in Construction Industry

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Abstract- *The construction industry is labour intensive and construction work is conducted in risky and dangerous situations. The importance of construction automation has grown rapidly in developed countries. In developing countries like India, the construction industries need automation technologies such as new machineries, electronic devices etc. The infrastructure project requires more numbers of skilled labour, good quality of work, increases productivity etc. The problems associated with construction work such as decreasing quality of work, labour shortages, and safety of labour and working condition of projects. To overcome these problems new innovative technologies such as automation which has the potential to improve the quality, safety, and productivity of the industries must be implemented. This paper describes the information about automation in Indian construction industry by using qualitative study of local construction industries and A growing awareness in the construction industry has emerged to pay a sharp attention to ICT as a catalyst that would mitigate the deficiencies characterized by this industry. The present study consists of theoretical analysis of various modern and advanced applications of construction industry like, Application of E-Commerce, IT & ICT principles, Value Engineering Approach, E-Construction methodologies, Automatic Machine Guidance and Electronic Document Management. It also comprises the methodologies to study efficiencies in construction and the management ways of materials.*

Keywords- Construction Industry, E-Commerce, Value Engineering, Automatic Machine Guidance and Electronic Document Management.

I. INTRODUCTION

Infrastructure construction is growing very largely in India. The construction industry needs automation techniques to perform the risky and dangerous work for good quality of work, increase productivity, reduce duration etc. Automation has been indicator of technological and developmental progress of infrastructure project. In developed countries such as Japan, Germany the use of Automation, developing the techniques and implementing automation are as good as

compared to the developing countries such as India and China. India is experiencing the large volumes of works in Infrastructure projects and a shortage of skilled labour so; there is need of automation technologies in Infrastructure projects and other construction works. The use of automation techniques will result in the less use of labours, less cost of project, early time of completion and increases the quality and productivity of construction work. The unskilled labours are unable to do good quality of work and take so much time as compared to automated technology. In this paper, the main objective is to discuss the obstacles in implementing automation in Indian infrastructure projects and construction industry. Literature review is taken to find out current status of automation in local construction firms. Despite the capabilities and effects of ICT, several scholarly review research endeavours have been proposed to investigate the ICT in construction industries. However, a rigorous review of ICT Technologies applied in the construction industry is missing. Most of those attempts were performed differently in terms of research intentions, objectives, purposes, types of ICT, duration of review, quality of review's methodological and analytical findings and review's implications

II. E-COMMERCE IN THE CONSTRUCTION INDUSTRY

E-commerce uses modern information technology, flexible production modes, and an agile organizational structure to produce products that meet customer's varying needs and provide corresponding services. It also uses computer networks and the Internet to buy and sell products and services, and to transmit information. E-commerce can be divided into different models: Business-to-Business (B2B) is used to manage data exchange between companies Business-to-Consumer(B2C)is used to manage data exchange between companies and consumers C2C is used to manage data exchange between consumers Business-to-Manager (B2M) looks for intermediary agents and logistics channels through the network; Business-to-Government (B2G) includes the informal ties between business managers and government officials and Business-to-Employees (B2E) use the network to deliver products or service information to employees.

Different from B2B and B2C, B2M is a new e-commerce model. The fundamental difference is that the target audience is different, the first two target audiences which are the final consumer, while B2M target's audience is the enterprise or the seller of the product. By considering current applications of the e-commerce model in the construction industry, this paper summarizes the relevant variables. In the context of mass customization, the key is understanding and responding to the changing needs of each unique customer. E-commerce can create a link to the customers and contribute to an environment that enables customers to communicate their needs to suppliers. The e-commerce platform provides the way to integrate customers in the production process through co-designing. Customer involvement in design is a requirement for product customization, so that a customization company and product supplier can full customer demands. The e-commerce platform can be used by customers to analyze customization options for procurement decision support, by customizing company and product suppliers for design, production planning, pricing, and to gather processing information (information required for production) for the products. Different existing e-commerce models of the construction industry were given in Table.1.

Table.1. E-Commerce Models

S.No.	Code	Model Details
1	B2B	Business-to-Business
2	B2C	Business-to-Consumer
3	C2C	Customer-to-Customer
4	B2M	Business-to-Manager
5	B2G	Business-to-Government
6	B2E	Business-to-Employees

III. APPLICATION OF IT IN CONSTRUCTION INDUSTRY

IT comprises many techniques, which have considerable potential for improving the management of information within the construction industry. The vast topic of IT includes the computing and ever-popular Internet, which are fields that are continually growing independently, but proportionately with each other. The ever-growing attention given to information resources suggests that better management of these resources become critical to project success. The use of IT in construction industry is growing rapidly. However, construction industry seems to make slow progress towards effective IT implementation for its unique features which distinguish it from other industries; namely one-off projects, industry fragmentation, low level of technology awareness and training, required up-front investment, on-going maintenance costs and resistance to change. IT can be of great assistance in all aspects of project planning, organizing, operation, and control. However, the

application of IT in construction industry is not effective as in other industries

IV. USAGE OF VALUE ENGINEERING PRINCIPLES IN CONSTRUCTION INDUSTRY

Companies in the construction sector have a better chance of getting jobs when they use the resources of the country in which they work reasonably, keep their costs at the lowest level and decrease their offer price in comparison with their rivals. But the low offer price is not the only factor for a specific company to get the job. Project must have a high "value". Value has different meanings for the producing company, owner, user or the designer. The builder company tries to finish the construction with the lowest cost to obtain high profit. Owner wants to get the biggest income from the building. User wants to be able to perform his works easily, while the designer gives more importance to his creation's aesthetics or functions. Purpose, time, quality and cost of every activity that will be realized during the construction process must be determined or estimated beforehand. Owner or user wants to know which feature they will have after the building is completed and with what cost they will have it. Because construction process has many components such as concept, design and drawing details of the project, construction etc., and it is a long-term production, the risk of completion of construction in time, based on the estimated costs (first investment + usage cost) by providing features

V. E-CONSTRUCTION METHODOLOGIES

Long-term vision of the construction sector emanates from the strategic objective of raising the productivity of Estonian construction sector the latest by 2030 to the average level of the European Union, which means at minimum a threefold growth. Attaining the defined objective presumes parallel development of several fields that influence the construction sector, because the growth of productivity is achievable only in synergy of these domains. At the same time, e-construction is the enabler and amplifier of various other domains. For example, utilization of information and communications technology (ICT) solutions is the prerequisite of automation of processes and facilitates introduction of novel management techniques (Lean, integrated project delivery (IPD)). One of the most important methods of ensuring increased productivity of the construction sector involves raising the efficacy of operational processes and information flows of the sector, which results in higher added value per employee of the sector. Hence, long-term vision of e-construction has to encompass digital and smooth movement of information, and close collaboration of all participants of the sector for the attainment of the mutual goal. Long-term

vision of e-constructions encompasses the following principles: Implementation of the vision results in creation of the digital Built environment, Creation of the digital built environment. Development, designing, building and utilization of buildings Representatives of various life-cycle stages, Information and data collection and exchange takes place automatically during the construction process, without excessive manual effort. Utilization of building information models enables to apply automatic control mechanisms, which reduces the amount of human errors. This means that creation and exchange of data is partially automated throughout the building's life-cycle, from designing until demolition. Information and data move between the parties of building's life-cycle smoothly, without failures and information loss.

VI. AUTOMATIC MACHINE GUIDANCE IN CONSTRUCTION INDUSTRY

AMG is an advanced technology that has been identified as beneficial to transportation agencies. AMG technology enables the equipment operator access to 3D design models that are uploaded to on-board computer installed on heavy construction equipment. The operator supervises the machine operation through a computer screen and adjusts its movement accordingly. Field staff can bring the design models installed on a tablet, coupled with a modern survey device, to the field to compare and verify the as-built conditions with the proposed design. Several state DOTs stated that using AMG in paving reduced the number of survey stakes and string lines, and overall project safety was improved since workers spend less time in the field near heavy construction equipment. Using modern software applications and experienced staff members, the Iowa DOT asserts that it produces 3D models with no more effort than what was formerly required to produce 2D plans. From contractors' perspectives, machine control provides the following benefits: Increased productivity and accuracy, Improved safety, Faster integration of design changes, More satisfied owners, Fewer errors in the field as it is easier to detect problems by reviewing the 3D/4D models before the job starts.

VII. ELECTRONIC DOCUMENT MANAGEMENT SYSTEMS IN CONSTRUCTION INDUSTRY

The use of electronic document management (EDM) systems has become more common among transportation agencies and their partners, especially for design and construction processes. Some agencies choose to use existing commercial products, and some agencies use their own in house customized software. An EDM system enables all project stakeholders to upload/download project plans and documents. In general, these systems greatly facilitate

electronic data exchange and communication among various project stakeholders throughout the project lifecycle. For example, the Michigan DOT (MDOT) is one of the leaders in implementing advanced EDM systems. They require their contractors to submit documents or models to the electronic file management system they adopted, Project Wise, which is specifically designed to retain design files, and they plan to implement digital signatures in the near future and to provide access to other project stakeholders. As mentioned, some agencies use software applications that are developed in-house or customized general-purpose commercial file storage and workflow-facilitating software applications to store and manage their electronic documents. One example is the Utah DOT's (UDOT's) Interchange program, which was developed based on a Microsoft SharePoint platform. Prior to program development, the agency first discussed with internal personnel and contractors the workflow and processes. The programming team then executed the development effort based on stakeholder consensus. The resulting product satisfied the need of both the agency and their contractors. The Interchange program supports document submission, task management, meeting minute development, review and distribution, design review, and other capabilities. Various design groups or contractors can submit documents or models to this program, and specify which discipline should review their uploaded documents. When changes are made to a document, the person who is responsible for reviewing it is notified immediately. Through this program, the agency can assign the task to each individual or group as appropriate. With the increased use of electronic documents, more agencies are expected to implement structured EDM systems to facilitate the need for better exchange of electronic documents and improved communications. In the near future, it is expected that the effective use of these systems will eliminate the need for using paper contract documents.

VIII. SIGNIFICANCE OF ICT IN CONSTRUCTION

Claims that an improvement in the information technology in construction (ITC) is a major international research endeavor in scientific institutions. Concur with Amor's view that there is a growing body of knowledge from researchers and policy makers from the developed and the developing countries regarding the unequivocal importance and role of ICT as a prime tool that has the potential to modernize societies, boost economy, and bridge huge barriers such as distance, equity, and time associated with the traditional World. Before getting into the details of ICT penetration in the construction industry, an agreed upon definition of ICT is a necessity. In this regard, defined ICT as any product that stores, retrieves, manipulates, transmits or receives information electronically. The term ITC as a

synonym to ICT, claiming that it has been used frequently worldwide. ITC was defined as the composite of information technology and construction and of the relationship between these two. Therefore, ITC was defined as the application of decision support tools which uses electronic machines and programs for processing, storage, analysis, control, transfer and presentation of construction information data during the whole life cycle of a construction project. Alternatively, defined ICT as a combination of communication systems and technical decision support systems. Respectively, the first refers to any independent device capable of providing communication like telephones, faxes, laptops while the second refer to computer applications. Automation is the use of computers to replace and/or enhance a variety of jobsite applications which includes surveying, the control of equipment, and the installation of prefabricated units using Global Positioning System (GPS) technologies and advanced robotic systems. However, Construction ICT entailed the use of computer systems that are capable of capturing, organizing, storing, analyzing, exchanging, transmitting, and sharing information namely, video conferencing, web based project management, DBMS, data warehousing, and data mining.

IX. METHODS OF MEASURING IN EFFICIENCY

Measuring inefficiencies on construction projects has been done numerous ways over the years such as, Measured Mile, Comparison to other projects, Comparison to contractor's bid, estimate, or plan, Use of expert testimony to establish inefficiency, Published inefficiency factors or studies, Bureau of Labor Statistics, Business roundtable, National Electrical Contractors Association, Mechanical Contractors Association. Many of these have been used for construction claims, such as the "Measured Mile". It gauges inefficiency loss by comparing a measurable period of time on a project impacted with inefficiencies against a period of the same length with no inefficiency impact. It is important to use known and accepted industry sources whenever possible to establish and build inefficiency tables. Reliable industry standards, practices, surveys, historical data, and case studies can all prove to be excellent sources for developing a table of factors for labor inefficiency for use in construction planning. Another consideration in developing a table of factors with reliable and known sources is the established credibility in helping to support or defend a construction claim and change orders as a result of impacts caused from inefficiencies.

X. MATERIALS MANAGEMENT

The following are the objectives of materials management in construction sector, Efficient materials planning, Buying or Purchasing, Procuring and receiving,

Storing and inventory control, Supply and distribution of materials, Quality assurance, Good supplier and customer relationship, Improved departmental efficiency To fulfill all these objectives, it is necessary to establish harmony and good co-ordination between all the employees of material management department and this department should have good co-ordination with the other departments of the organization to serve all production centers. The functions of materials management are discussed below: In order to fulfill the objectives of materials management as stated above to meet the basic objectives and goals, the functions of the materials management are also categorized as primary and secondary functions. Materials Requirements Planning (MRP), Purchasing, Inventory Planning and Control, Ascertaining and Maintaining the Flow and Supply of Materials, Quality Control of Materials, Departmental Efficiency, Standardization and Simplification, Make and Buy Decisions, Coding and Classification of Materials, Forecasting and Planning. Special training sessions should be arranged on site to update the workers regarding the latest techniques. Plant and machinery should be updated regularly in order to avoid any break down. Workers and contractors should be guided for correct methodology to execute a particular task. Regular check should be kept on planning so as to overcome any error. Proper supervision should be done on site to improve the level of workmanship.

XI. CONCLUSION

Now a day's awareness on various construction methodologies plays vital role due to the increase the population which demands the area of l buildings, etc. The increasing needs in the construction sector are fulfilled by the application of various technological methodologies like Application of E-Commerce, IT & ICT principles, Value Engineering Approach, E-Construction methodologies, Automatic Machine Guidance and Electronic Document Management. A growing awareness in the construction industry has emerged to pay a sharp attention as a catalyst that would mitigate the deficiencies characterized by this industry.

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