

Information And Communication Technology (ICT) In Construction Engineering and Management

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Abstract--In this modern era, information technology has become an effective management tool in all types of industries. However, because of its complex nature and fragmented structure, the construction industry is the slowest one in adaption of information technology tools. With the advancement in all the areas and increase in the awareness of the participants about advantages of using ICT tools, the current decade experiences a considerable surge in the use of ICT within construction. The construction industry and its participants need to handle huge amounts of data in terms of designs, time and cost calculations, transportation updates etc. in the most sustainable manner. To address this challenge in an effective way, the industry must use appropriate ICT tools. The aim of this paper is to study the role and scope of ICT in the construction industry and discuss the factors that affect its implementation from the prospective of Industry, Organization and Participants. The paper has exploratory approach with the aim of researching existing literature, describing the present state of ICT implementation with the objective of highlighting the role and scope of ICT and emphasize on the existing barriers in context of Indian construction industry. Therefore, Objective of this research is to explore the case study and describe the use and applications of information and communication technologies in construction industry.

Key words: *Effective management; Organization; Information technology; Construction industry; Communication technology*

I. INTRODUCTION

The construction industry is a vast organization. Almost all the construction projects involve many participants and processes and demands for effective communication amongst them. The important factor involved is the need for proper information management and clear communication amongst all the project participants. However, due to the extended fragmentation, enhancing communication amongst all the project participants is a challenging

task. Huge amount of data with wide dissimilarities involved complicates the information management task. The development team of a construction project encompasses a work force with wide variation of expertise, professional skills, computer acquaintance, educational background and working environment, which further complicates the process. The distance between the construction office and the site makes communication even harder. Each project differs in its location, surroundings and project participants, making the information standardization a difficult job. The volume and type of information to be communicated is also massive. Effective information transfer needs properly structured data.

An efficient way to provide such information transfer is using an information management system. To achieve the expected results more emphasis is given on ICT tools. Both the researchers and the ICT professionals have employed several ICT tools to provide solutions to the construction industry. This paper aims to identify the role and scope of ICT that can enhance the productivity of the construction industry in India. In recent years, many researchers have studied the construction sector for its complex nature and the role and scope of ICT to achieve effective solutions to enhance its productivity. The cultural context of construction projects has changed in recent years creating a more complex business environment. One reason behind this is the rapid development of communication technologies. With the increasing need to have immediate information and flexible working practices in a global market, information transfer tends to be electronic. This enables increased volume of information transfer dependent on the time zone. These information and communication technologies (ICT) have encouraged geographical dispersion and a retreat from face-to-face contact with

more asynchronous communication. Information and communication technology (ICT) is defined and discussed differently in construction writings as the actual hardware employed to perform a basic information processing task. Also take the view that communication within organizations and between them is concerned with the exchange of information and the management of it. The flow of information from a form of communication. There is a need to distinguish between 'information technology' and 'communication technology' since information technology is essential in construction for the storage of information, but its use does not necessarily mean communication has to take place.

II. LITERATURE REVIEW

Sahil Kaushik "Use of Information Technology in Construction Industry for Supply Chain Management" A poor administration on development activities can prompt noteworthy negative contacts with low efficiency, cost and time overwhelm, clashes and debate bringing about cases and tedious prosecution. Past examinations called attention to that a proficient administration of the development co-ordinations process can be an approach to lift the development profitability. Appropriate administration of the supply chain would bring about bringing down costs, short conveyance time, low stock level and enhance dependability which would enhance the aggressive position of associations.

Sourabh Naik¹, Snehal Bobade "The Benefits of Information and Communication Technology Adoption in Construction Project Management for Small and Medium Enterprises" Nowadays Information and communication Technology plays an important role in the construction industry. Today's activities are carried out in the corporate offices and the project sites with the help of Information and communication technological tools and applications. Using the technology enhance communication strategy can help enterprises in the successful delivery of their projects. Currently, there is growing awareness among the enterprises to adopt the information and communication technology But in small and medium enterprises still using the conventional methods for the management of the project and within every phase of the construction. several construction organisations today might perceive that greater use of Information Communication Technology would enhance their performance and may well employ the technology to improve some specific processes of their endeavour, Information and communication Technology usage in most construction firms have often been described as relatively limited and ineffective compared to other

sectors. This situation could probably be true for the small and medium enterprises in Pune.

Dr. Kailash Mohapatra, Dr. Dipti Prasad Mishra "Impact of Information Technology on Construction Industry" Recently, information technology has been impacting industries, economics, the way of life and even the culture throughout the world. Production industry has been attracting much attention as an important indicator of economics, and numerous researchers have investigated the relationship between information technology and productivity. Construction is one of the largest industries but little research has been conducted to know the relation between information technology and construction industries. The main aim of this article is to determine the degree to which information technology usage, specifically the use of information technology to automate and integrate construction project work functions, is related to construction productivity.

Monali Bartake "Role and Scope of Information and Communication Technology (Ict) In Construction Engineering in India"In this modern era, information technology became an effective management tool in all types of industries. However, because of its complex nature and fragmented structure, construction industry is the slowest one in adaption of information technology tools. With the advancement in all the areas, and increase in the awareness of the participants about advantages of using ICT tools, the current decade experiences a considerable surge in the use of ICT within construction. The construction industry and its participants needs to handle huge amount of data in terms of designs, time and cost calculations, transportation updates etc. in most sustainable manner. In order to address this challenge in an effective way, the industry must use appropriate ICT tools. Aim of this paper is to study the role and scope of ICT in construction industry and discuss the factors that affect its implementation from the prospective of Industry, Organisation and Participants.

Smit Rangani, Jayraj Solanki "Automation in Construction Industry It's Application and Barriers to Implimentation on Construction Site"Construction industry is one the oldest and most contributing in nations economy. Construction industry is labor concentrated and work is directed in hazardous environments; in this way, the significance of construction robotics has developed quickly. For good quality work, for example, absence of talented specialists, inadequately introduced equipment, poor plants , and so forth among this in an expansion in the genuine expense of construction and work. The

significance of construction automation has developed quickly in evolved nations. In nations like India, the construction firms need automation, for example, new equipment, electronic gadgets and so on. The venture requires good quality of work, great nature of work, builds efficiency and so on. Considering late application and tasks for utilizing robots and automation in the construction business.

Karan Shah, Dr. Nisha Soni, Zalak Shah
“Scrutinizing Attributes Influencing Role of Information Communication Technology in Building Construction” Information Communication Technology (ICT) can provide powerful strategic and tactical tools for construction industry, which, if properly applied and used, could bring significant advantages in promoting and strengthening their competitiveness. Construction projects require effective coordination and collaboration between the project participants due to large number of separated stakeholders involved at all the stages of the projects.

Joshi Ghanshyam Sanjaybhai , Jayraj V Solanki
“Information Communication Technology in Managing Buyer Supplier Relationship & Increase Supply Chain Value in Procurement” As on a construction site, materials performance plays vital role in delays and rate swarming so as a key point procurement of materials plays an important and foremost role in Real state, which will expressively affect on corporation’s accomplishment and managing buyer supplier relationship theatres a weighty role in to generate market value. This study is aimed at using the two types of relationship that is long-term relationship and competitive or short-term relationship Use of Information Communication Technology (ICT) in an organization will make the more coordination and teamwork between site engineers, contractor and consumer and to determine the challenges in using relationship for value creation of various companies the value chain management will be studied of those companies. It has brought improvement in the performance and process flow of connectivity of procurement of material on site in a construction process in terms of delays, quality, quantity and expenditure. The major goal of introducing ICT in a construction process is to reduce inventories and resources which are not in use in the process.

Anthony Obododike Ekwuno **“The Value of Effective Communication in the Construction Industry”** In recent years, communication in construction has steadily declined and this has affected productivity. Despite the construction industry's significant contribution to economic growth in developed and developing countries, there are still great hindrances in construction project productivity

due to poor communication. However, this gap significantly delays muchneeded productivity gains, as it is difficult to fully overcome the associated disruptions and choose the best remedy to minimize their impacts in the Nation's Economic Development. This study is therefore necessary to fill these missing gaps. This study aimed to establish the value of communication in the construction industry. The study used quantitative research methodology. A combination of primary and secondary sources was used to address the main research objective. Questionnaires were used to collect primary data throughout the study. Surveys were conducted online, by mail, by phone, and in person. Allstakeholders in the project will benefit from the findings. It will help eliminate the issue of unnecessary disputes among the parties due to project failure. Both professionals and future college and university graduates, whose intentions are to proceed to the working field after graduation, will also benefit. The construction industry is doomed unless it addresses communication issues. The value of teamwork in the workplace is obvious, and it is frequently directly influenced by effective communication practices. Effective communication saves money and boosts a company's reputation.

S.Keerthi1, V.Vidya **“Integrating Project Management Information System and BIM for Inspecting and Coordinating in All Phases of Construction”** The Construction industry has been transformed through the adoption of digital technologies, particularly Building Information Modeling (BIM) and Project Management Information Systems (PMIS). It explores the benefits of integrating these systems in all phases of construction, from pre-construction to post-construction, including improved project efficiency, reduced costs, increased quality, and enhanced collaboration.

Aiswarya Premdip1 and DR R.N Uma **“Analysing the Role of Information and Communication Technology (Ict) In Construction Industry”** In the construction industry there is a necessity for improving the construction efficiency through adopting innovative methods. Information and Communication Technologies (ICT) help in increasing the client satisfaction by reducing coordination errors and provide a greater understanding among project participants in terms of better handling issues and requirements. Construction projects are faced with many challenges that must not be ignored or underestimated. Some of the wicked problems and challenges such as understanding how one decision will impact decisions in other areas; problem of addressing the risk due to dynamic and

uncertainty existing in the environment; resolving conflict where there are competing claims resulting both good and bad outcomes from the same value system are required to be well managed, if required using innovative methods such as using ICT and software packages. Therefore, Objective of this research is to explore and describe the use and applications of information and communication technologies in construction industry. It involves examining the current trends of ICT based construction practices and assessing the potential for its improvement by way of innovation.

A. SUMMARY

Today the construction industry is facing many challenges, including the need to change current work practices, become more client orientated, become more competitive, and become more productive (Love, 1999). With this background and several socio-economic developments, many countries have identified the significance of improving the performance of their construction industry to meet the objectives of its developmental goals (Ofori, 2000). The construction industry's processes and the working style is always of a temporary nature (Gann, 1996). Due to the complex nature of the construction projects, many participants need to interact and cooperate. The distance between the administrative office and the actual construction site makes the process of communication much harder. The use of ICT can simplify the process in an efficient way. Proper documentation is another area where the construction industry prominently lacks, which affects their decision-making speed. Some basic IT tools are commonly used by the design personals, but latest technology adoption remains the area of challenge, which results in delays at the operational stage of big project. To achieve effective project management and implementation many levels need to be studied from the perspective of ICT implementation. The construction project managers mostly spend major portion of their time in data handling.

III. RESEARCH METHDOLOGY

[1] RESEARCH DESIGN

To the study, a structured questionnaire was prepared and distributed among the construction contractors. Survey questionnaires are categorized as quantitative research and this was preferred because, quantitative approaches are deemed more specific and result oriented; and involves the collection of numerical data to explain, predict, and/or control phenomena of interest. The case study was further divided into four categories; the first category dealt with "General Information" like financial background, years of experience, professional background of respondents

and so on. The second category "ICT Infrastructure" was related with the ICT platforms, network platforms, operating systems etc. "Extent of ICT usage comprises the third section, in dealt with the ICT usage by the industries

The five point likert ordinal scale was used to measure the level of usage by responding firms from "Never" to "Always". The final and fourth category "Factors hindering ICT usage" asked the responding firms to find the reasons hindering the use of ICT in the construction industry. The "SPSS" software was used for the analysis of data and the results are represented in the form of tables and charts

[2] DATA ANALYSIS

Concerning the working experience of the companies surveyed, Fig2 shows that 18.33% had worked as contractors in the construction industry for over 15 years, 26.67% between 10-15 years, 51.67% between 5 to 10 years and 5% for less than 5 years. The high representation (50%) of firms with experience in between 5 to 10 years is significant to provide some understanding their ICT challenges over these past periods.

On the issue of respondents viewpoint on the extent of current usage of ICT in their firms, Table 4.2 shows a high percentage (56%) of respondents believe their current ICT usage is average while 37% consider their ICT usage as low. Only 7% thought they are using ICT to a high extent in their company. Given the perception of the respondents, there is some level of recognition that their current ICT usage appears ordinary suggesting some aspects for improvements. The survey further revealed that (Fig 3), about 41.67% of the companies have separate IT division in their organization. A separate IT division within the organization provides an indication of the extent of use of information and communications technology for the day to day activities of that organization.

ICT BENEFITS:

According to (Perkinson & Ahmad, 2006), a contractor can increase his competitive benefit by incorporating ICT technologies thus benefiting the construction project. Benefits of ICT in three perspectives are,

a) Industry Perspective: According to (Fujitsu, 1998), ICT can provide long term benefits to the industry and create new ways of doing business and offer competitive advantages. The general benefits provided by this practice can be: Increased Business Turnover, Shorter Time Cycle, Easy Management of Complex Projects, Improved Documentation, and Gain in Productivity.

b Organizational Perspective: The important drivers that can drive the construction sector to implement ICT are: Technological Opportunity, Performance Enhancement, External Demands, and Competitive Benefits.

c) Project and Stakeholder Perspective: As per (Gann, 1996), automation using ICT can help in decision making from early planning and conception stages, through design, engineering and procurement, to erection, installation, commissioning, operation and facility management.

[3] CASE STUDIES

A set of eleven case studies were gathered from across Canada. Professionals who are at the cutting edge in the use of IT was interviewed and the findings were summarized in case studies. Each case study focuses on a construction project, is three to four pages long and is structured with the following sections, Project Overview, Project Information, Interviewee(s), Use of Information Technology, Benefits, Obstacles, and Conclusions. The IT con Vol. 9 (2004); Rivard et. al, case studies were numbered according to the location they were conducted: V for Vancouver, T for Toronto, M for Montreal, and F for Fredericton. A summary of each case study is provided below with its title and the names of the interviewees. Interested readers can access the actual documented case studies for additional information.

The case studies cover architecture, engineering, construction management and specialized contractors. Case studies deal with each domain. A large dot: indicates that a domain is an important element of the case study; a smaller dot: • indicates that a domain is somewhat mentioned; and no dot means that the domain is not covered by the case study. The top header provides the identification number of each case study, which can be used to find the corresponding summary below. The following subsections provide a brief overview of each case study and the technologies used. The research highlights various barriers and factors in mainly three perspectives for implementing ICT systems in construction sectors which are as below, The case study was further divided into four categories; the first category dealt with “General Information” like financial background, years of experience, professional background of respondents and so on. The second category “ICT Infrastructure” was related with the ICT platforms, network platforms, operating systems etc.

IV. CONCLUSION AND FUTURE SCOPE

Communication Technology (ICT) is well recognized by building contractors as a significant technological spotlight that can help increase the effectiveness of communication and data during the construction process. The study has indeed revealed that there is a significant level of awareness among the contractors about the potential benefits ICT could offer to their operations. While the use of some selected ICT hardware, notably Desktop PCs, Laptops, digital cameras and mobile phones appears high, more advanced and portable mobile ICT hardware such as Personal Digital assistance (PDA) and Tablet PCs were found to be deficient. Again, the general attitude of the firms towards ICT is positive and this approach may have influenced their confidence to use the technology to various extents. However, the current level of ICT usage in general appears to be at a more rudimentary stage consisting of basic hardware and software applications.

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