

Application of Information Technology in Construction Management

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Abstract

Over the past few decades, information technology (IT) influenced almost in every field and industry in decision making as well as execution level. IT had decisive impact on economics, methodology of working and even the working culture throughout the world. Construction Industry is an integral part of Infrastructure development in a nation, leading to economic growth and development. Economic growth is not possible without contribution from construction. Construction is one of those industries the World which represents the large portion of the Gross Domestic Production (GDP) for several countries. The IT has considerable influence in the field of construction and plays important role in the management of construction Industries. From the planning to the implementation and controlling, IT helps on the every stage of the construction and its management, by enhancing the Work-ability with the advancement in the methodology. The rapid growth of construction Industries generated a requirement of Technology based monitoring and controlling system. Technologies like GIS, GPS, Image Processing, etc. helps highly to manage the construction techniques especially in the planning as well as Monitoring and Implementation level. Many researchers have presented new ideas for supporting the construction management using IT. With every new construction technology, the working process enhances and gives new methodology of construction. The main use of information technology is to automate and integrate the functions of construction project aiming increased productivity. IT has decisive impact on every stage of construction management such as planning, scheduling, implementation, controlling and monitoring. It also helps the decision maker to avoid/overcome the delays and wastage of the time, material and assets by providing real-time data. This paper gives an overview of the role of IT in construction management in present scenario and also reaches-out to the requirements of future as well.

Keywords: Construction Management, Information Technology, Networking

I. INTRODUCTION

Information technology (IT) can be defined as the use of electronic machines and programs for the processing, storage, transfer and presentation of information [7]. Information Technology (IT) have been radically transforming the way we live, learn, work and play. Many companies in the construction industry do not generally appear to appreciate the positive changes and advantages that the new technology was providing to companies in the sector of the economy [4].

Over five decades, the construction industry works only on the paper. No one knows the value of the IT in the field.

Every construction is only based on the experience with the hypothetical knowledge of construction. The method of the construction is old and the planning and designing is on the Working State Method (WSM). And also no method is available for the check of the defects and cracks. The planning and scheduling is doing roughly. No parameters are used in this process. Without software's, the construction of complex structures is highly difficult as well as time taken and also the construction is so expensive that the risk cannot bears easily.

In the first half of 1970s the construction industry made an effort to shared knowledge and performance measurement tools within the industry. This effort ceased as the bigger enterprises began to see information generated at their companies as enterprise assets and competitive resources.

In the 1980's, PCs were introduced and only used in few construction companies. Throughout the 1980's, although most construction firms were using computer technology for many of their core functions such as accounting, wages and salaries. By the second part of the 1980s, about eight years after the introduction of reliable PC equipment, some companies had reached a situation in which their staffs on many of their larger projects were experiencing the advantages of the new technology through the use of planning, drawing, spreadsheet and word-processing software packages.

In recent years, the construction industry has begun to acknowledge the importance of detailed planning and work preparation on construction sites. There is a need for better documentation and control of what is actually done on the construction site, and of how it is done?? IT provides the help for maintaining these type pf works. IT trends that are expected to continue include increasing computational capability, improved interoperability, expanding storage capability and extending connectivity, as well as a profound evolution of software and data norms [6]. It will include the ability to more perfectly represent the real world in analysis and simulation tools, revolutionizing engineering practice by enabling fine-grained representation of physical problems. It also contains some negative consequences which may include the loss of information, quality implications etc. These are some issues and difficulties, which resist the use of IT in the higher level of the construction process. But now a large number of software packages are available to all the disciplines of the construction team at every level of the construction process. They provide support for a broad

range of activities such as project management, building visualization, computer aided design and drafting (CADD), design appraisal, cost estimation, information storage and retrieval, structural analysis, on-site management, etc.

Few years before, it was almost impossible to design the complex structures like **Burj Khalifa**, **Palm Jamira**, **Taipie-101** etc. So, IT also helps allot in designing complex structures by modern structural design software applications, such as 3D modelling and Building Information Modelling (BIM), provide an example where designing complex structures and organising the electrical mechanical, site, structural and quantifying of a project can be achieved in minimum time and increase the efficiency all in one data framework [1].

Today Information Technology (IT) is responsible for the entire construction process, from planning to finishing, information being generated, transmitted and interpreted to enabling the project to be built, maintained, reused and eventually recycled.

As IT impact on the modern society, through interconnected computer network known as **INTERNET**, as shown in fig 1. Through Internet, the Client or the buyers as well as the Head of organization are able to see the updates of the construction site with the next steps. It also keeps an eye on the delays of the construction. The construction industry faced continuously challenge of changing and improving current work practices in order to become more client-orientated, with the adoption of IT. Much effort has been directed toward improving construction productivity with the use of information technology (IT) in construction because it can decrease the time for data processing, communicating information and increase overall productivity. It also save the waiting time for the procurement, as the sensors or the monitoring cameras alerts the Engineer as well as the Procurement Manager about the raw materials. Information Technology highly helpful in keeping check in day to day work with the alert of the delays and also adjusting these delays with the proper scheduling.

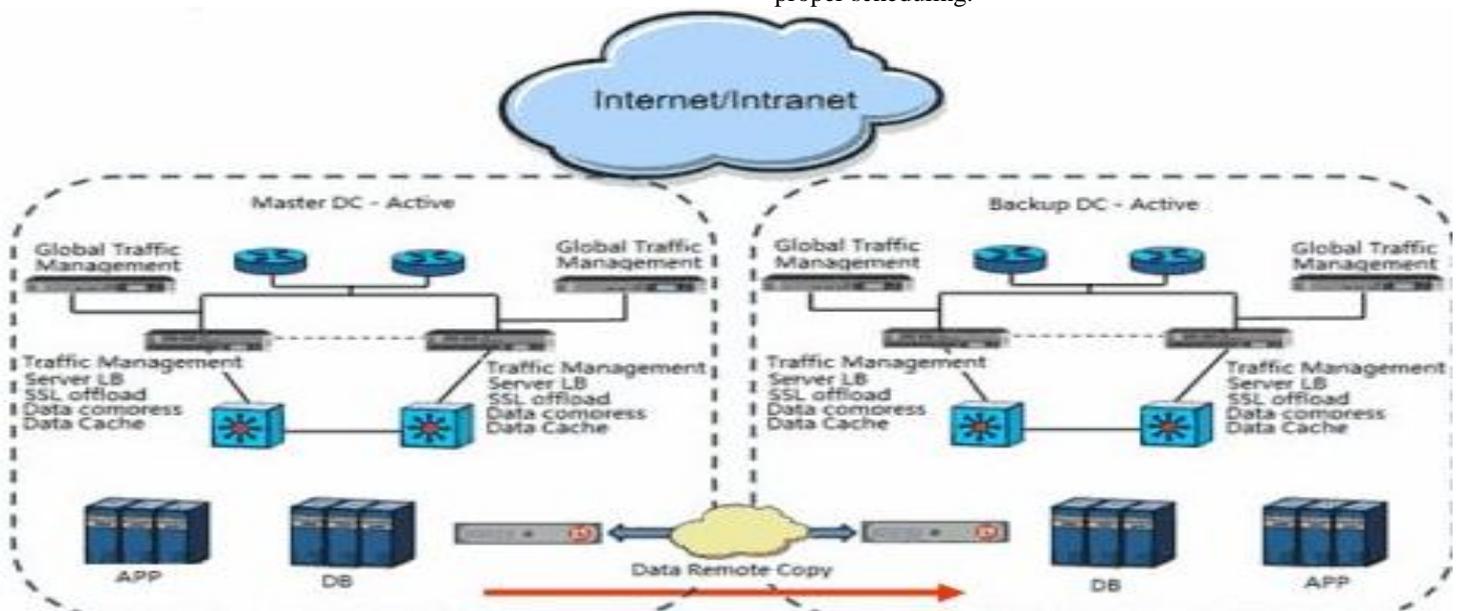


Figure 1: Application of IT on Construction Site

As the information technology helps in planning the requirements of the construction such as concrete, steel, electrical and piping etc, it contribute to value added growth and productivity in the construction industry with other industries.

As figure 2, shows where the application of IT used in the construction process. The figure shows the main application areas for the existing software packages in the construction.

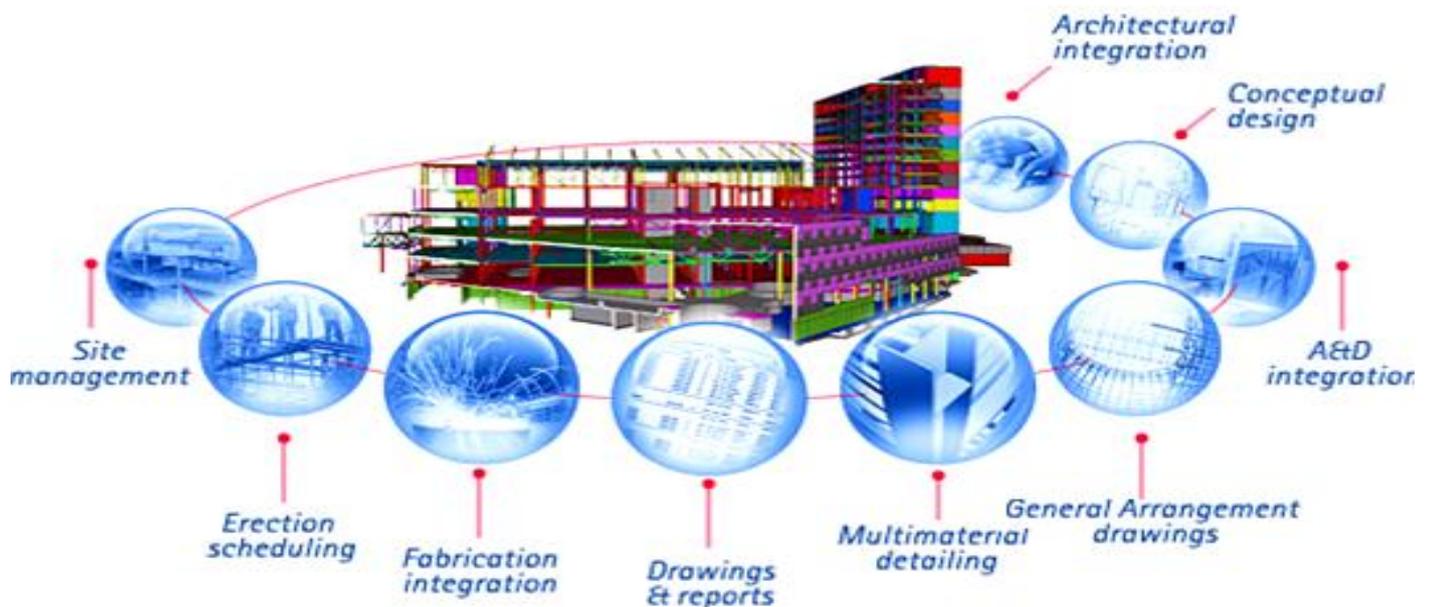


Figure 2: Application of IT application Construction Planning & Management.

A. Application of Information Technologies in the Construction Sector [3]:

Many software applications are available to support most aspects of a construction project. They designed largely as the solution to a specific problem. These applications can be grouped into the following categories.

- Drawing and Reports,
- Integration,

B. The Development of Construction Industry by the use Information Technology [3]:

The use of information Technologies in the construction industry is generating new opportunities for collaboration and information exchange among organization that work on a construction project.

The development of computing technology has meant that tools for analysis involving data manipulation have tended to develop earliest and in isolation. These tools play to the enormous strengths of computers in the rapid analysis of complex data sets- analysis which is frequently impossible if manually attempted.

During the 1970s, a new form of graphical manipulation developed to aid the creation of engineering design through CAD. Large public sector projects usually relying on extensive standardization and prefabrication offered the opportunity to develop CAD systems.

In 1980s, the development of the personal computer (PC) which dramatically reduced the cost of computing power, and enabled a much wider diffusion of computers within the industry, while the processing power of computers continued to grow exponentially. Most importantly, site offices could now be equipped with computers. It makes the work easier and quick.

- Fabrication Integration,
- Multi-material detailing,
- Computer Aided Cost Estimation,
- Building Engineering Application,
- Computer Aided Facilities Management,
- Planning, Scheduling, Site Management,
- Computer Aided Design and Visualization,
- Business and Information Management.

C. Research on Information Technology usage in Construction [5]:

A research by **Balli** (2002) proved that handheld computers in conjunction with wireless networking technologies could provide accurate, reliable and timely information to construction project players at the location that it is needed. The handheld computers would allow people to access material, tool, equipment and drawing information, which could reduce delay time and boost productivity [8].

Global Positioning Systems (GPS) and Radio Frequency Identification Technology (RFID) are two important intelligent tracking and locating technologies used in construction. (**Caldas**, 9) indicated that the application of GPS not only provided direct time savings in the material-locating process, but it also reduced the number of lost items, work disruption and labor idle-time. In addition, it could improve standardization and automation of locating process, route optimization, layout optimization, and data entry. **Ergen** [10] stated that an automated material tracking system using radio frequency identification technology combined with GPS technology could eliminate the deficiencies in existing manual methods of identifying, tracking and locating highly customized prefabricated components. These researches presented a promising future

of GPS and RFID, as the typical IT application in the construction industry.

In 1999, **Brewer, Sloan, and Landers**, cites Intelligent tracking is also an important application of IT in manufacturing. The various forms of intelligent tracking technologies (ITT) included global positioning systems (GPS), geographic information systems (GIS), wireless telecommunications, and radio frequency identification (RFID). The technology has the potential to contribute to improvements to manufacturing. This research provided a list of benefits of the wireless RFID system and discussed how scheduling of event times could become more accurate and time wasted could be minimized. It also showed that the RFID coupled with GPS could greatly change production quotas and connect customers and suppliers more efficiently.

Range-free techniques are those techniques which do not use signal strength for distance measurement. One research in 2003 described a range-free localization scheme (APIT). The authors compared the performance of their algorithm with the performance of the other well-known range-free techniques. The comparison showed that this technique provided better accuracy. It seemed that the APIT technique was a simple approximate technique and since sensor networks did not need very accurate location estimates, this technique which was quite similar to the accumulation array method of **Song** [12] introduced in 2007 might be good enough for many sensor applications.

The use of Building Information Modeling has recently expanded. According to a survey of thousands AEC participants in North America conducted by **McGraw Hill Construction** in 2009, almost 50% of the industry was using BIM. **Heller and Bebee** [13] summarized the benefits of BIM as follows:

- BIM fosters greater collaboration between project stakeholders, inspires ingenuity on site and leads to more productivity.
- BIM helps companies streamline business processes in terms schedule optimization, and automated cost estimating.
- BIM is able to pick up coordination issues early on that would have been costly.
- BIM minimizes the errors in the field.
- BIM contributes to companies' savings and productivity increase.
- BIM's visualization features increases quality and efficiency [5].

Industries in many countries are yet to understand the essential value and its importance to the development of their construction sector. However, the benefits of IT come at a cost since the complexity of work, the administrative needs, the costs of doing business, the continual demand for upgrading and the greater knowhow required [1].

Analyses show that IT was highly associated with firm, schedule, and cost performance.

D. Role of IT in Construction Management:

Construction engineering and management is the art of bringing the project on time and within budget in spite of all the variables and specialties within a project as well as the high fragmentation within the construction industry [15]. From the Egyptian pyramids till the early eighteenth century, the architect was the master builder. He performed the main activities through the preconstruction phase, such as project design, materials purchasing, and craftsmen hiring [15]. Due to the simple technology, less diversity of construction materials, and owner's lack of sophistication in the delivery of projects, his role expanded to involve the management of construction process [16]. Nowadays, the construction industry has become more complicated than ever before due to the new business requirements and challenges. Hence, it is necessary for engineers to use the available new technologies such as Information Technology to achieve those requirements.

Construction management contains the planning, organizing and understanding each activity that depends on each individual at each level. IT helps the construction management to improve the competitiveness and effectiveness, and flexibility of the whole world. IT gives the improvement in some of the important element of the Construction Management, such as:

- Management and Leadership,
- Teamwork,
- Statistical Methods,
- Material Supply,
- Delays Management, etc.

The rapid developments of computer program led to appear many programs which are used in projects management, for example, the most common software are MS project and Primavera [15].

II. SUMMARY

Construction Management is the art of bringing the project on time and within budget in spite of all the variables and specialties. To achieve the perfectness in the construction, IT helps allot in the same.

Construction industry has logged behind other sectors in terms of applying Information Technologies. In the main, the boards of operating construction companies are dominated by engineers and surveyors whose knowledge of computing is very often limited to what systems have been implemented at head office, and whose interaction with computers is limited to occasional meeting with senior computer professionals rather than fellow engineers. Their general view is that the implementation of any new system takes a long time, is expensive and involves 'outside'. As most firms in developed countries have increased and will increase further their investment in IT, this has raised productivity within their construction industry and resulted

in an increase in the quality and speed of work, financial controls, communications, and access to common data [1]. Nevertheless, many software is currently being used by the construction sector like CAD tools, Spreadsheets, Word Processing, GIS, GPS and so on.

With the growth in the use of information technologies by construction companies, the increasing availability of electronic document, manual classification becomes impractical.

IT plays an important role in the construction management and support at almost every stage, such as planning, execution, monitoring, controlling, resource levelling, equipment management, costs and assets management, etc. From the use of IT in construction industry, the working ability enhances highly and gives the more accurate results. From the heavy electronic machines to the light Tablets, every gadget plays important role in the management and helps the Engineers in every situation.

Information technology has been positively impacting construction productivity and will likely continue to do so in the future.

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