



Advancement in Construction Management

Ravish Kumar

Assistant Professor, Department of Architecture & Planning, NIT Patna, Bihar, India
ravish@nitp.ac.in

Arpita Srivastava

M. Arch. 3rdSem., Department of Architecture & Planning, NIT Patna, Bihar, India
arpitas.pg21.ar@nitp.ac.in

Manoj Kumar Rajak

Bureau of Indian standard, -New Delhi, India
manoj@bis.gov.in

Fulena Rajak

Professor, Department of Architecture & Planning, NIT Patna, Bihar, India
fulenarajak@nitp.ac.in

Bijay Kumar Das

Associate Professor, Department of Architecture & Planning, NIT Patna, Bihar, India
bijay@nitp.ac.in

Abstract

Building construction and infrastructure development have been a component of major civilizations throughout their history. Great examples, of architecture include the Great Pyramid, the Great Wall of China, and many more ancient constructions of historical significance. The fundamental component for the completion of these buildings is design, planning, execution, and closure. Planning of project execution is the most critical aspect, to have the ability to accomplish the required project execution in the allotted time and on framed expenses. Certainly, some outstanding quality and construction management procedures were implemented in the past, and someone was present to supervise the resources and time schedule. In today's construction project management, many mathematical tools and techniques such as bar charts, CPM, PERT and so on are employed for project planning. To manage the multi-tasking and complicated building environment, other standalone computer software and web-based packages are also in use. This paper aims to investigate advancements in construction management when dealing with extremely complicated building procedures in a complex environment. The methodology applied is to study and cite the literature of various preferred software management tools in the construction industry with the sequential order of the year, purpose, uses and process of the particular software. The results obtained are the analytical study of the software tools used in the construction industry.

Keywords: Construction Management; Computer Software; Web-based Construction Management

1 Introduction

Numerous researchers have identified construction industry characteristics that are distinct from those of other industries, e.g., 'field oriented' (Paulson, 1985), 'extremely conservative' (Rosenberg, 1982), 'too many small firms' (Cassimatis, 1969), 'fragmented' (Barrie & Paulson, 1978), and 'technologically stagnant' (Business Roundtable, 1982b). But a closer look at construction technology shows that these are only some of the ways in which the different qualities of built products and the limitations of construction technology lead to different results. A key part of

making the construction industry more technologically competitive is for people to learn more about the important features of built stuffs and how these features affect construction technology and its capability to improve. The Construction Industry includes services for building, changing, re-building, and fixing up different kinds of structures. For success of every project time and cost are very important parameters. The purpose of project management is to finish the project in the time allotted and within the budget that was planned. The total cost of a project goes up when it takes longer to finish. A Guide to the Project Management Body of Knowledge (PMBOK Guide) – Sixth Edition (Project Management Institute, 2017) explains that traditional view of project success is that scope, time, and cost are all met.

To enhance the performance of the construction activities, digital skills are important. The project environment is extremely complicated, and it is inconceivable that decisions could be made without software tools. The software tools enable the application of concepts and the visualisation of issues and solutions. Some of the mathematical tools for construction management include CPM (Critical Path Method), PERT (Program Evaluation Review Technique), Bar chart, Pie-charts etc. The software tools include Primavera, Microsoft Project etc. Some web-based packages, WPMS (Web-based Project Management System) like PM-ASPs (Project Management System-Application Service Provider) are also there. This paper explains the traditional and advanced construction project management tools and software in addition to web-based packages to investigate recent developments in construction management.

2 Bar Chart, CPM & PERT

A wide range of strategies required to be created in response to the practical problems of project execution are focused on establishing the project work, organization, as well as generating complete plans and budgets for inspection and managing execution throughout the project duration (Nicholas,1990).The different approaches make an important significant addition to communication by providing graphical representations, reports, observations, and assistance for review meetings (Nicholas,1990).

Bar charts or Gantt charts, due to their popularity of the advantages of dividing big projects into smaller tasks, mask a significant role in the development of Construction project management. Henry Gantt created his charts known as Bar chart in the 1910, and they followed employment in significant projects during World War I and the building of the Hoover Dam, which therefore facilitated the widespread usage. Therefore, his name started to appear on the charts (Seymour & Hussein, 2014). Bar charts are a straightforward depiction of the project schedule. They are not for displaying the priority relationships between activities.

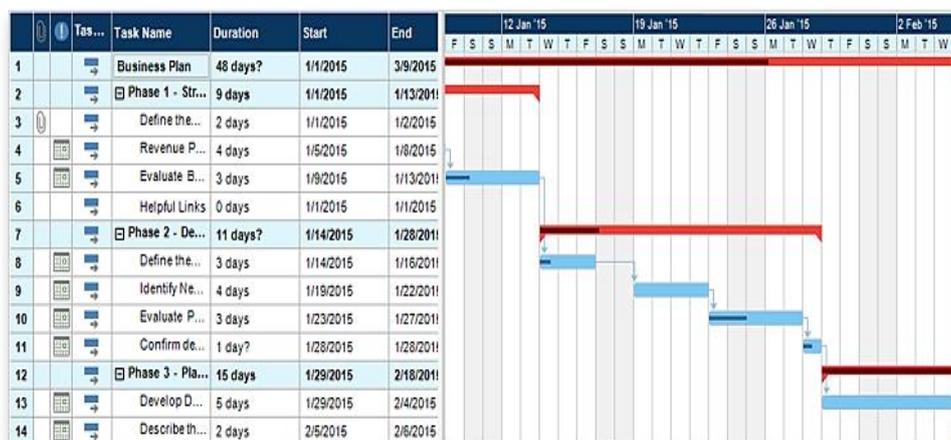


Fig. 1: Gantt Chart Outlines the Tasks that must be Completed and their Respective due dates (The Schedule) (Gantt.com, 2023)

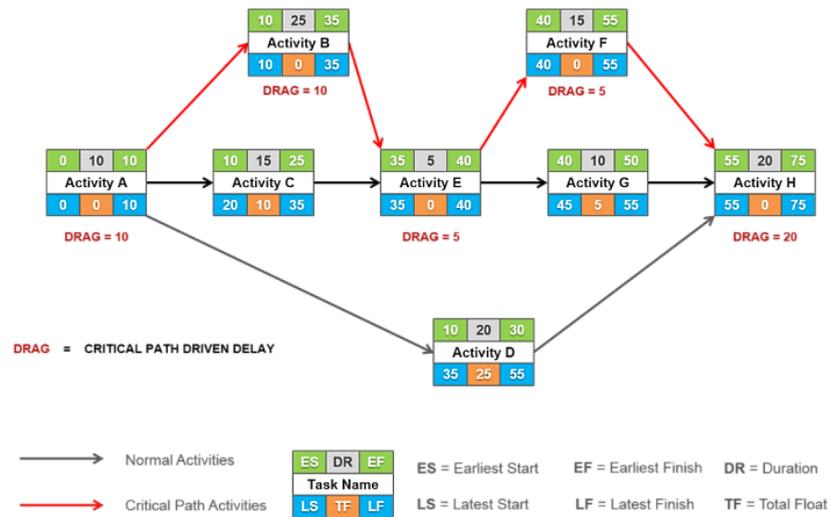


Fig. 2: Node Network Diagram for CPM Technique (Shuttleworth, 2017)

(Snyder, James, & Kline, 1987) Claim that the advent of CPM/PERT in 1958 marked the successful starting of the contemporary project management period (KWAK, 2003). It's fair to say that CPM/PERT has received special attention in the growth and, in some ways, the commencement of modern project management. Despite some overlap, CPM/PERT was developed in parallel to the chemical industry and the navy, two very different industries. The Polaris project, the first SLBMs with nuclear warheads, was spearheaded by the American Navy in 1958. One of today's most widely utilised methods was developed by the U.S. Navy, according to legend, Program Evaluation Review Technique (PERT), through the Polaris project. PERT worked effectively to represent the many scheduling possibilities of the project because of the significant complexity and unpredictability involved with project scheduling. Nearly at the same time as PERT, the Critical Path Method (CPM) was created. The upshot of a significant building project acted upon by the E.I. du Pont de Nemours Company was the creation. A sizeable chemical factory was to be constructed as part of the project. The necessity for the business to make an accurate cost and time estimate for the project resulted in the creation of the CPM. They initially called the approach they devised Project Planning & Scheduling (PPS), but it was eventually transformed into the well-known CPM method. (Seymour & Hussein, 2014). Project network techniques like PERT, CPM utilise network strategies to schedule work and provide an examination of the scheduling effects that activities have on one another, as well as the identification of critical and float activities, are basis for estimation of cost, allotment and administration of resources, and analysis of risk. The project organisation is interwoven with the work structure of project, allowing for the responsibility distribution to project participants. As according, to this viewpoint, the notion that the traditional method procedure for implementation advances, management and planning are practised on a regular basis is "static & closed" (Davidson, 1991) can be countered.

3 Software Packages

In order to accomplish various project management responsibilities, software support is required (Shtub, Jonathan & Globerson, 2005). Project management software programmes such as Microsoft Project, Primavera, and others are frequently used by professionals. According to some surveys [by (Liberatore & Johnson, 2003; Liberatore, Johnson, & Smith, 2001)], these tools are mostly used for critical route planning, with little usage of more advanced approaches such as time-cost trade-off analysis, simulation, and probabilistic analysis.

3.1 Microsoft Project

Microsoft Project (www.microsoft.com/project/) released its first version for the DOS operating system in 1984. The major purpose of application in design was to make it easy to use. Since its introduction, project managers have preferred MS Project as a tool (Hilo, Rashid, & Ismail, 1985-1989; Travica et al., 2007; Galloway, 2006), although it has never surpassed any other PM product. This is particularly evident in the construction sector, where it was never fully compliant with the sector's specific practises and processes. The most often used Project programme is Microsoft Project, which is mostly used for planning. Despite the fact that EVA (Earned Value Analysis) tools are accessible in this programme, they have largely been utilised in practise gathering and presenting data in several ways. These variables might be the source of the restriction: management, or they may find them too hard to utilise. Furthermore, getting these tools may be deemed impossible given the project budget or too expensive considering the anticipated advantages (Hazır, 2014).

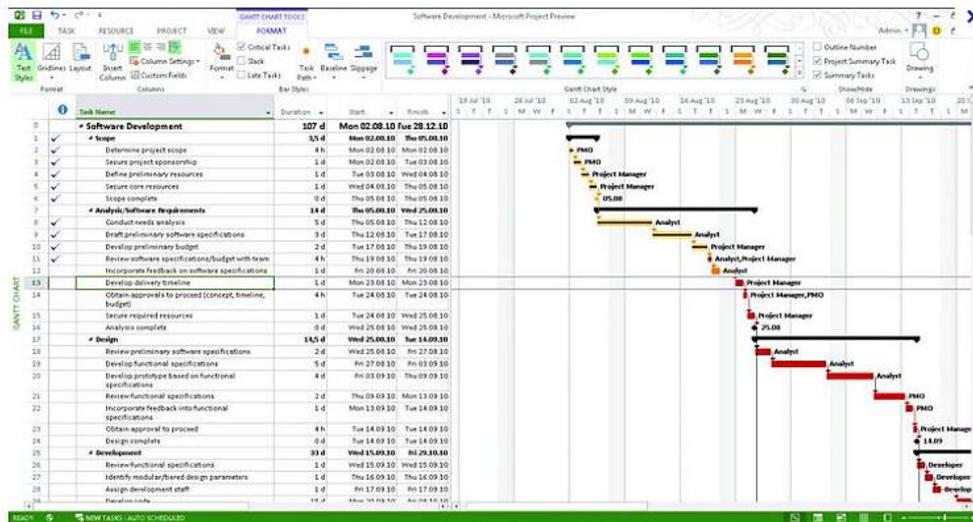


Fig. 3: Demonstration Project on Microsoft Project (Abramova, Pires, & Bernardino, 2016)

3.2 Primavera

The Primavera Systems (<http://www.oracle.com>) has been creating its PMS (Project Management System) package for the construction industry since 1983, and it is now a top supplier of Project Portfolio Management (PPM) solutions for the sector (Galloway, 2006). Estimation, activity sequencing, resource allocation, and timing are all part of the Primavera software scheduling process. The purpose of construction scheduling is to complete projects on schedule and to allocate resources efficiently. Primavera scheduling provides effective control (Kumar & Krishnamoorthi, 2015). Chopra & Dewangan (2014) indicated that, if used appropriately, the Activity ID and Activity Description—two of the underutilised components—can significantly improve the schedule's quality. The planning team has a responsibility to carefully choose the Activity ID structure in advance to ensure that schedule preparation proceeds without any problems. Scheduling involves the following steps: Creating EPS (Enterprise Project Structure). The initial stage in developing an optimum timeline for a project is to compile all of the project's data. Some of the steps illustrated below may be completed with the Primavera P6 programme creating the whole structure of the firm, including its branches, that is carrying out the project with Primavera P6. This may be referred to as Enterprise project structure (EPS). A project is a development approach that consists of a number of separate activities and supporting materials. The project is overseen by the different sections of EPS (Enterprise Project Structure). Given planned start and end dates, this is

possible. The project assigns a global, resource, or project calendar (Mahure & Ranit, 2018). Following the Primavera P6 methodology and analysis for the project planning and scheduling processes, drawings in the company's collections: Some methods and analysis for the Primavera P6 doing Project Planning and Scheduling, Drawing Collections from the Company stages are provided. The following approaches are used for project tracking and application administration. It contains detailed information about the quantities, the generation of OBS (Organisational Breakdown Structure) for the project, the generation of EPS for the project, the creation of a new project, the generation of a calendar for the project, the generation of a WBS (Work Breakdown Structure) for the project, the creation and characterization of project activities, definition of project function and resources, assignment of resources to activities, resource analysis and levelling of the project, and establishment of a new baseline for the project (Zerin & Joy, 2020).

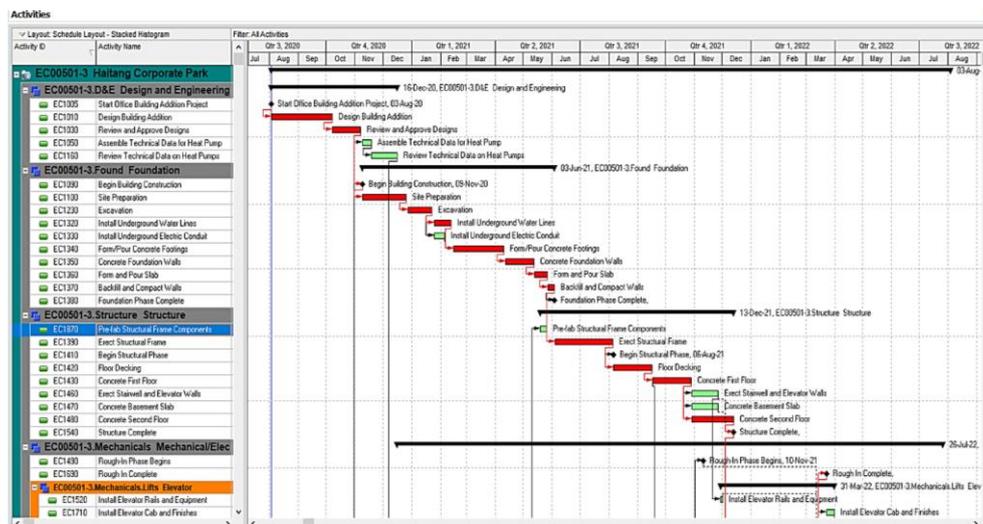


Fig. 4: Demonstration of a Project on primavera (The Standard for Planning and Scheduling, 2022)

3.3 MS Excel

Excel was developed to take use of Windows Vista, the eagerly anticipated next iteration of Windows (see www.microsoft.com/windowsvista). Microsoft's product interfaces are continuously refined and improved in order to expand the capabilities of knowledge workers, according to the company's developers. Because each office application contains so many features and options, Microsoft developers felt obligated to make the products easier to use and provide users with less obvious options. Microsoft Office 2007 has the latest edition of SharePoint Technologies, which consists of two distinct components: MOSS (for a Measure of Software Similarity) and Office. Documents are created and checked into MOSS using Office's built-in "check-in" procedure. As a result, version numbering, revision tracking, and strict collaboration rules are in place. Simple publication, retrieval of published materials, tracking, and other aspects of collaboration activities are available in Office 2007 programmes such as Word and Excel. The extra capabilities in Excel 2007 (together with those kept from earlier versions) are ideal for project managers, providing a one-stop shop where you may not only write (or link to) project documents, but plan and add the schedule, charts, and other components also. Excel defies conventional spreadsheet definitions. As the project progresses, the following Excel features can be implemented: generating custom forms, creation of a database, using Visual Basic for Applications (VBA), create macros and module programming, and design statistical and mathematical formulas that may be utilised to calculate and present project data (Heldman & Heldman, 2007).

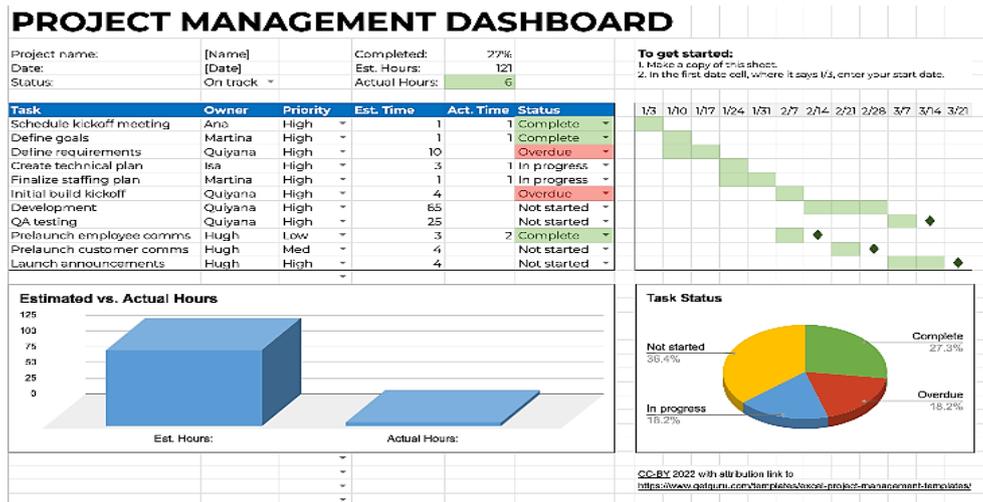


Fig. 5: Demonstration of Project on MS Excel (9 Free Project Management Excel Templates & Examples, 2023)

4 Web-Based Packages

Through savvy servers and browsers, the Web can also get around incompatibilities in data formats. The same system may therefore be shared over the Web by independent project members utilising various hardware platforms (Rojas & Songer, 1999). The benefits of Web technologies in the construction industry may be roughly grouped into three categories, as stated in (Skibniewski & Abduh, Web-based project management for construction: search for utility assessment tools, 2000): the facilitation of relevant information services, participant communication, and computers for engineering and management. In recent years, the concept of managing construction projects via the Internet and similar technology has become increasingly popular among practitioners. The purpose of Web-based Project Management System (WPMS) is to document construction project and management. WPMS is an electronic project management system and a personal network which uses Internet protocols to convey information (Brien, 2000).

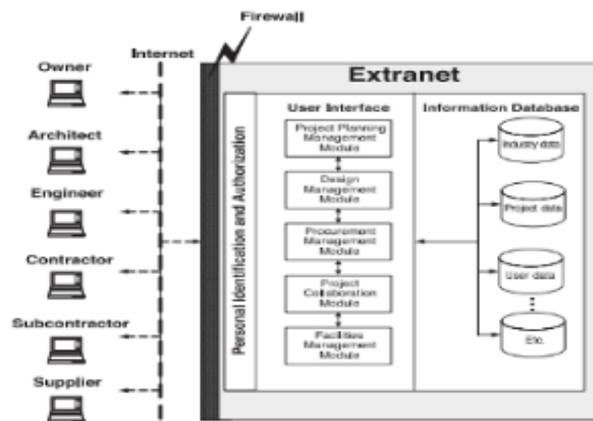


Fig. 6: Functional scheme of WPMS (Skibniewski & Nitithamyong, Web-based construction project management systems: practical advantages and disadvantages, 2004).

Only the project team has access to the system, which may be spread across many organisations. It essentially provides a centralised, widely accepted, and reliable way to distribute and store project information. All kinds of variations like geographic and border-related are completely eliminated by keeping project data within the server and sharing it via a regular web browser operating as a gateway. Project, design, management, and finance information are the four fundamental kinds of

construction project details that are often carried out through WPMS, as noted by Mead (Mead, 1997). In addition to information about the project, it also includes design information, management information, financial information, including cash flow, and information created by the project's accounting team. Information for design covers any data produced by the design team, such as CAD drawings. When project information shifts, the server's database may be quickly updated with the new information. Project members of the team may approach the updated data at any time from faraway places by inputting a digital user ID and password, overcoming the issues with linear communication systems (Thorpe & Mead, 2001).

4.1 Project Management System-Application Service Provider (PM-ASP)

“Project Management System-Application Service Provider (PM-ASP),” is gaining popularity because it requires less technical, building and managing resources, both financial and human resources (Thorpe & Mead, 2001). Due to the fact that PM-ASP is contracted out to an ASP, it does not require internal design and maintenance, has a cheap initial investment and administrative expenditures, and is easy to stay on top of cutting-edge technology. As a result, it is a workable option for a small A/E/C company that lacks the funds to support a complex networking infrastructure or an internal IT group. Although PM-ASP is a subject that is becoming more and more important and is still quite fresh and its optimum usage patterns and expansions have not yet undergone comprehensive examination by both practitioners and researchers in the field of building. Existing business models of PM-ASPs include Project Collaboration Network (PCN), Project Information Portal (PIP), Project Procurement Exchange (PPE) etc. The known visage of PM-ASPs include document management, process of workflow of project, directory of project, revision control and central logs, advancement in searching, conferencing, online related discussion, scheduling and calendar, project camera, converting a file, services related to printing, customized website, access while being offline, outside the system messaging, wireless integration, project information archiving, service related to information, service related to finance, E-bidding, procurement. Some other features which affects PM-ASPs include cost advantage, outsourcing advantage, clash among various IT professionals, Competition of ASPs etc. (Skibniewski & Nitithamyong, Web-based construction project management systems: practical advantages and disadvantages, 2004).

5 Conclusion

The Bar Charts / Gantt Charts, PERT/CPM network, are some of the tools and techniques used in conventional project management to implement. They are governed by the project team's network and organisational structure as well as the method used to disassemble the project into its constituent elements. On the other hand, software like Primavera, Microsoft Project adopts a strategy that views project activity from a high level. It is often depicted as a continuous flow of work units assigned to the project to carry out its duties. In short software, also expands the capabilities of construction project managers, architects having basic knowledge. Lastly, in WPMS, project data is saved on the server, and a regular Web browser is utilised as a medium to interchange the required data, removing geographic and hardware platform disparities. This paper's focus was on identifying the traditional and advanced construction management tools (including web-based packages) in an effort to comprehend the restrictions that emerge from building technology and to examine efforts made to get beyond those limitations. The building industry's driving drivers of development were mostly left out of this narrative. Therefore, there is a huge possibility for additional research when it comes to comprehending the dynamics of the

construction technology related constraints they bring about. The paper also aims to dispel the myth that software management tools are too complicated and time-consuming to learn, despite the fact that they are simple, time-saving, resourceful, and tend to increase one's proficiency. This myth is held by construction managers and other people in the building industry.

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