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# **CHANGING TRENDS IN CONSTRUCTION PROJECT MANAGEMENT A REVIEW FROM THE HISTORY TO PRESENT DAY CONSTRUCTION PROJECT MANAGEMENT PRACTICES**

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## **ABSTRACT**

*Construction of building and infrastructure development is a part of great civilizations throughout the different time of development. The great examples of buildings such as great pyramid, Great Wall of China and many more ancient structures of historical importance, all are examples of marvellous Architecture. The basic part of completion of these buildings are design, execution and closure. Design is the foremost and important whereas the execution is the most important in order to complete the project in timely manner and with quality. There is certainly some excellent quality and construction management methodology was adopted during those time and someone is present there to manage the resources and time scheduling. In present time there are various mathematical tools and techniques are being used such as Bar chart, CPM, PERT etc. in construction project management to handle the construction projects. Various standalone and web-based packages are also in practice to handle the multi-tasking and complex construction environment. This paper aims to explore the start of management tools and techniques in historical era to present day time, when we are handling very complex construction practices.*

**Keywords:** Construction project management, CPM, PERT, Bar Chart, Computer Software

**Cite this Article:** Dr. Ravish Kumar, Er. Manoj Kumar Rajak Dr. F. Rajak And Dr. Bijay Kumar Das, Changing Trends in Construction Project Managementa Review from the History to Present Day Construction Project Management Practices, *International Journal of Civil Engineering and Technology*, 10(3), 2019, pp. 288-293  
<http://www.iaeme.com/IJCIET/issues.asp?JType=IJCIET&VType=10&IType=03>

## 1. INTRODUCTION

The way of managing and organizing resources (e.g. people) to complete the project within time and scope as well as maintaining the quality and cost, is known as construction management. A project is meant to be one-time effort and temporary in nature, it is carried out to generate an exceptional product for a beneficial value. <sup>(1),(2)</sup> Although, activities which are undertaken for project are one time and permanent in nature and it is carried out to create those activities repeatedly. Hence, managing the both, are two different thing and it requires different technical aspects and philosophy for developing the construction management. <sup>(3)</sup>

The first and foremost challenge of construction management is to deliver the project within defined constraints. <sup>(4)</sup> The second is integration of input and optimization of allocations need to meet the primary objectives. A project is a set of objectives (people, money, materials, space, energy, communication, provisions etc.) which needs to be handled properly to meet the need of predefined objectives.

There are some common activities among the most projects like dividing of project work, team communication, task scheduling and tracking of the defined work. There are three most important major phase in project work:

- a) To build the plan
- b) To manage and track the project
- c) Closing of project

### 1.1. WHAT IS PROJECT MANAGEMENT?

Various authorities defined construction project management as per their experience and perceptions.

PMBOK (Project Management Body of Knowledge as defined by the Project Management Institute - PMI): - "Project management is the application of knowledge, skills, tools and techniques to project activities to meet project requirements."

PRINCE2 project management methodology: - "The planning, monitoring and control of all aspects of the project and the motivation of all those involved in it to achieve the project objectives on time and to the specified cost, quality and performance."

PROJECT: - Temporary services undertaken to create a unique product or service. Projects bring form or function to ideas or needs.

DIN 69901 (Deutsches Institut fur Normung - German Organization for Standardization): - "Project management is the complete set of tasks, techniques, tools applied during project execution"

## 2. HISTORICAL BACKGROUND

In early 1900, master builder and the creative architect would mainly manage the civil engineering project, for example Christopher Wren (1632–1723), Vitruvius (first century BC), Isambard Kingdom Brunel (1806–1859) and Thomas Telford (1757–1834) (Lock, 2007)

. Later on, in 1950, the organisation adopted the systematically techniques and tools to complex project.<sup>(5)</sup>

Project management developed from various field of application as a discipline, for an example construction work, defence activities.<sup>(6)</sup> There are two forefathers of the discipline. One is Henry Grant, known as the father of planning and control technique<sup>(7)</sup>, is also well known for discovering Grantt Chart also termed as Bar Chart. Other is, Henri Foyal who created five management functions that structure the establishment of the body of knowledge related with program and project management.<sup>(8)</sup> This method is the indication to contemporary project management tools comprising work breakdown structure (WBS) and .

From 1950, it was the beginning of new era in project management, where the all core engineering field joined together to work as one. Hence, project management became one of the distinct diciplines aroused from the discipline of management which is related to engineering model.<sup>(9)</sup> Prior to the 1950 in United States, ad hoc basis was adopted to manage the project, using mostly informal techniques, Gantt charts and tools. Then there after, two mathematical models to schedule the project were established.

However, as the time passed, the increasing size of the project as well as demands in construction required more cultured techniques. Those two models were

1. The "Program Evaluation and Review Technique or PERT", developed by Booz-Allen & Hamilton "as part of the United States Navy's (in conjunction with the Lockheed Corporation) Polaris missile submarine program".
2. The "Critical Path Method" (CPM) developed in a joint venture by both "DuPont Corporation and Remington Rand Corporation for managing plant maintenance projects. These mathematical techniques quickly spread into many private enterprises".

Further specialized techniques were developed with the help of these two tecniques as a precedence network, in lieu of a serial and repetitive production and "Graphical Evaluation Review Techniques (GERT)" which involves more than unique uncertainty in the whole system.<sup>(10)</sup>

Next, the computer was introduced which helped to handle a bigger project with higher efficiency. With the help of computer, those techniques were further modified. Various software's were designed to accomplish the aspects of the project. These software's helps to performs different tasks (resource leveling, status of resource, time scheduling etc.) smoothly and very easily.

In 1969, Construction management industry formed the Project Management Institute (PMI) to serves its own interest. The reason of PMI is that the techniques and tools of Construction Management are normal even among the broad utilization of tasks from software industry to the construction industry. The widely used standard and guidelines contains in "A Guide to the Project Management Body of Knowledge (PMBOK)" which was authorized by Board of Directors of PIB in 1981. Again in 1967 similar type of development was found named as "International Project Management Association (IPMA)". Now both the organization is a participant of "global project management standard".<sup>(11)</sup> In continuation various International standards were set up by various bodies to recognize the project management discipline. These are ISO 21500: 2012 - Guidance on project management, ISO 31000: 2009 – on Risk management, Capability Maturity Model from the Software Engineering Institute, GAPPS, an open source standard describing competencies for project and program managers, Project Management Institute (PMI), HERMES method, Swiss general project management method, The ISO standards ISO 9000, a family of standards for

quality management systems, and the ISO 10006:2003, for Quality management systems and guidelines for quality management in projects, PRINCE2, Projects IN Controlled Environments, Association for Project Management Body of Knowledge, Team Software Process (TSP) from the Software Engineering Institute, Total Cost Management Framework, AACE International's Methodology for Integrated Portfolio, Program and Project Management, V-Model, an original systems development method, The Logical framework approach, which is popular in international development organizations, IAPPM, The International Association of Project & Program Management, guide to project auditing and rescuing troubled projects, Australian Institute of Project Management.

### **3. OBJECTIVES OF CONSTRUCTION MANAGEMENT**

Specific goal is achieved through the established project. Those goal are supported by objectives and can be tracked. The prime goal of a project manager is to manage the project properly. The satisfaction of customer and control of quality of project is yet another additional goal. Each goal is supported using triple constraints model of scope, time and cost, which is adopted by most of the institution of project management. The each and every objective should be “Specific, Measurable, Attainable, Relevant and Time-bound” or “SMART”.<sup>(12)</sup>

### **4. THE TRADITIONAL TRIPLE CONSTRAINTS**

Project needs to perform and deliver as human being does under some specific constraints. Usually these constraints are scope, cost and time. These are represented as the side of a triangle named “Construction Triangle”. All the side of the triangle has an impact of each other. A further addition to these constraints is quality which becomes the forth constraint.<sup>(13)</sup>

### **5. RELEVANCE AND IMPORTANCE OF MANAGEMENT SKILLS IN THE PRESENT-DAY PROFESSION**

- I. To handle the competitive environment
- II. To manage the resources such as (money, material, manpower, machine)
- III. To control the unforeseen situation.
- IV. Transformation of Information

According to various researchers, today’s global economy is transforming as a knowledge economy. The ‘IT’ (Information Technology) sectors has given a boost in the beginning of 21<sup>st</sup> century to become a developed country. It’s not only with IT but the change in process of working and dealing with the information has conveyed the change of thinking process and the value of creation in modern tactics in project and management.

The current economy is also being affected by these changes. Now the information, innovation, creative thinking and knowledge is used as strategic resources in place of current capital strategic resources. The production is influenced by the skills and knowledge. Enterprise can gain the competitive advantages through implementation of the managerial skills and the inventions related to the project where the knowledge should be the key factor in the process of invention.<sup>(14)</sup>

### **6. TRENDS IN CONSTRUCTION PROJECT MANAGEMENT**

As the concept of construction project management was realized in the classic periods when the Great Pyramid at Egypt, Great Wall of China, Pantheon at Rome and many more marvelous structures started building. In 1911’s the Bar chart by Henry Gantt and five

management functions by Henri Fayol that form the foundation of the body of knowledge associated with project and program management was got invented. This invention is the forerunner to modern project management tools such as work breakdown structure (WBS) and resource allocation. From 1950's the profession getting recognized by the number of international societies for the challenged faced in the project management. In 1940, Line of balance (LOB) is used as management control process in construction, where the project contains blocks of repetitive work activities, such as roads, pipelines, tunnels, railways and high-rise buildings. In other words, it schedules activities in such a way that: resource utilization is maximized; interruption in on-going process is minimized, including hiring-and-firing; and the effect of the learning curve phenomenon is maximized.<sup>(15)</sup> In late 1950's two mathematical techniques CPM (Critical path method) and PERT (Project evolution review technique) was developed under two different projects. CPM was used for repetitive projects while PERT was used for probabilistic projects. During 1980's based on these mathematical techniques number of standalone software packages were developed worldwide to plan, control and monitor the complex construction projects on Fortran and C programme languages. In 1983 Primavera and in 1987 Microsoft Project, the first version of these two commercial software packages were released. After introduction of internet, number of web-based packages are available in the market now-a-days. There is emerging concept of 4D Construction Project Management, which deals in planning, managing, construction and tracing the project in model.

## 7. CONCLUSION

Today's construction environment is very competitive, dynamic and challenging. For completing project on time, on budget and with quality needs to have proper management system. From the classic period we have very good Architectural examples and that is from the existing massive Architectural marvellous buildings. Someone is there to look into Project management of the entire completion of the building. Looking into modern trend the revolution started after 1900's Bar chart, CPM and PERT used for modern construction project management to handle complex projects. After the introduction of computer in 1950's, standalone and web-based software packages was developed to manage the projects. These standalone and web-based software have number of benefits over traditional tools. These packages integrate the required features for the monitor and control the project such as network diagram, bar chart, resource allocation, time scheduling etc. in order to complete the project. These are establishing effective communication for the success of a project which is very important, especially in such a dynamic environment like that of a construction project.

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Changing Trends in Construction Project Managements Review from the History to Present Day  
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