

An empirical analysis of Managing Project Networks

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Abstract

The Project Management is a key working for successful completion of a specified project. In Project Management, vigorous knowledge, specified skills, object oriented tools and methodology are applied. This study also describe the key elements of Project Management. In this research paper, researchers explain the concept of Project management with a live illustration of sports complex. This research paper is also helpful for those researchers who are involved in managing different applied projects in various business fields' viz. construction and engineering, development of a new product, manufacturing process in intermittent production, etc. The application of this research paper is very useful for every organization in this dynamic world.

Keywords: Project Management, Project Networks, Critical Path Method and Network Planning Techniques.

Introduction

Project Management is the practice of initiating, planning, executing, controlling, and closing the work of a team to achieve specific goals and meet specific success criteria at the specified time. The primary challenge of project management is to achieve all of the project goals within the given constraints (Phillips, 2003). This information is usually described in project documentation, created at the beginning of the development process. The primary constraints are scope, time, quality and budget (PMI, 2010). The secondary – and more ambitious – challenge is to optimize the allocation of necessary inputs and apply them to meet pre-defined objectives. The object of project management is to produce a complete project which complies with the client's objectives. In many cases the object of project management is also to shape or reform the client's brief in order to feasibly be able to address

the client's objectives. Once the client's objectives are clearly established they should influence all decisions made by other people involved in the project – for example project managers, designers, contractors and sub-contractors. Ill-defined or too tightly prescribed project management objectives are detrimental to decision making.

A project is a temporary endeavor designed to produce a unique product, service or result with a defined beginning and end, undertaken to meet unique goals and objectives and typically to bring about beneficial change or added value. The temporary nature of projects stands in contrast with business as usual (Paul C. Dinsmore *et al*, 2005), which are repetitive, permanent, or semi-permanent functional activities to produce products or services. In practice, the management of such distinct production approaches requires the development of distinct technical skills and management strategies (Cattani *et al*, 2011).

Elements of Project Management

There are several elements which are involved in Project Management such as Management Information System (MIS), Project Plan, Project Schedule and Project Execution. The other element of Project Management consist of a defined Project Team which includes Project Manager, Project Executive, Project Supervisor and Project Workers. There are several Internal and External resources used to complete the projects. The Internal Resources are Management, Managers and Executives, Human Resources at all levels and Procurement and Inventory while as External Resources include Suppliers, Agencies and Contractors. The framework of elements of Project Management is shown in

figure 1.

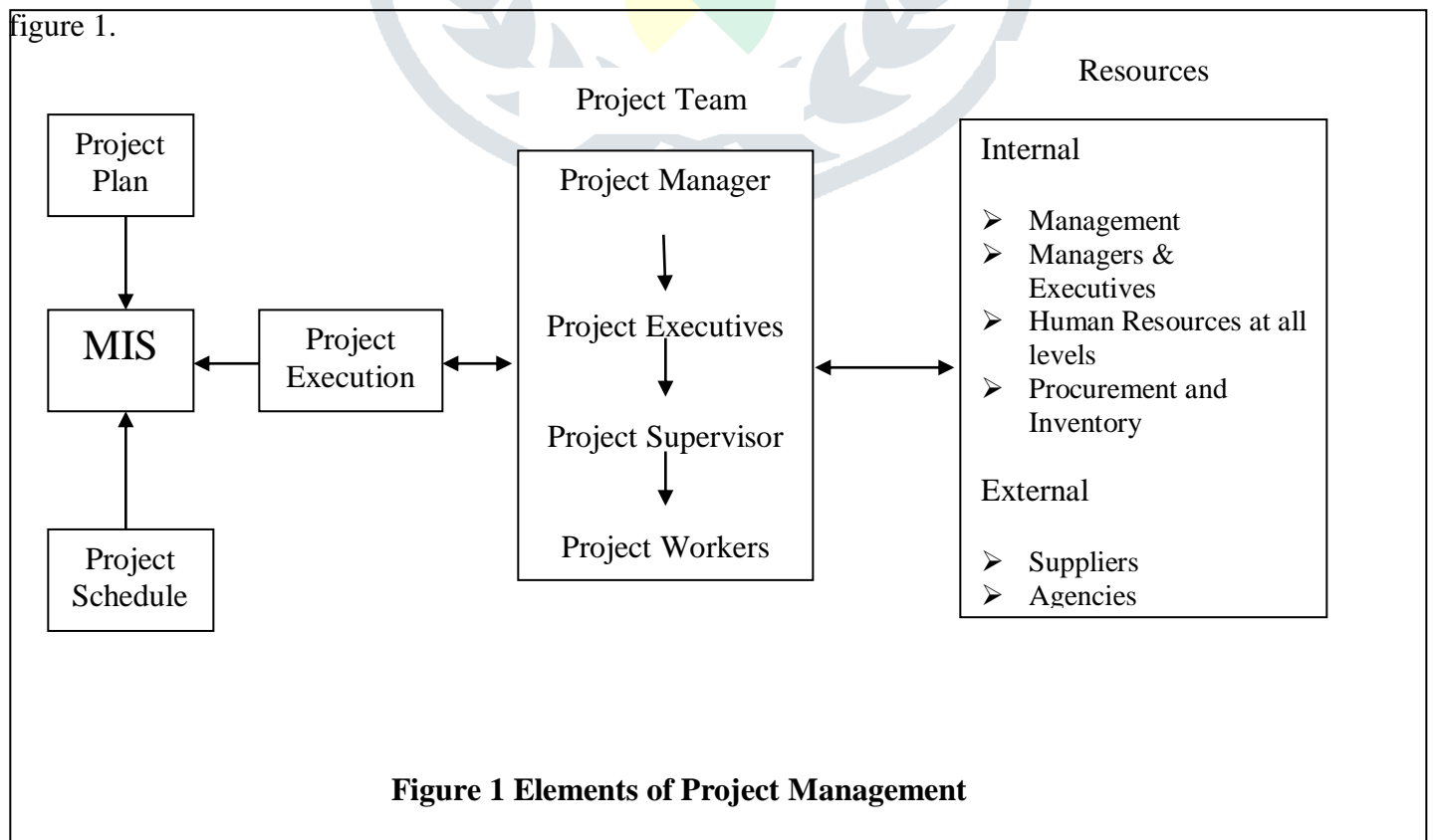


Figure 1 Elements of Project Management

Critical Path Method

The Critical Path Method (CPM) is an algorithm for scheduling a set of project activities. A Critical Path is determined by identifying the longest stretch of dependent activities and measuring the time required to complete them from start to finish.

It is basically a networking planning technique of project management which is designed to provide the intense and minute level control. It also provides the different reports related to the progresses of the project for dynamic executing system. The procedure of CPM consists of three stages:

Stage 1: Requirements for CPM

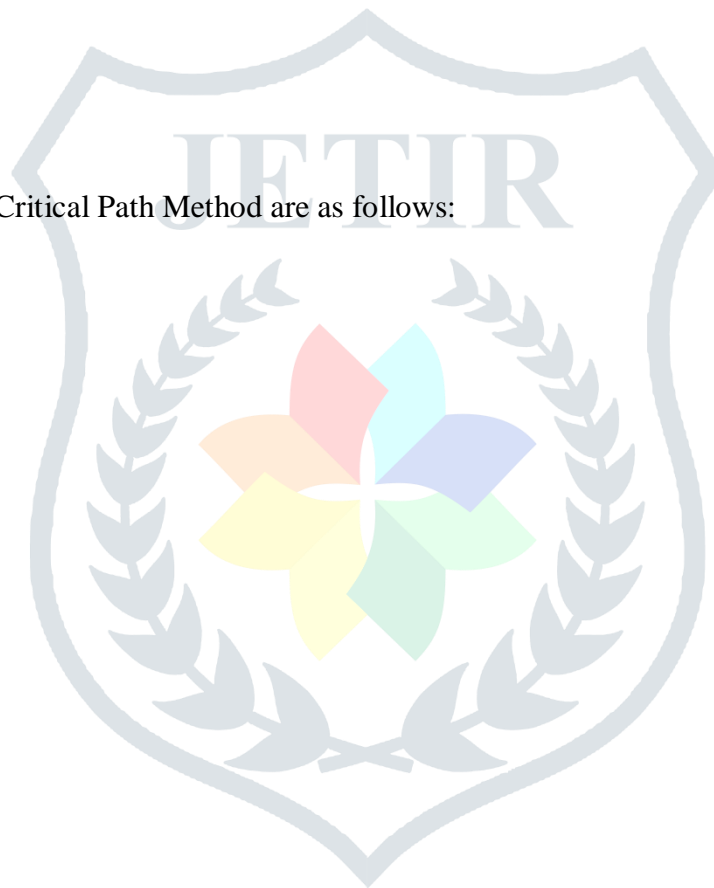
Stage 2: CPM Process

Stage 3: Outputs

CPM Terminology

The terminology used in Critical Path Method are as follows:

- ❖ Activity
- ❖ Dummy Activity
- ❖ Event
- ❖ Network
- ❖ Critical Path
- ❖ Critical Activities
- ❖ Earliest Start
- ❖ Earliest Finish
- ❖ Latest Start
- ❖ Latest Finish



Review of Literature

Cindea *et al.* (2018) depicts in their study on optimum batch calculation in designing the technology of execution of a welded structure within a company with mechanical profile, this being one of its main objects of activity. Because of the duration of different operations in the technological itinerary is not equal or in a multiple report, loading of machinery and workers cannot be done in a uniform manner, the production process being interrupted most often, narrow places and stocks large unfinished production, which is why we tried to determine an optimum manufacturing batch that would no longer allow these drawbacks. The solution of these problems is differentiated, considering the particularities of the manufactured product, the technological process, based on the economic analysis, aiming at the adoption of an optimal variant. The method provides the possibility to determine the influence of the size of the batch of parts on the duration of its production cycle.

Razdan et al. (2017) describe in their study that conventional techniques like Critical Path Method (CPM), are being constantly refined to cope up with the changing trends in Project Scheduling. Distributed resource constrained multi-project scheduling problem has been taken up recently. It primarily focusses on handling resource conflicts. A method has been developed to distinguish between resource dependent and logic dependent activities. The following case study concentrates on the time constraint and involves implementation of CPM in the optimization of the manufacturing procedure of an All-Terrain Vehicle (ATV). The analysis is based on the data collected from the club of College of Engineering, Pune, that manufactures ATVs and the aim of the study is to minimize the total project duration using CPM, considering the limited time and resources available at hand.

Maidamisa (2013) described in his article that traditional techniques of decision-making have hindered the technical efficiency of most professionals and executors of the public project in many developing countries such as Nigeria. The use of Gantt chart in project planning has continued to increase as a source of last resort in spite of its severe limitations for ineffective project management and delivery. CPM has gained widespread commendation and acceptance in the developed countries. This technique is yet to gain any appreciable acceptance for implementation of public projects in Nigeria. Professionals and executors of public projects in Nigeria have remained conscientiously to the Gantt chart. In order to address this problem of project planning, the CPM was applied to “construction of a complex building at Federal University of Technology, Yola.” This paper describes a specific case study with real data and an application. The results show the effectiveness of the CPM in, planning, scheduling, and organizing, coordinating, managing, and controlling of project time and cost. The study concludes by arguing that, CPM is not difficult to apply and when applied it improves inter-departmental communications, gives clear definition of responsibilities and minimizes the occurrence of crisis management.

Goksu and Catovic (2012) explain in their research that because of the growing effects of the globalization in various business environments, the manufacturing industry is expected to be effective and yet efficient. According to this, in planning, scheduling and controlling a project, which is a combination of various activities, project management techniques (PERT and CPM) are used. Therefore, the research question is how will the implementation of CPM and PERT influence the effectiveness and efficiency of furniture company "Dallas"? The answer to this question is relevant in order to point out the importance of those methods in reducing the project completion time and costs. The data are taken from the furniture company "Dallas" and it will be combined with literature reviews. The research study is fueled by the following objectives: First is to determine the activities that are involved in the manufacturing process in selected company. Second is to demonstrate the benefits, as well as the drawbacks that those methods might create in the organization. And third is to

demonstrate the influence of CPM and PERT in the entire furniture industry and its competitiveness. Implications of this research paper are evaluation of the project completion time and control of the resources, in order to see that the project is completed within the planned time and cost by using mentioned methods. At the end of the study, the result is expected to help all the individuals as well as the companies to understand more the concept of CPM and PERT methods in reducing the project completion time and costs.

Research Objectives

- To study the concept of Project Management and Critical Path Method and draw the CPM Network.
- To draw the graphic view of the relationships among the required activities.
- To determine the critical path through the network.

Illustration

The details of constructing a sports complex is shown in table 1. It consists of a various activities with its description and the duration of activities. Draw the Network Diagram and find out the Critical Path from the given data.

Table 1 Construction of Sports Complex

| S. No. | Activity (i – j) | Description | Duration (in weeks) |
|--------|---------------------|---|------------------------|
| 1. | 1 – 2 | Break Ground | 3 |
| 2. | 1 – 3 | Excavation | 3 |
| 3. | 1 – 4 | Foundation | 3 |
| 4. | 2 – 5 | Utilities | 5 |
| 5. | 3 – 6 | Framing | 6 |
| 6. | 3 – 7 | Roofing and Weather Resistant Barrier | 9 |
| 7. | 4 – 7 | Rough Plumbing, Mechanical Systems, Lighting and Electrical | 5 |

| | | | |
|-----|--------|---|---|
| 8. | 5 – 8 | Air Sealing and Insulation | 3 |
| 9. | 6 – 8 | Dry Wall, Siding and Flooring | 5 |
| 10. | 7 – 9 | Tiling, Painting, Cabinets and Shelving | 6 |
| 11. | 8 – 9 | Finish Plumbing, Electrical and Lighting | 4 |
| 12. | 9 - 10 | Certificate of Occupancy, Modifications and Moving In | 5 |

Solution of the Illustration:

The figure 2 represents as the precedence diagram of the Network, which is as follows:

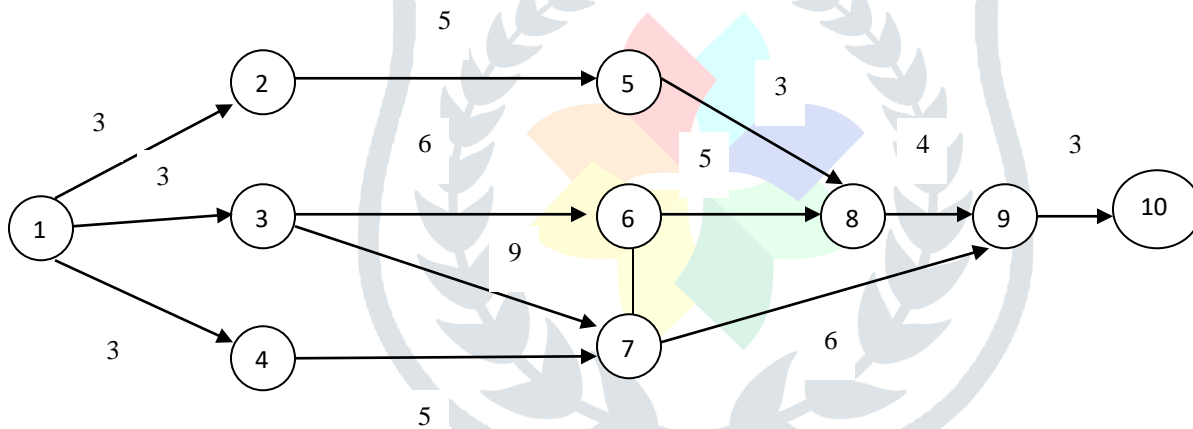


Figure 2 Precedence Diagram of Network

Abbreviations:

- Activity
- Dummy Activity
- Event
- Activity Duration

Determination of Earliest Time

Formula for calculating this:

$$E_j = \max [E_i + D_{ij}]$$

Initial event is supposed to occur at time equal to zero.

i.e. $E_1 = 0$

Now, $E_2 = 3, E_3 = 3, E_4 = 3, E_5 = 8, E_6 = 9, E_7 = 12, E_8 = 14, E_9 = 18, E_{10} = 23$

Determination of Latest Time

Formula for calculating this:

$$L_i = \min [L_j - D_{ij}]$$

$L_{10} = 23, L_9 = 18, L_8 = 14, L_7 = 12, L_6 = 9, L_5 = 11, L_4 = 7, L_3 = 3, L_2 = 6, L_1 = 0$

The figure 3 shows the analysis of Critical Path which is as follows:

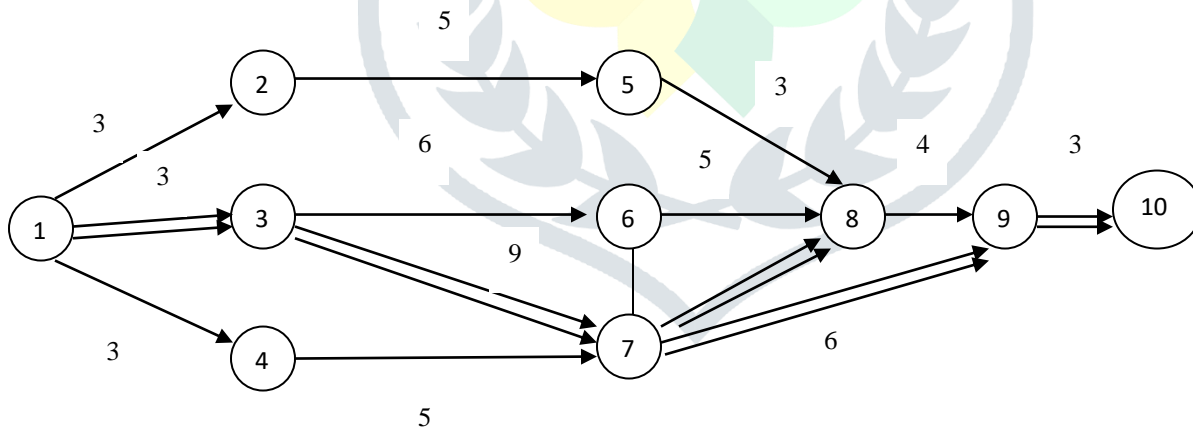


Figure 3 Analysis of Critical Path

The Critical Path of above illustration is shown in figure 4, which is as follows:

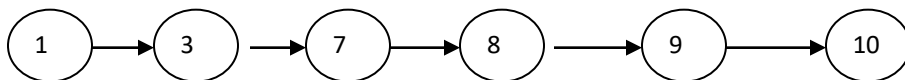


Figure 4 Diagram of Critical Path

Conclusions

Managing Project Networks have been identified as changing organizational forms which are showed by the project based applications. Different Project networks are allowed for the internal as well as external consolidation of resources and thereby help to regain the managerial needs for flexibility and stability in project business. Above illustration depicts the case of a construction of a sports complex. This illustration is done with a help of Critical Path Method (CPM). This illustration consists of precedence diagram and its analysis. During the analysis of this CPM, researchers determine the earliest time and latest time. Finally the Critical Path of this illustration is shown in figure 4.

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