CHAPTER 1

INTRODUCTION AND DESIGN OF THE STUDY

1.1 Introduction

A Project is a temporary endeavor, having a definite beginning and end (usually constrained by date), undertaken to meet unique goals and objectives, usually to bring about beneficial change or added value\(^1\). The primary challenge of project management is to achieve all of the project goals and objectives while considering the preconceived project constraints such as scope, time, and budget. The secondary challenge is to optimize the allocation and integration of inputs necessary to meet the pre-defined objectives.

Project management System accommodates a complete set of skill-building strategies that puts success well within the reach. It is the discipline of planning, organizing, securing and managing resources to bring about the successful completion of specific engineering project goals and objectives\(^2\). Prior to 1950s, in the United States, projects were managed on an \textit{ad hoc} basis using mostly Gantt Charts, and informal techniques and tools.

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2. \textit{ibid}
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Two mathematical project-scheduling models were developed at that time namely the "Critical Path Method" (CPM), developed as a joint venture between DuPont Corporation and Remington Rand Corporation for managing plant maintenance projects and the "Program Evaluation and Review Technique" or PERT, developed by Booz Allen Hamilton as part of the United States Navy's Polaris missile submarine program. These mathematical techniques percolated into many private enterprises due to its effectiveness in the Project Management System (PMS)³. The project-scheduling models were introduced to supplement the PMS on technology application, project cost estimation, cost management, and engineering economics pioneered by Hans Lang and others.

1.2 Project Management Development Process

Traditionally PMS constitute five stages in its process, such as, Initiation or conception of the project; planning and designing; executing; monitoring and controlling; and completion of the project.

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Based on the nature of the industry there are variations on the stages of the project like Pre-Planning, Conceptual Design, Schematic Design, Design Development, Construction Drawings, and Construction Administration⁴.

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The traditional approach is followed by other modern methods like PERT, CPM, CCPM (Critical Chain Project Management), Agile Project Management, Extreme Project Management, Event Chain Methodology, PRINCE2 and so on. PRINCE2 is a structured approach to project management, introduced as a generic project management.

It is a combination of the original prompt methodology with IBM's MITP (managing the implementation of the total project) methodology. It provides a clearly defined framework describing procedures to coordinate people and activities in a project, designing process and supervision of the project, and adapt to the practices when there are changes in the pre-planned project.

The PRINCE2 method, specifies each process with its key inputs and outputs and the specific goals and activities to be carried out. This allows control of any deviations from the plan, for efficient control of resources. The various management roles and responsibilities involved in a project are fully described and are adaptable to suit the complexity of the project and skills of the organization.

1.3 Project Management Constraints:

Any project need to be performed and delivered under certain constraints. Traditionally, these constraints have been listed as "scope,"
"time," and "cost". These are also referred to as the “Project Management Triangle”, where each side represents a constraint.

![Project Management Constraints Diagram]

**Figure 1.3 Project Management Constraints**

One side of the triangle cannot be changed without affecting the others. A further refinement of the constraints adds quality i.e., the quality of performance or product, into a fourth constraint.

The project management success is measured by the project team’s ability to manage the project to produce the expected results from efficient management of time, cost and other resources. Another approach could be managing the three constraints i.e., finance, time and human resources. This implicates inducing more finance by bringing in more human resources to reduce the time of the project and completion of the project in time or before time.

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1.4 Project management practices in India

In the past Project Management was traditionally taken as an intuitive and internal process, where some form of project management was practiced in a large number of organizations, both in private and public sectors without any training. A study over 15 sectors including Auto, Power, IT, Retail, Banking, and Hospitality was found that project management practices in India differed not only on the basis of size and complexity of the project involved, but also across sectors as well as the forms of ownership (Public or Private). A higher level of maturity of project management practices was found in the capital intensive sectors (e.g. Power, Steel, and EP&C) or sectors like IT, which involve multidimensional or complex projects. The private sector reports a higher level of induction of project management than the public sector in India.

The second largest heavy earth-moving machinery Manufacturing organization in Asia has successfully deployed SAS Service Parts Optimization solutions to increase the manageability and profitability of their Stock Keeping Units (SKUs). BEML has a complex network of 25 regional depots and more than 70 Products with 210,000 SKUs to manage a vast supply chain and logistics network in India, the Middle East, Africa and Brazil. With such an intricate set-up, accurately forecasting the demand stream of spare parts was a major challenge. In order to optimize inventory
levels, they wanted a solution that could help them determine the SKUs required, with right quantity, right place and at right time. SAS Service Parts Optimization solution helps them accomplish these challenges seamlessly.

BEML is ranked as "The Largest and Most Profitable Construction Equipment Company" by Construction World - NICMAR, 2007. It has emerged in the forefront of heavy engineering industry with a track record of growth and revenues for over four decades. For its innovative management practices the company has been awarded the "Golden Peacock Innovation Management Award". BEML has also been rated as "The Fourth Largest Wealth Creator in the Country" by Dalal Street Magazine.

1.5 Project Management Practices in BEML

Bharat Earth Movers Limited (BEML), a public sector undertaking, is India's largest and Asia's second largest manufacturer of earthmoving equipments with remarkable presence in numerous sectors such as coal, mining, steel, cement and irrigation. BEML has hi-tech manufacturing facilities with sophisticated CNC machines, arc-welding robots & FMS units at Kolar Gold Fields, Mysore and Bangalore. The company possesses a strong objective to stay in a dominant position in the manufacturing and supply of Earthmoving, Mining, Construction, Railway and Defense Equipments and serves the customers to its best both at the domestic and international level. BEML is one the premier public sector undertaking which falls under the
administrative control of defense ministry, was incorporated in the year 1964, to cater mainly to the equipment needs of Indian Defence, having its corporate head quarters and central marketing division in Bangalore. Later on, yielding to the demands of public, joint and private sector, BEML started its commercial production of its products. For the past four decades and above, it has come to the forefront of heavy engineering industry and has established an undisputed, strong leadership in the earthmoving industry.

BEML has been diligently focusing on quality, safety and productivity as their primary motto to achieve success in business consistently. This has been achieved through pioneering new technologies and value-addition in all its processes and products over the years. Along with this, their strategic alliances with global partners also have ensured a continuous flow of top-of-the-line technologies, leading to gain international competence. This achievement is made possible due to the contribution of its world class R&D (Research and development activities).

BEML was able to achieve 85% rating in a number of its products, resulting on spearheading towards fast-track indigenization enabling it to gain many accolades, such as accreditation of ISO 9000 and attaining the position of second largest manufacturer of earthmoving equipments in Asia. The organization has vital applications in diverse sector of economy such as coal, steel, mining, cement, power, irrigation, construction, road building, defence
and railway. The services and production has also expanded towards manufacturing high quality hydraulics, heavy duty diesel engines, welding robots and undertaking of fabrication jobs.

1.6 Statement of the problem

Project managers tend to be craftsmen who have learned their trade empirically through on the job training and experience. They are not highly trained professionals but experienced practitioners, usually with a professional and most specifically with technical background who have developed a skill and reputation for dealing with unique situations and irregular tasks, an aptitude required for managing projects. Projects are unique, novel, and transient undertakings where rote and logic are not enough to secure a successful outcome, some degree of innovation is required; the quiddity is a process that helps us to manage these situations. The Project management system pertains to the intricate Project management Practices generally applied by the Project Managers with lot of challenges. The challenges faced by the Project managers in accomplishment of the projects balancing between the triple constraints - Time, cost, resources, along with the quality, skill and performance involved in projects claim the need for this study especially in BEML, which is known for its complexity and success over the decades.
1.7 Operational definitions

1.7.1 The Public Sector Undertakings (PSU)

The Public Sector Undertakings (PSU) are owned, managed, and controlled by the government. It is one of the major instruments in the hands of the government envisaged for the planned growth of Indian economy, in conformity with the objectives of economic development with social justice.

1.7.2 The Project Management Practices

The Project Management Practices in PSUs, is extremely important problem area to bestow concentration for a developing economy such as India. Unfortunately, many a public, private and joint sector projects undergo a sea-change of schedule slippages and cost overruns due to various reasons. To rectify the situations, a project has to be blended with meticulous precision and scrupulous planning, effective implementation coupled with professional touch of management so as to achieve the objectives of time, cost and performance. Scientific techniques of project management, no doubt would play a major role in streamlining the management of projects.

1.7.3 Time over-run

Time management is a seriously lagging issue in implementing projects. Time over-run is the undue delay in completion of the Project within the scheduled time. Time over-run increases the estimated cost.
1.7.4 Cost Over-run

Amount by which the actual cost exceeds the budgeted, estimated, original, or target cost. A cost overrun, also known as a cost increase or budget overrun, is an unexpected cost incurred in excess of a budgeted amount due to an under-estimation of the actual cost during budgeting found to be common in infrastructure, building and technology projects.

1.7.5 Project Management software

BEML has adopted the “PRIMAVERA” Software for its Metro rail projects and normal PERT and CPM for its other projects. The Primavera software is used in project-intensive industries including engineering and construction, public sector, aerospace and defense, utilities, oil and gas, manufacturing and high tech, and IT and services. The software helps in optimizing resources and the supply chain, reduce costs, manage changes, meet delivery dates, and ultimately make better decisions, all by using real-time data.

1.8 Need for the study

The ability to allocate resources to achieve a goal within the specified period of time, making it unique, is the hallmark of project management. BEML is taken as a case study to understand its PMS (Project Management System), a source of information for the Public Sector
Undertakings in India. It helps to understand on the allocation of resources in project management and identify the effects of resource allocation on achieving its specific goals. The study enables to examine the final outcome relating to the potential problems and pitfalls that can occur in projects. Hence, BEML (Bharat Earth Movers Ltd.), which is known for its complexity and success over the decades, was chosen to analyse its Project Management Practices, as a role model among the PSUs in India.

1.9 Objectives of the study

1. To portray the conceptual and theoretical backdrop of Project Management System (PMS) and the Project management practices followed in the organization under study.

2. To examine the relationship between the personal factors and the occupational status of the Project managers.

3. To analyse the relationship between the Project Management Practices (PMP) and the Project Management System

4. To identify the personal decisions of project managers in administering the projects.

5. To associate the factors of the Triple constraints (Time, Cost and Resources) with the PMS.
1.10 **Hypotheses of the study**

The following hypotheses were formulated and tested

**H₁**: There is no relationship between the personal factors and the occupational status of the Project managers.

**H₂**: The Project Management Practices (PMP) followed does not have any relationship with the Project Management System.

**H₃**: The personal decisions of project managers in administering the projects do not have any significant relationship with the PMS

**H₄**: There is no significant relationship between the project constraints and the PMS

1.11 **Research Design & Methodology**

1.11.1 **Nature of study**

This is a descriptive method done as a case study analysis on an organization to study the Project management Practices in public sector undertakings. For the purpose of the research study one of the successful public sector organization in India i.e., BEML (Bharat Earth Movers Ltd.), Bangalore has been taken to study the effectiveness of PMS implementation.
The study is about the Project Management Practices followed by the Project managers in the organization under study. The Project managers of two different occupational statuses are the respondents for this study, namely the Managers and Assistant Managers. The study attempts to analyse the relationship on their occupational status, their personal decisions taken relating to the Project Management practices applied in managing their Projects for an effective Project Management System. The study involved three stages. The first stage was set to delineate the study areas, select the respondents, and defining of the independent variables. The second stage was to conduct the field work for collecting the necessary information. The third stage of the study involved statistical analysis and interpretation of the findings.

1.11.2 Sources of Data

The data collected includes primary data basically through a questionnaire designed to obtain information from the Project Managers involved in managing the complex projects. The demography of the sample under research has been confined to Bangalore city only. The demography of the sampling unit was chosen based on the sophisticated technology, complexity in managing the projects and the success history of the organization over more than three decades in the Project Management System.
The Bharat Earth Movers limited, Bangalore, had 14 Managers and 28 Assistant managers during the year of study i.e., in 2009*. The questionnaires were distributed to 42 Project managers who have been involved in BMEL projects. The sampling unit was the population of the total number of project managers working in BEML. From the population of 42 respondents, the data collection accounted for a total of 42 responses which makes a population study.

1.11.3 The Instrument

The Research Strategy adopted was Survey Method, from 42 respondents, who were the Project managers in BEML. The Data Collection is through self-administered questionnaire and scheduling the interactive interview process with those respondents who were available in their respective office premises during the office hours, for understanding the variables of the Project Management System, as also to obtain the first-hand information about their experience and observe on their personal decisions taken at the time of administering the projects.

A questionnaire was developed to identify the variables relevant to the Project Management System to ascertain the efficacy in accomplishment of the projects and to identify the constraints in timely completion of the projects. An inventory of personal decisions in Project Management Practices has been built, and 50 statements have been developed to assess the PMS.
The questionnaire includes a 5 point Likert Scale, to identify and probe through the decisions taken by the Project Managers constructed with scales as Strongly Agree (SA), Agree (A), No opinion (NO), Disagree (D), and Strongly Disagree (SD).

1.11.4 Sample Design and Sample Size

The researcher adopted judgmental sampling method. The respondents chosen for the study were from an age group ranging from 40 to 55 years working in BEML, located in Bangalore city. Hence, the final data collection was made from a sample of 42 respondents, representing the population of the organization under study, which were complete and usable, has been taken for analysis.

1.11.5 Reliability Test

Besides ensuring the validity of the instrument, that is to be guided in a study using qualitative methodology, Reliability tests were made.
Table 1.1 Reliability Statistics

<table>
<thead>
<tr>
<th>Constructs</th>
<th>No. of questions</th>
<th>Cronbach’s Alpha</th>
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<tbody>
<tr>
<td>1. Project Planning</td>
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<td>2. Project Identification</td>
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<td>3. Project development</td>
<td></td>
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<td>4. Risk Management</td>
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<tr>
<td>5. Project Execution, monitoring and control</td>
<td><strong>63</strong></td>
<td><strong>.83</strong></td>
</tr>
<tr>
<td>6. Time, Cost, Resources</td>
<td></td>
<td></td>
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</tbody>
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The Reliability analysis using Cronbach’s Alpha scale were tested on the demographic variables (63 items) of the respondents, showed a reliability of .83 given in Table 1.1 which is greater than .7 confirming the adequacy and authenticity of the questionnaire, which is considered as highly significant. According to Nunnally (1994) a scale of alpha > 0.7 is considered reliable.

1.12 Statistical Tools and Analysis

The statistical tools used in this study, to test the Project management Practices in BEML, includes the percentage analysis, Factor
Analysis using KMO & Bartlett’s Test, Principal Component Analysis, Rotated Component Matrix, Chi-Square and ANOVA.

The collected data were edited, coded and summarized with the help of the Statistical package. The statistical tools such as percentage analysis, Factor Analysis, Regression analysis, Average Score Analysis, Z test and t test were used in this study for analyzing the data. Factor analysis was applied to identify the personal decisions taken by the Project managers. Chi-square was used to analyse significant relationship between the two variables under consideration relating to personal and PMS and the Regression analysis was used to assess the existence of multiple correlation among the PMS factors in association with the PM Practices.

1.13 Scope and Limitations of the study

In any Project Management research it is the ambiguity that often arises when respondents are exposed to a few critical situations, for them to make decisions on personal judgments. Given the nature of project management, the limitations are inherent to all such studies. These limitations do not detract the value of the study, rather, they should be taken to point out the precautions to be observed in understanding and comparing the results. Moreover the behavior of human, especially relating to project management decisions, seems to be more consistent, with a traditional outlook to achieve the desired goals.
The methodology for identification, classifying and measuring of several Project management factors were only one of the different possibilities and is not a perfect one. As such, in a descriptive study on personal decisions on Project Management Practices, these weaknesses are unavoidable and one has to use the findings with one’s own maturity and understanding and insight to arrive at practical solutions or even explanations of reality.

1.14 Chapterization

Chapter I: Introduction and Design of the study

This chapter presents the problem of the study, outlines its importance, sets out the objectives, and presents the research methodology adopted, and indicates the scope and limitations of the study.

Chapter II: Review of Literature

The second chapter discusses and presents a brief review of literature collected for this study along with research gap.

Chapter III: Project Management Practices in Public Sector Undertakings - An overview

This Third chapter discusses the Project Management Practices followed in the Public Sector Undertakings, the classification of PUS and highlights of project management practices in India.
Chapter IV: Origin and growth of BEML

The fourth chapter exhibits the profile of BEML. It describes its success factors in managing complex projects and gives a brief history about the organization under study.

Chapter V: Performance of BEML - An Analysis

This chapter highlights on the PMS followed in BEML. The traditional and enhanced practices that has helped in its growth, sustenance and competence, over four decades of its successful business.

Chapter VI: Executives’ perception about Project Management Practices

This chapter provides an analysis on the demographic variables and Executives’ perceptions relating to the Project Management Practices applied in BEML, based on their experience and occupational status.

Chapter VII: Summary of Findings, Suggestions and Conclusion

An overall review of the findings of the study has been presented in this chapter from the analysis of the preceding chapters. The findings project the implications of the Decisions taken by the Project Managers and its impact on their efficiency in managing the complex projects. A few directions for future research is also suggested.