
ASSESSING IMPLEMENTATION OF PLANNING AND SCHEDULING IN CONSTRUCTION PROJECTS ACROSS INDIA

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Abstract

The Indian construction industry is estimated to contribute 9% to the country's GDP, and the industry is currently worth approximately US\$ 145 billion. The market has shown excellent growth potential, but the industry is also facing delayed projects. 70% of infrastructure projects in India face time and cost delays which pose a significant risk to the stakeholders. The COVID-19 crisis worsened the situation as 90% of construction projects in India were slowed down due to the lockdown. Over 30% of labours stayed away from construction sites for fear of contracting the virus, leading to unprecedented circumstances. The leading causes of the delays identified in this research are unforeseen circumstances that remain unaccounted for during project planning and scheduling and a lack of clear communication between project stakeholders. This research focused on planning and scheduling challenges in four different construction terrains in India: hilly region, northern plains, coastal and desert region. The construction sites in these regions face distinct challenges like various soil types, variable climatic conditions, and challenging logistics. This paper highlights essential techniques of planning and scheduling, barriers, the importance of proper planning and scheduling and the significance of the role of the PM to improve the delivery of the projects.

The research would support the project stakeholders in understanding the importance of applying planning and scheduling techniques in the construction industry of India.

Keywords

Indian construction industry, planning, scheduling.

1 Introduction

The stakeholders, client, consultant, contractor, suppliers, and investors are crucial to driving a construction project and are responsible for optimizing construction project management due to the industry's competitiveness. Project management aims to effectively enhance the objectives according to the stakeholder's needs by proper planning and coordination. It involves a clear definition of the project scope, accurate cost estimates, resources allocation, and a strong understanding of project management to develop effective project planning and scheduling, enabling timely project delivery according to cost and quality objectives. Clients need to realize the returns on their investments, and thus, planning and scheduling perform an essential role in completing the project on time and at a

predetermined cost. Construction planning is necessary and thought to provoke activity for managing and executing construction projects. Scheduling means creating order and logic for construction activities and estimating the workforce and other related resources for the project's construction. The main reason for poor project performance is the lack of knowledge of proper planning and scheduling techniques. Baldwin and Bordoli (2014) said that effective project management, project execution, and project planning and scheduling are the keys to success. This research focuses on the construction projects of India, where the projects are constantly being affected by schedule and cost overruns. Such problems are improper planning and scheduling of the construction activities and arise due to inappropriate explanations of the project scope of works during the initiation stage. These challenges can be overcome by clear communication between project stakeholders and keeping the variance of planning and scheduling to the bare minimum.

1.1. Research objectives

A successful project means completed within pre-planned time, quality and cost objectives; project delivery is according to the needs of the project stakeholders and completed within the defined scope (Kerzner, 2009). The reality is there are flaws in planning and scheduling, and these can arise due to improper identification of risks in the initial planning stages. Sometimes threats are unforeseen, like the recent COVID-19 virus, which has led to project delays worldwide. There is a need to account for good float between key project milestones during the project planning to have minimum impact on final project delivery. The research focuses on different topographies of India: Hilly Region (Himalayas), desert region (Thar desert), Coastal region (western and eastern ghats), and northern plains, each having unique construction practices, leading to the implementation of variable planning and scheduling techniques.

The literature reviewed construction projects in India, and the analysis has shown that most projects are being affected by time and cost overruns. It is unclear that the main reason behind the delay is poor planning and scheduling of activities. For example, analysis of Indian government infrastructure projects shows that only 20% of projects are on schedule, and 80% are suffering from either time or cost overrun (COVID-19: Assessment of economic impact on the construction sector in India, 2020). This report states the effect of COVID-19 is severe on the project cost as it has led to an increase in labour cost by 20%-25%. Megaprojects in India showed that 47% face delays due to multiple reasons (Singh, 2009). Government analysis shows that every project suffers from 20%-25% cost and time overruns (Ministry, 2021). According to the latest report published by MOSPI, examining over 1700 projects, 401 projects have cost overruns, 583 projects are facing schedule delays, and 205 projects have time and cost overrun (COVID-19: Assessment of economic impact on the construction sector in India, 2020). The main reasons for delays were land acquisition, inadequate planning and inappropriate budgeting, underestimation of project cost, changes in project scope and shortage of workforce (Ministry, 2021).

The aim is to inspect the significance of project stakeholders in understanding the application of planning and scheduling techniques in the construction industry of India.

The following defined objectives will achieve the aim:

- To identify various planning and scheduling techniques that are essential for proper project planning and scheduling.
- To recognize the barriers to planning and scheduling and defining the techniques to overcome these barriers.

- To highlight the importance of proper planning and scheduling in project management.
- To analyse the significance of project managers in the construction industry across India.

2 Literature Review

The Indian construction industry will grow at a CAGR of 15.9%. It is driven by commercial sector CAGR of 16%, followed by infrastructure sector CAGR of 13% and lastly driven by residential sector CAGR of 11.1% (Markets, 2021). The decline in the residential sector is due to the increase in unemployment due to COVID-19. The industry will rise due to the government's effort to develop the country's infrastructure and housing sector. There is tremendous growth in this industry, but the question arises: is this industry ready to acquire the benefits of the development. The weak points of this industry are less usage of technology and the absence of standards across the construction process. By adopting better practices like a shift to better work quality and less wastage, the organizations can capture this growth potential.

2.1 Topography of India

India has diverse topographies spread across all its regions, which influences adopting appropriate construction methodology. The various construction topographies in India are the hilly region, northern plains, coastal and desert region. Construction in these regions faces distinct challenges like a different type of soil, variable climatic conditions, unique building techniques, and logistics difficulties.

India's weather ranges from a temperate climate in the north to a tropical monsoon in south India. During March- June, there is summer, July- October is monsoon, and from November- February, there are winters (Asianinfo.org, n.d.). The terrain varies across India, i.e., flat planes along the Ganges, desert in the west, the Himalayas, the hilly region in the north, and coastal plains in the south. The typical hazards across India are floods, earthquakes, droughts, soil erosion, deforestation, air pollution, water pollution, and overpopulation. These regions possess variable risks to the planning and scheduling of construction projects.

2.2 Planning and Scheduling in Construction Projects

Construction project management aims to optimize the project's objectives effectively according to the stakeholder needs by proper planning, coordinating and controlling and enables project delivery within time and cost constraints. Poor project performance depends upon the improper application of project management concepts, leading to poor planning and eventually leading to project failure.

CIOB states that planning is "the determination and communication of a proposed course of action integrating thorough methods showing time, place and the resources" (CIOB, 2011).

Scheduling means creating an order, logic, and estimating workforce to build the most efficient and cost-effective project. Scheduling sets the thorough working plan on a time scale set by crucial objectives (Hildreth et al., 2005).

Baldwin and Bordoli (2014) have mentioned that sharing the construction plan among the project's stakeholders is mandatory, which are an essential part of the construction process, the clients, project managers, architects or designers and contractors.

E.g., Bandra- Worli sea link in Mumbai highlights the failure of a major project in India. The project was planned for US\$ 45 million (INR300 crore) and is to be completed by 2004. Still, eventually, it

was finished with a five-year delay in 2009, with an actual cost of US\$237 million (Rs.1600 crores), which is approximately 425% cost overrun from the project estimated cost (Bharath and Pai, 2013).

2.2.1 Project stakeholders and their roles and behaviour in planning and scheduling

The flow of communication between project stakeholders is not given adequate importance during construction practice. Effective planning and scheduling of the project influences the organization's culture and mindset of the project team. The roles of project stakeholders for the progress and control of construction plans must be defined and synchronized for the successful completion of the project.

(Owolabi et al., 2014) observed that the client caused 51% of the delays, followed by the contractor at 36% and consultant at 13%. Industry research shows that based on the ratio of the final estimated cost to estimated cost, approximately 40% of all the projects undergo more than 10% change (Ibbs, 2012). As the number of changes increases, the project's productivity decreases, which leads to cost overruns and time delays.

It is essential to have detailed inputs from the project stakeholders in the early planning stages to implement project planning. Understanding scheduling concepts should include critical issues such as buffers, resource loading, identification of risk, and mitigation and control techniques (Heuer and Zack, 2014). Heuer and Zack (2014) also mention that scheduling ensures that all the activities to be performed by the contractor are adequately planned, coordinated, staffed, and executed sequentially. It also adds to the decision-making of the stakeholders regarding the monthly progress payment of the contractors. The owner and the contractor must agree upon a schedule that indicates a logical path for completing the project.

2.2.2 Methods & tools for project planning and scheduling

The Methods and tools utilized for construction planning and scheduling are Gantt charts, Critical Path Method (CPM), Program Evaluation and Review Technique (PERT), Critical chain project management and Last Planner System. The Gantt chart is displayed with bar charts, emphasizing the percentage complete of each task without showing the links between them. Whereas PERT shows the interlinkage between the activities and highlights information as a network model, it does not show the percentage completion of tasks. PERT can help the project manager to visualize the sequence of activities (Bryant, 2007). Critical chain project management concentrates on the issues in scheduling activities and finds the crucial activities that form the 'critical chain' for construction work. The last planner system sees what 'should be done, considers what 'can' be done, and helps decide what 'will' be done.

2.2.3 Barriers to planning and scheduling

A proper definition of the project's scope at the initial planning stages is necessary for projects success. An unnecessary involvement by project stakeholders can hinder the success of the planning stage. Studies have highlighted that the delay in planning stages is because of the desires of the project stakeholders. Owners play a more significant role by constantly changing the scope of the project. An attitude of not focussing on project planning harms the projects' performance. Refer to figure 1 and 2 which highlights the common barriers to planning and scheduling.

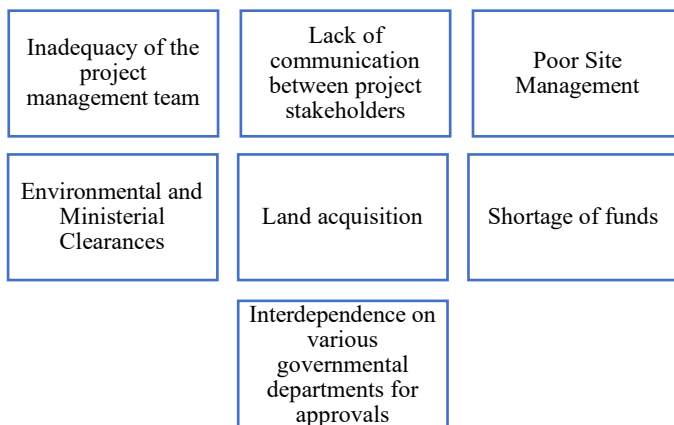


Figure 1 Barriers to project planning



Figure 2 Barriers to project scheduling

The project's success relies on the effectiveness of the planning stage, and adequate resource allocation leads to accurate planning. Planning further leads to scheduling which is responsible for the execution of the work, and proper scheduling helps the stakeholders monitor the progress of the project. Stakeholders are the key decision-makers, and clear communication is essential for the project's success. The more integrated the stakeholders better will be the delivery of the project. Planning depends on topographies, and different topographies have multiple challenges. It is comparatively easier to work in the resourceful cities, e.g., Delhi, Mumbai and Gujarat, compared to comparatively less resourceful hilly regions, e.g., Kullu, Shimla, Manali, Jammu & Kashmir. Extra precautions are needed while planning in topographically challenging areas.

3 Research Methodology

This research paper observes the understanding of the project stakeholders regarding planning and scheduling, emphasizing how they modify planning and scheduling due to the problems faced while working in different topographies of India. The research also highlights the difficulties encountered in other regions of India that hinder the construction process and understands the role of the project manager in managing the projects.

This research had adopted an interpretivism epistemology, a study in which the researcher must interact with the research. Data was collected using both qualitative and quantitative approaches. The researcher conducted around 12 semi-structured interviews and 50 questionnaires across ten projects in different regions of India. The collected information is from project stakeholders: the client, project manager, contractor, and architect from the other areas of India, i.e., hilly region, desert region, the northern plains, and the coastal region. The connection between literature and research adopted deductive and inductive approaches. The deductive approach incorporates quantitative data and begins

with theory and hypothesis, followed by research that validates the literature. The inductive study includes qualitative data, begins with real-life examples, and progresses towards literature based on the observations.

4 Findings and Discussion

4.1.Respondents Background

The data collected targets the viewpoint of the major project stakeholders: the project manager, client, contractor, and architect (refer to figure 3). The perspective of all stakeholders (refer to figure 4) is essential to understand as it assists in answering the objectives.

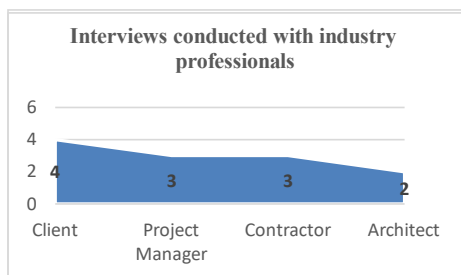


Figure 3 Interviews conducted with industry professionals

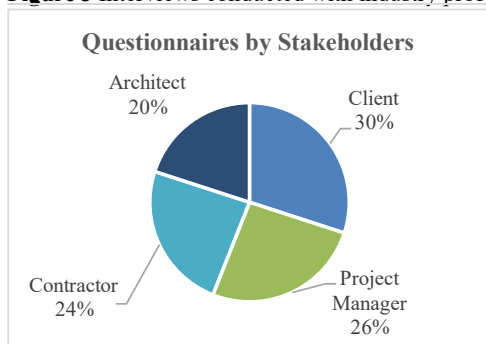


Figure 4 Questionnaires responses by industry professionals

This research has covered responses from industry experts with different years of experience to receive valuable project insights (refer to figure 5).

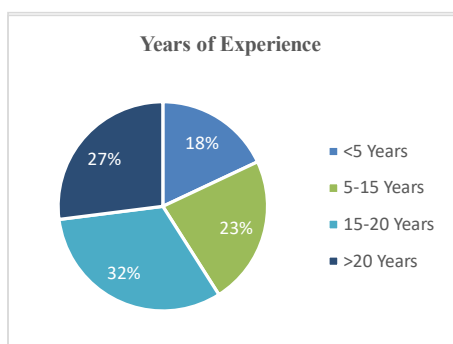


Figure 5 Respondents' Years of Experience

4.2.Data Analysis

The data was thoroughly collected across all the regions of India, and most people who responded possess an experience of over 15 years, which validates the quality of data utilized. The responses highlight both planning and scheduling have equal importance in the successful delivery of a project. The methods and tools of planning and scheduling used in different regions of India are similar, and the utilization varies based on the barriers each area possesses.

The key deliverables from this research are:

- Only 20% of the respondents feel that planning and scheduling have been ultimately adopted in the industry and the remaining are unsure about the implementation.
- 44% of the people feel that planning is vital for the execution of the work as, without a proper plan, there is no execution strategy to follow. The project managers use the project plan to decide the schedule of activities and inspect the quality of work.
- 52% of the respondents believe that scheduling is important as delays in scheduling can lead to project failure in terms of completion date. Scheduling is also used for resource planning, workforce management and procurement of construction materials.
- 64% of respondents believe that the role of the PM is essential for the execution of the work. The PM is responsible for monitoring the site and making crucial decisions regarding the implementation of the work. Whereas 40% of the respondents disagree that only the PM is responsible for the project's planning. The planning process is a team effort, and this has been stated and accepted by 50% of the respondents.
- Effective planning and scheduling barriers are budgets, natural calamities, change in the original scope, unskilled workforce, and the project budget. 40% of the respondents believe that the significant barriers are all the above, but 28% think there are other planning and scheduling barriers. These barriers are unavailability of resources, poor communication, improper project leadership and inefficient experience in planning and scheduling.
- A project can have multiple delays, and 64% of respondents believe that float in project scheduling is essential for delivering the project on time.
- 48% of the respondents believe that culture has an impact on construction projects. The Indian construction industry is multi-cultured with people from different caste and religions, following various rituals, and speaking other languages.
- 56% of the respondents mention that CPM is widely used, followed by PERT and Gantt chart. It is vital to be on schedule with activities on the critical path as a slight deviation could lead to an overall project delay by two months or more, as stated by an interviewer.

4.2.1. Region-based analysis

Hilly Region: Planning and scheduling are essential in this region. Proper planning leads to accurate scheduling and thus fewer delays. Critical path and PERT are the techniques that are used for planning and scheduling. The activities on the critical path are not delayed, as they can lead to the overall delay of the project. The barriers in this region are unwanted rainfall, high-risk work environment, work casualties leading to a loss time incident, and restricted use of heavy vehicles. These barriers can be overcome by considering these factors during the formation of the project baseline.

Desert Region: Proper planning and scheduling are critical for the success of the project. The critical path method is the commonly used technique in this region. A milestone chart is prepared to monitor the success of the project. The barriers in this region are extreme weather conditions, lack of resources and unskilled labour. These can be mitigated by localizing procurement, hiring skilled labour and resources from nearby areas, and distorting the working hours for the execution of work.

Northern Plains: It is the most accessible terrain to work, and planning and scheduling play a significant role in project success. CPM, PERT and Gantt charts are the techniques that are used in this

region. The water level is low, hence adequate government clearances are required, the laws are relatively strict in this region, and there might be a hindrance from government and political parties. Overcoming barriers through adequate consideration of obstacles during the planning and proper communication between the project stakeholders.

Coastal Plain: In this region, excessive rainfall can affect scheduling as it leads to floods. Bribing officials to get work done is a common practice, and it involves enormous risk, and RTI activists also pose a threat to the construction activities. Strip and pile foundation is used in this region as the bearing capacity of the soil is low.

In general, festivals affect the scheduling of activities in all the regions of India. The diverse culture of this industry plays a significant role in managing the construction project.

Planning and scheduling are crucial in executing and monitoring construction activities (refer to figure 6).

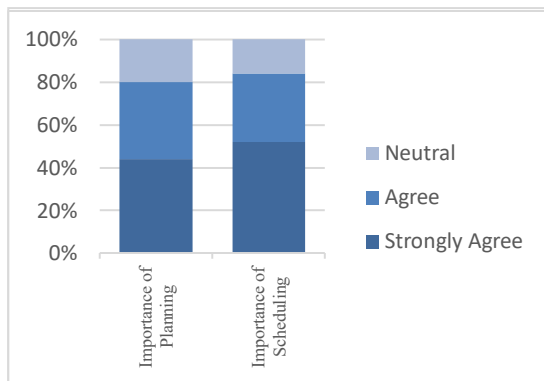


Figure 6 Importance of Planning and Scheduling

The project manager plays a significant role in the execution of construction projects. The project manager acts as the project owner on the site and makes crucial decisions to complete the project. The questionnaire has determined 64% of the respondents believe the role of the project manager is significant in the execution of the construction project. It has been illustrated below in figure 7.

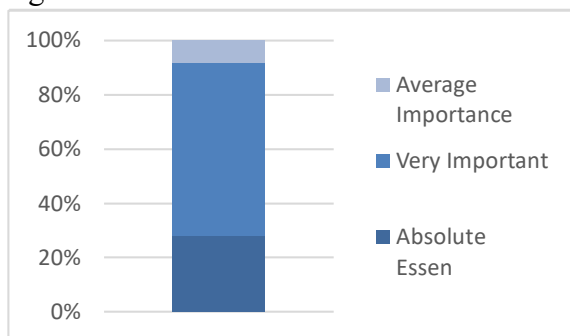


Figure 7 Importance of the role of PM in managing construction projects

The common barriers to planning and scheduling were defined by the respondents, as illustrated in figure 8.

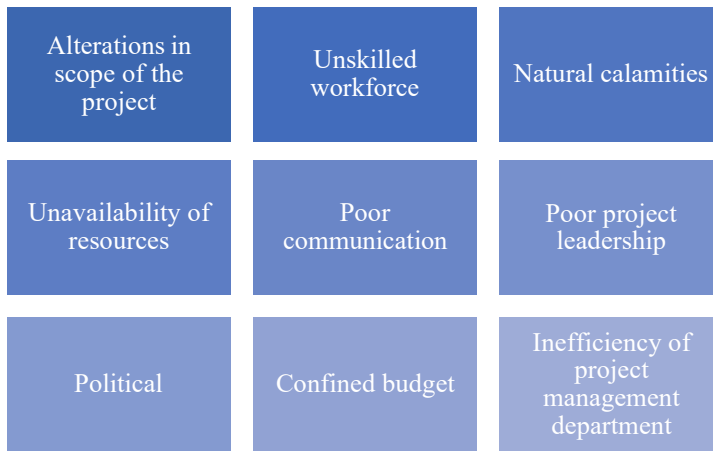


Figure 8 Barriers to planning and scheduling

Figure 9 illustrates the commonly used project management techniques mentioned by the respondents through the questionnaire.

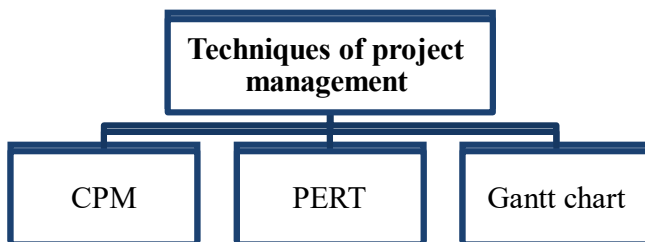


Figure 9 Techniques of project management

5 Conclusions and Further Research

The research objectives are evaluated based on the literature review and the data collected through interviews and questionnaires.

The study concludes that all project stakeholders play a crucial role in determining the project's success and are equally vital for the proper execution of the construction activities. Each region of India faces barriers that can be mitigated by proper planning and scheduling. Still, construction is most challenging in the hilly area, followed by the desert region, and it is most feasible in the northern plains. The challenges can be overcome by clearly defining scope, detailed resource allocation, localized procurement, and proper communication. The respondents had variable opinions on the correct planning and scheduling technique but emphasized that technique changes as per the nature of the project. The responses were in cohesion with the literature that planning, and scheduling are crucial for successfully delivering a construction project. At the same time, it highlights that both these activities are a team effort that involves all stakeholders. The research emphasizes the project manager is responsible for the on-site execution of the work, and the effectiveness of the project manager depends upon the proactiveness of the client and other stakeholders. The manager drives the project through the knowledge and experience essential for constructing projects in any environment. This research has aimed to inspect the significance of project stakeholders in understanding the application of planning and scheduling techniques in the construction industry of India.

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