Importance, Roles and Responsibilities of a Planning Engineer in the Indian Construction Industry

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Abstract:
The role of the planning engineer is crucial for successful planning, monitoring, controlling of the project. The Indian construction industry lacks the ability to implement project controls and project management tools leading to tremendous delays. It is crucial that at least planning engineers should be deployed for each construction projects for transparent reporting to sr. management. Collaboration & Synchronization between various departments during the project life cycle can only be achieved 100% by having a planning engineer in the project organogram. The proper organization hierarchy is essential for the implementation of the role of planning engineer. Project Controls department must be introduced for better working of planning engineers. This study examines the obstacles faced by the Indian construction sector when implementing the role of planning engineer. This study uses a questionnaire survey, answered by the industry experts. There were 140 respondents. The questions related to effectiveness of planning engineers in the Indian construction industry were also covered. The responses conclude that the Indian construction industry is struggling in managing/implementing the role of planning engineer, thus, facing a biggest failure in getting the right reports at the right time that are delaying the projects in terms of cost, time & change of scope. The Indian construction industry must be more organized. Management should be more concerned about ensuring the proper implementation of roles, responsibilities & authority of planning engineer, follow international recommended guidelines like AACE for understanding in detail about the role & responsibilities of planning engineer, provide latest software to planning engineer for digitalization of reports and provide appropriately training at the required time.

Keywords: AACE, PMI, project planning, planning engineer, Indian construction industry.

Introduction
India's construction industry is rapidly growing and contributing a significant amount to the country's overall economy. The bulk of India's construction industry is made up of real estate and urban development infrastructure projects. The real estate section covers residential, commercial, hospitality and retail projects. The urban development sector includes sub-segments such as sanitation, marine, education, transportation, and healthcare related projects. The construction Industry in India is expected to reach $1.4 Trillion by 2025 (Sethi, 2022).

India’s annual spending budget now stands at Rs. 438,795 crores despite India's total "Gross National Product" (GNP), being at Rs. 2200,000 crores plus. Over the years, more than 50% of budget expenditures have been spent on civil
engineering projects. The country's construction industry is a driver of economic growth. In 2003, investment in this sector contributed 6.5 percent to GDP growth. Every rupee spent in construction leads to an increase in GDP of Rs.0.80. This compares to Rs.0.14 or Rs.0.20 in agriculture and manufacturing. Statistics show that the construction sector generates 7.76 times more revenue than other industries and has a greater number of job opportunities (Laskar, & Murty, 2010), which now grows to 9% of India's gross national product (GDP). Also, the country's construction industry employs more than 50 million people, the second largest employer (Banerjee, 2020). Construction has been given industrial status thanks to the efforts of the Planning Commission and the Indian construction industry.

However, there are some concerns and challenges as the industry grows and develops which are slowing down the industry's progress. Management of construction projects is the main concern. Management of construction projects includes labors, site execution team, different departments, all Managers (Project Manager, Project Director, Project Controls Manager), clients and other related stakeholders. Proper communication between the various parties involved in projects is must but often neglected by management. This can lead to disagreements between various stakeholders that result in delays (Loganathan et al., 2017). This article will discuss the challenges faced by India's building industry when it comes to project management. These suggestions can also be made and should be used to develop a better strategy. Here, Planning Engineer pays a crucial role by keeping all stakeholders informed through proper communication channel just avoiding conflict and getting exact decision from Sr. Management on the raised red flags by him/her.

Most studies that attempt to illuminate activities that enhance project success have focused on generic strategies for project success. Experts agree that project managers shouldn't be focusing on just one aspect of a project's success (Larsen et al., 2016). Change management, design management, procurement management, stakeholder management, project planning, monitoring in terms of scope, budget and time identified as key practices that have a significant impact on the KPIs of the project (Ritchie et al., 2013). Planning Engineer plays a vital role in covering these aspects. Also, clear objectives and goals, support from management, and sufficient funds/resources are the other three most important success factors for projects (White & Fortune, 2002). According to some reports, the competency of the project team, the commitment of the client, and the contractor's ability all play a part in the overall project's success (Yong & Mustaffa, 2013).

Collaboration among project participants was also found to be the most important element with the highest positive impact on project costs performance. The contractor's ability to complete tasks on time was one of six performance criteria that could be affected (Iyer, 2005). Based on studies, smaller teams, more focused and less dispersed will result in better project outcomes. Planning Engineer plays a dynamic role in all department collaboration and coordination for better monitoring of the project. This article will discuss and evaluate various pieces of literature on roles, responsibilities and obstacles faced by planning engineer.

**Literature Review**

**Project Planning and Management and Its Importance in the Indian Construction Industry**

The Role of the planning engineer is the collection and analysis of data regarding a project in order to maintain schedules and costs within the Construction Industry. This is mainly done by the departmental Role of Planning Engineer (Ling, 2004). The job of a planning engineer includes many tasks, starting from initiating, planning, monitoring, controlling and managing the project. The planning engineer's role is to monitor the status of the project, make predictions about the expected outcomes, and improve the overall performance of the project if they are not as anticipated. Based on AACE (14R-60) (AACE, 2006) recommended practices, the role of planning engineer includes
many functionalities but not limited to the following:

- Aligning initiatives to the goals and objectives of the portfolio/organization.
- Developing acceptable planning & scheduling techniques and methods.
- Preparing procedures and guidelines for project planning, scheduling & controlling the project.
- Review contract volumes for understanding the project scope.
- Collaborating with all departments for development of project plan and then transforming it into project schedule which includes creating workflow diagrams, WBS, activities, key milestones, contractual dates, and calculating & assigning resources to all the activities.
- Building a risk mitigation strategy a.k.a. risk register along with the project controls manager & project manager. Calculating risk value & assigning the same to the activities created in the project schedule.
- Proper use of CPM software like Primavera P6.
- Calculating the critical path and critical activities.
- Creating Narrative of the project plan.
- Creating & assigning baseline to the software.
- Proper analysis of the project schedule during initial preparation and during updation.

Figure 1. General Role of Planning Engineer During Planning Stage

- Time impact analysis (TIA), Proper budgeting monitoring (may be by using S-Curve), delay analysis (may be by using Planned vs Actual) and forecasting of upcoming activities.
• Accurately updating project progress by coordinating with site engineers along with project managers. Reporting to Sr. management & client via acceptable/agreed schedule progress report formats (like Dashboards, Weekly/Monthly progress reports) including change management reports. Highlighting areas of concerns. Raising flags on the delay of critical activities. Showing various variances through the software.

• Regular site visits.

• Continuous improvement of the reports to show the realistic progress.

• Capture lesson learned and how schedule varies throughout of the project life cycle.

Although a project may involve many variables such as scope, resource, time & budget to name few, the job of the planning engineer is to focus on the cost and schedule components of the project, while also assessing risks (Sanchez et al., 2017). The project controller might report to the planning engineer for one project or a portfolio of projects and vice versa. The planning engineer’s role is important for project control. They alert stakeholders to possible problems and help them correct course if necessary. Part of the job of the planning engineer is to oversee and manage the various factors that impact the price and time schedule (Kivilä, 2017). Planning engineer provides timely insights that allow project stakeholders to make the best decisions. (Baban et al., 2020)

Because the Indian construction industry lacks effective & transparent management, the use of planning engineers becomes more crucial for even monitoring small projects. Construction is a complex business that requires a large number of workers and engineers. To ensure transparency in the construction project, all levels of management and investors must work together. A survey conducted in 2018 found that 90% of participants agree with the effectiveness and efficiency of planning in construction projects. The poll also revealed a correlation between project success and the role of planning engineer. Respondents who rated project controls & planning engineer as "critical" were twice as likely to reach all project goals. Projects in which both were “not considered important” had been three times more likely to fail.

These results are a reminder of the importance of project control & planning engineer, especially considering the number of instances where major deviations from the initial project estimates have occurred in the past. No matter how large the project is, project managers know that unexpected problems, additional costs or delays will occur (Pishdad-Bozorgi et al., 2018). This applies regardless of whether the project is a large-scale construction project or a launch site for a small company. If the project manager isn’t able to anticipate and manage schedule, scope, delays and costs, they will lead to major cost increases and ripple effects throughout the organization. Hence, planning engineer needs to be deployed to overlook these critical items.

Let’s take a look at the various role & responsibilities of planning engineer along with the organizational chart:

**Implementing a Project Involves the Collaboration of Planning Engineer with Project Manager, Site Team and Other Related Departments**

Project collaboration is vital for the entire team to work together effectively. The collaboration with the project manager and the site team enables the planning engineer to carry out the managerial as well as technical project goals. The definite distinction in the responsibilities and delegation of the authority is pertinent before the actual project begins (Dixit et al., 2019). The ongoing discussions related to the project assistance in solving and preventing any conflict, which is vital for smooth operations. (Kordova et al., 2018)

Ideal Condition for Planning Engineer to work in an organization under Project Controls Manager as explained below through an Organogram:
Figure 2. Explains the Planning Engineer Position When Project Controls Department is Present in the Organization

Not an Ideal Condition for Planning Engineer to work in an organization directly under Project Manager as explained below through an Organogram:

Figure 3. Explains the Planning Engineer Position When Project Controls Department Don’t Exist in the Organization. Typical Indian Project Organization Hierarchy

Planning is Essential for Project Success
The planning engineer needs to complete project planning before the project execution begins and monitor the same programme throughout the project execution. For this, a detailed study and discussion with the involved professionals is a must. The ability to communicate with the project managers, operations head, site teams, and other departments is important (Zuo et al., 2018). Project planning is a guiding force & project plan is a tool for stakeholders, sponsors, and the project manager for avoiding any risk and reaching the goals/contractual completion date of the project in timely manner without budget overrun. (Malik et al., 2019)

Project Budgeting
Properly evaluate costs for each activity and understanding when deviations occur, budgeting must be integrated into project plan. The senior
management team along with project controls manager & project manager can use a transparent model to establish a budget baseline based on the contract BOQ or as per company standard templates with the help of planning engineer. For this, they should have the ability to understand cash flows and why they are important, or a workshop can be arranged for the same. (Blumentritt, 2006)

Let’s say one activity named ‘Concreting’ will be using resource like concrete with costing around INR 4,500 per cubic meter and Labour with costing around INR 300-400 per cubic meter. If ‘Concreting’ activity is assigned 1,000 cubic meter (cum) as a material resource, then the costing for the activity will be:

- **Concrete:** INR 4500/cum X 1000 cum: INR 4,500,000/- (Material Cost)
- **Equipment:**
  - Rental rates: INR 1.2 lacs/month i.e. INR 170/hour or a Concrete Pump cost around 04 lacs.
  - Pumping rate: 60-80 cum/hour i.e. total working hours will be 12-17 hours which vary accordingly.
  - Hence, the equipment cost for this concreting will be: INR 2125-2833/- which vary accordingly.
- **Diesel cost:** 04 litre/hour, so fuel cost will be INR 5000-6800/- which vary accordingly.
- **Labour:** INR 300/8 hours i.e. working for around 12-17 hours will be 300 X 02 X 05 Nos.: INR 3,000/- (Manpower Cost) which vary accordingly.

**Risk Management**

Risk management is easier when risk register is in place, prepared with the help of planning engineer. It’s possible to reduce the schedule impact by identifying risks early, monitoring them regularly (by updating the risk register), putting in place mitigation measures & keeping aside a contingency amount. It also helps to protect against future threats. (Siraj, & Fayek, 2019)

**Controlling the Schedule**

Projects that go over budget are often due to the combination of several factors but timely controlling the same can reduce the delay impact. It is because of this that effective change management cannot be underestimated. Projects can stay on track by using a "Change Log" to track changes and evaluate their impact. These change log can be shared with project controls department head and with sr. management for timely decision by planning engineer.

**Forecasting**

Planning engineer can improve the accuracy of estimates by having a clear understanding of the previous causes of overruns in price and schedule in other projects. It is essential to accurately measure progress in forecasting i.e. Physical percentage of work completed. The planning engineer can use a variety of forecasting algorithms and methods to make a prediction. They can predict the cost of the project anytime during the course of project by using CTC (Cost to Complete) when needed. The planning engineer can respond faster and take corrective actions if the project takes a wrong turn by providing regular and timely reports. (Leon, et al., 2018)

**Administration of Results**

It is essential to use and define KPIs (Key Performance Indicators) to monitor and forecast trends and project health (Bapat et al, 2021). According to a recent study, it was found that the use of the EVM tool improved the profitability of a particular project by +14.20%. (Proaño-Narváez et al., 2022). Planning engineer can calculate the Planned Value (PV), Earned value (EV) and Actual cost (AC) at any specified date to analyze the performance of the project. Planning Engineer is required for the same.

**Communication Management**

This is a technique that involves establishing procedures and systems to help team members communicate within & outside the organization. The goal is planning engineer to keep track of progress updates reports, record minutes of meeting (MoM), manage workflows & share these reports with the respective stakeholder as
per the communication matrixes, so that the execution team can focus on the actual progress rather than in these documentations (Abbasi et al., 2020). The use of the RACI Chart developed by planning engineer plays a crucial part in the communication/authorization process for making decisions in the project.

Problems Encountered During the Implementation of Role as a Planning Engineer in Indian Construction Industry

While the importance of planning engineer has become more accepted, companies must remember the following:

1. How successful is it being implemented within the business?
2. Is it producing the expected results?
3. Is the data reliable?

Many organizations place blame on their planning engineers for the project failure. It is now time to check if control mechanisms were properly applied (Abbasi et al., 2020).

See a list of issues and roadblocks encountered when deploying planning engineer:

**Lack of support from the top management:**
In India, it is a major problem in the construction industry. Monitoring is considered a passive work. Project managers given overall responsibility to control the project and take decisions leading to no transparency left in the system as execution and reporting comes under single authority. Project Managers thus influence these reports according to their leverage and present the wrong planned vs actual reports to Sr. management leading to wrong decisions being taken by them, thus affecting both time and cost of the project. Planning engineers cannot achieve their goals without autonomy and authority. Hence, its always better that planning engineer either work under project controls or directly reports to Sr. management.

**Perception towards deployment of Planning Engineer as overhead:** Planning Engineer keeps on working behind the shadows of various other managers, hence, Sr. management thinks that planning engineer is not contributing to the project success. As per experience, one can predict that a single planning engineer can cost anywhere from 0.05% to 0.13% of a project’s budget. However, planning engineer can help save anywhere from 05% to 15%. Hence, Sr. management should encourage to deploy or provide required training to their existing planning engineers to perform better.

**Management is more focused on project delivery and gives greater powers to the site execution team:** The Site Execution team uses this perspective of Sr. management to their advantage and manipulates site progress reports according to their requirement. This leads poor decision-making by Sr. management that negatively impacts project time and cost. Instead of focusing on me-versus-you, this can be solved by forging alliances. Firms can achieve success by integrating the role of planning engineer with other elements (Bhuiyan et al., 2019). Planning engineer are not people who stop work at site or bring bad news about the project, this perspective needs to change as planning engineer is the only one raising all the required flags at the right time.

**Out-of-date and Manual processes:** Even if the management team is aware of the importance of the job of the planning engineer, deployment of planning engineer will still not yield results (Singh et al., 2018). Many companies still rely on manual processes and slow spreadsheets to manage and track progress reports and change requests. They are more likely to produce inconsistent, not adequate, not transparent data and remain fragmented than they are to provide comprehensive insights.

**Aims and Objectives**

The prime aim and objective of the study is to answer the following questions:

1) Importance of Planning Engineer.
2) Roles and Responsibilities of a Planning Engineer.
3) Use of latest planning software by Planning Engineer for better planning, scheduling, monitoring, and controlling.
4) Transparent progress reporting by planning engineer.
5) Proper cost controlling by planning engineer.

Methodology
This study employs quantitative research, and both primary data and secondary data are collected. To collect primary data, this study employs a survey technique. This survey questionnaire is used to evaluate the state of Indian construction and plan for planning engineers. Secondary data is also included in this study. Secondary data is information that was previously published in magazines, newspapers, journals, and other online sources. This study uses some of the past publications and journals to gain a better understanding of India's construction industry and how planning engineer works.

The methodology used is Interpretive Structural Modeling (ISM). ISM is a technique to methods the interrelationships linking elements of interest in a specific domain via experts' knowledge of the context of the elements. (Watson, 1978).

Results
This article contains both primary and secondary data. The survey asks people who are directly or indirectly involved in the Indian construction industry. There were 140 respondents to the survey. Participants responded via email to the survey questions. Many participants pointed out that the Indian construction industry's traditional project management system is ineffective. The challenges encountered during project controls implementation also affect the deployment of planning engineer. The ineptness of project managers and their failure to properly manage project was the main reason responsible for time and cost delay on the project.

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Issue</th>
<th>Responses in percentage</th>
<th>Total Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The sr. management still follows traditional method of progress reporting and consider that any engineer can produce these reports.</td>
<td>16%</td>
<td>140</td>
</tr>
<tr>
<td>2</td>
<td>Inadequate training of existing staff on planning techniques, methods and latest software.</td>
<td>23%</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>The lack of understanding of project management tools and techniques by sr. management and site team</td>
<td>15%</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Sr. Management control and regulation are not adequate and out-of-date</td>
<td>14%</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>No Project controls department</td>
<td>19%</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Conflict between Project Manager &amp; Sr. Management on deploying of planning engineer</td>
<td>09%</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Lack of experience in the field of planning and project management of existing staff but still he/she feels they know all about project planning and scheduling.</td>
<td>04%</td>
<td></td>
</tr>
</tbody>
</table>

Participants identified seven issues as the biggest problems in the Indian construction industry. Apart from this, 87% of participants agree that the onsite execution team don’t care about the progress reporting. Hence, planning engineer needs to be deployed at site for regular progress updates.

Following hypothesis was used for data analysis and interpretation. Questionnaire survey was created and circulated among the 140 participants and results were collected via email. Mainly participants were from infrastructure and heavy civil construction industry. Participants include planning engineer, site engineers, construction managers, project managers, project controls manager & sr. management. Medium and large organizations are only considered for the survey.
• HR1: Importance of Planning Engineer in an organization

• HR2: Planning Engineer helps in smooth monitoring controlling of the project

• HR3: Transparent Progress reporting of the project by deploying Planning Engineer

• HR4: Usage of Planning Software at optimum level by Planning Engineer

• HR5: Cost controlling is better when project is monitored by Planning Engineer

The results can be seen with the help of the following graphs:

![Figure 4. Importance of Planning Engineer in an Organization](image)

![Figure 5. Planning Engineer Helps in Smooth Monitoring Controlling of the Project](image)

![Figure 6. Transparent Progress Reporting of the Project by Deploying Planning Engineer](image)

![Figure 7. Usage of Planning Software at Optimum Level by Planning Engineer](image)

![Figure 8. Cost controlling is Better When Project is Monitored by Planning Engineer](image)
Together with the engineering & execution staff, the planning engineers make sure that the projects are delivered on time. They develop and put strategies into action, figure out labor and material costs, evaluate execution team performance, and prepare communication matrixes. Planning engineers additionally analyze data, produce reports, & deliver presentations when needed thus digitalized all the reports for easily accessibility.

Discussion

Indian project management is plagued by major problems that affect the efficiency and quality of the Indian construction industry. Many errors and delays are caused by traditional project management techniques still used in the construction industry (Baban et al., 2020). Delays on construction sites can also lead to budget increases. Project Management Institute (PMI) states that every international development project has budget and time overruns. According to reports (Sagarkumar, 2020), more than 40% of Indian building projects had time overruns between 1 and 252 months. Further as per report published by KPMG & PMI in association by MoSPI in 2012 states that non-availability of highly skilled professionals can have an adverse impact on the project delivery and cost. By 2022 Indian infrastructure sector is expected to have a shortage of around three million project professionals including project planners. Hence, it is imperative to increase investment in training and mentoring to develop the requisite skill set in the available professional in the company.

Planning Engineer plays an important role in project management. It requires skills, knowledge, and tools to create a baseline project and then to perform an assessment to ensure that accurate and timely information is provided. Participants in the survey identified a lack of coordination between planned expense and actual expense as a major obstacle to controlling project costs effectively and meeting deadlines.

One senior construction executive assert that project management in India lacks its true meaning. It requires the integration of time and costs, which is often not the case. Implementation of construction project management is often done in a half-hearted fashion, with minimal investment and poor training. This is because there is not enough management buy-in. All employees must be taught project management skills by their line managers. They should also receive all the support and encouragement they need. This is because project team members lack project controls knowledge and training. Experts believe that planning engineers & project managers would be more effective at project controls if they had more knowledge of the latest project management methodologies like Prince2, Agile or Scrum. People believe planning engineer is all about Gantt charts. Sr. Management don’t understand terms like "earned value management (EVM)", time impact analysis (TIA), histograms or "S curves." It is essential that a business commits to completing projects on schedule and within budget. It must establish the right project control procedures and structures, and train employees to use them.

The contractor generally executes and manage projects in India. This includes creating, maintaining schedules and generating status reports. Hence, a competent project controls teams should be deployed by the contractor. Public initiatives are used to improve transparency in the system. It is important to increase the effectiveness of planning, execution, monitoring and controlling.

Conclusion and Suggestions

Planning engineers are known for their data-driven approach and meticulous attention to detail. In the event of a cost overrun, the project managers would like to know the exact reason for it, how much it costs, and what can be done to fix it. A fully integrated solution by planning engineer has many benefits, including lowering costs and improving efficiency.
Implementing proper project control can help India's construction industry achieve new heights. The Indian construction industry is flourishing due to India's expanding economy, growing demand, and increasing international investor interest. The core features of today's world, "Transparency", "Adaptability", "Sustainability" and "Digitalization", are key to improving the image of Indian construction industry around the world. All stakeholders, including vendors, clients, and contractors, should acknowledge them. It is becoming increasingly obvious that the current processes and methods are flawed. It is also easier to understand the industry's future challenges. Because of the labor-intensive and traditional sector, implementing project controls can be difficult. It is crucial to receive support from the construction industry experts to make Project controls a success. This includes hiring and training current employees in project controls. The software is effective in the domain of project control. The entire process needs to be reviewed and improvements should be made. Hence, if implementing Project Controls is a difficulty, then at least company must deploy a planning engineer who directly reports to sr. management about the project progress and raise flags wherever necessary.

You'll need top-quality Planning Engineers for your project. They are going to produce the blueprints, analyze the survey data as well as work with a variety of specialists to figure out everything from the initiation to completion of the project. Planning engineers must make certain the structure is safe and long-lasting, and not just appealing to the management.

There are numerous benefits that an engineer can get from understanding project management. A planning engineers' who already have a degree in civil engineering combined with the knowledge of project management enables them to develop and use outlines for better project implementation. Their capability to identify problems early in the project also assist them to reduce risks.

**Recommendations**

India's project planning process is managed in markedly different ways by the public and private sectors. This is due in large part to insufficient transparency, corruption, excessive bureaucracy, and poor project execution. These issues call for reforms in government policies and the implementation of public-sector activities. To keep up with the growing market demand, efficiency and productivity in India's construction industry must improve. The industry must implement project controls, must hire planning engineer & implement international recommended guidelines for project planning to remain competitive. Digitalization by using latest software is must.

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