

To Study The Requirements Of Technical Skills For Civil Engineers In Construction Management Domain

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Abstract- *One of the main pillars of the Indian economy is the construction sector. The industry has the potential to expand further as a result of urbanization, industrialization, and economic development. Since 2007, the construction sector has contributed more than 8% of the GDP to the national economy. India is expected to maintain its position as one of the nations with the fastest-growing construction output over the next ten years. Construction is India's second largest economic activity after agriculture, accounting for 6 to 9% of GDP over the last five years while growing at an annual rate of 8 to 10%. Construction investments were reported to be close to USD 50 billion in 2008, with continued growth expected for the rest of the decade. In short construction industry in India is growing very rapidly. With this there is a huge demand for the technical manpower by the industry. But on the other hand, industry always finds a gap in the technical skills that are required by the civil engineers. In this project we will try to study the demand of the construction management industry so that the coming generations can prepare themselves in the better direction and get ready for the evolving landscape of construction management.*

workers with the necessary training persist. As a result of a significant gap in technical and managerial knowledge is noticed by the engineers who are handling the site.

The construction industry is the backbone of infrastructure development, continuously evolving with advancements in technology and project complexities. Civil engineers play a pivotal role in this domain, ensuring the successful planning, design, and execution of construction projects. However, the transition from a purely technical role in civil engineering to a multifaceted role in construction management necessitates a broader skillset.

This dissertation aims to investigate the specific technical skills required by civil engineers venturing into the construction management domain. By understanding the current industry landscape and the evolving needs of projects, we can bridge the gap between engineering expertise and effective construction management practices.

This research will explore the technical skill requirements across various stages of a construction project's lifecycle. This includes skills in areas like:

I. INTRODUCTION

The government, through a series of initiatives, is working on policies to attract significant investor interest. Over the last five decades, the Indian construction sector has served as a growth engine for the Indian economy, becoming a critical input in the country's socioeconomic development. Construction is India's second largest economic activity after agriculture, accounting for 6 to 9% of GDP over the last five years while growing at an annual rate of 8 to 10%. Construction investments were reported to be close to USD 50 billion in 2008, with continued growth expected for the rest of the decade. A noteworthy contribution to employment is made by the industry, which in 2008–2009 generated 31.46 million jobs, of which 1.25 million were in engineering. According to government data, the need for labor for construction is expected to increase at a steady rate of 8%–9%, adding about 2.5 million new jobs to the current stock each year, of which 125,000 are engineering jobs. Despite the industry's economic significance and capacity to create jobs, problems with low productivity, restricted mechanization, and a shortage of

- **Construction Materials and Methods:** A thorough understanding of advanced materials, innovative construction techniques, and their applicability to different project types.
- **Planning and Scheduling:** Proficiency in project scheduling software, critical path method (CPM) analysis, and resource allocation to ensure efficient project execution.
- **Quality Control and Assurance:** Implementing quality control procedures, interpreting relevant codes and standards, and ensuring adherence to specifications for material selection and construction practices.
- **Construction Cost Estimation:** Developing accurate cost estimates, considering material costs, labor rates, and equipment needs for project budgeting and financial management.

By analyzing the technical skills demanded by industry professionals and academic institutions, this dissertation aims to provide valuable insights for both civil engineering graduates and construction companies. The findings can contribute to curriculum development programs, bridge the skill gap for new entrants, and enhance the overall efficiency and effectiveness of construction projects.

II. IDENTIFY, RESEARCH AND COLLECT IDEA

In this project, we will interact with professionals who have been working in this industry for a prolonged period. Then we will create a questionnaire that will first ask for the industry's problems, specifically in construction management projects, and then we will focus more on improving the human resource problem in the construction management industry. To begin, we will identify the technical skills in high demand by the industry while recruiting engineers for construction projects. We will try to analyze the impact of having technically sound engineers on infrastructure projects in terms of time, cost, and quality. We plan to interview professionals in the field such as retired secretaries, superintended engineers, executive engineers, and PWD department deputy engineers. We will meet directors of engineering consulting firms, project managers of contracting firms, some assistant managers, and project directors as a result of this. We will attempt to analyze the industry's demand after receiving feedback and responses from industry professionals.

III. WRITE DOWN YOUR STUDIES AND FINDINGS

We will interview industry experts and create a questionnaire in order to gather and properly analyze the industry's demand. This survey will assist us in analyzing the outcome.

The steps involved in project are as follows:

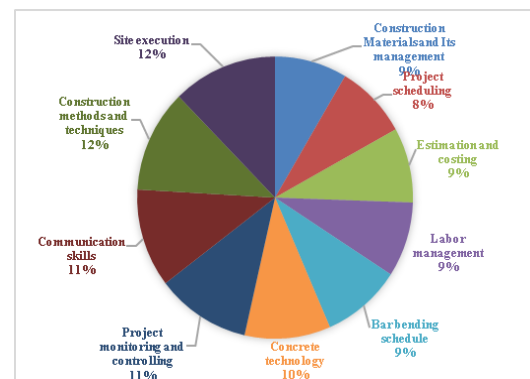
1. Putting together a questionnaire
2. Scheduling appointments with industry experts
3. Carrying out an interview
4. Examining the answers
5. Report Preparation

While framing a questionnaire rating were given for every subject from 1-5. This methodology is known as scaling on rate method.

- 1) for not important skills
- 2) for rarely important
- 3) for Moderately important skill

- 4) for Very important skill
- 5) for Most important skill

Analyzing the responses: Quantitative research approach was adopted through in-depth understanding of the existing literature in the area of skills and skills shortage as well as their effects on construction projects. This allows for formulation of a clear research question for acquiring necessary information for the study. Using survey method, questionnaires were administered on respondents with adequate knowledge of the skills shortage issue in the construction industry



The pie chart illustrates the responses collected from experienced professionals in the construction industry regarding the essential technical skills required for civil engineers in construction management. The data, segmented into various skill categories, highlights the relative importance of each competency.

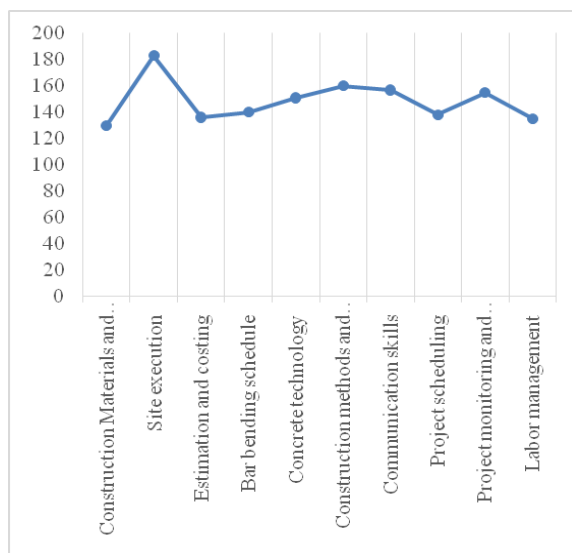
Site execution tops the list with 12%, indicating it as the most critical skill. This emphasizes the necessity for civil engineers to effectively oversee and manage on-site activities, ensuring that projects are executed according to plans and specifications.

Project monitoring and controlling and *communication skills* each account for 11% of the responses. The significance of project monitoring and controlling reflects the need for continuous oversight and adjustment to keep projects on track. Communication skills are equally important, underscoring the need for clear and effective interaction among stakeholders, team members, and clients.

Concrete technology follows closely with 10%, highlighting the importance of understanding concrete properties and applications in construction projects. The ability to manage concrete work effectively is crucial for structural integrity and project success.

Each of the following categories – Construction Materials and Its Management, Estimation and costing, Bar bending schedule, Labor management, Project scheduling, and Construction methods and techniques – represents 9% of the responses. These skills are essential for detailed planning, resource management, cost estimation, labor supervision, and implementing effective construction methods.

Overall, the chart indicates a balanced requirement across various technical skills, with site execution, project monitoring, and communication skills being slightly more emphasized. This distribution suggests that a well-rounded expertise in both technical and managerial aspects is vital for civil engineers in the construction management domain.



The line chart presents the importance of various technical skills for civil engineers in the construction management domain, based on feedback from seasoned professionals in the construction industry. The vertical axis represents the number of responses, while the horizontal axis lists the different skill categories.

Site execution stands out as the most critical skill, peaking at around 190 responses. This indicates that the ability to manage and oversee on-site activities is paramount for civil engineers, ensuring projects adhere to plans, timelines, and safety standards.

Following *site execution*, skills such as *Communication skills*, *Concrete technology*, *Construction methods and techniques*, and *Project monitoring and controlling* are also highly valued, each garnering responses between 150 to 160. *Communication skills* are essential for effective collaboration and coordination among stakeholders, while concrete technology is crucial for

understanding the properties and application of concrete in construction projects. Construction methods and techniques, along with project monitoring and controlling, emphasize the need for proficiency in modern construction practices and the ability to keep projects on track through continuous oversight.

Construction Materials and Its management, *Estimation and costing*, *Bar bending schedule*, *Project scheduling*, and *Labor management* received responses in the range of 130 to 150. These skills are critical for detailed planning, resource management, accurate cost estimation, scheduling, and managing labor forces effectively.

Overall, the chart highlights that while site execution is seen as the most crucial skill, a comprehensive skill set encompassing communication, technical knowledge, modern construction techniques, and effective project management is vital for civil engineers in construction management. This balanced distribution underscores the multifaceted nature of the role and the need for a diverse skill set to succeed in the industry.

IV. CONCLUSION

This chapter presents results of responses received from the respondents. It also shows the relative importance index and planning implementation level of various studied factors for the above-mentioned group of respondents. This study involves a questionnaire survey approach from which statistical data was collected to answer questions in respect of the main subject of study. Questionnaire is the main tool used. Figure 4.1 represents the percentage of responses received from representatives of civil engineer, contractor, consultant.

Relative Importance Index and Planning Implementation Level:

This section analyzes the data collected through the questionnaire to determine the relative importance of each technical skill identified by the respondents. The Relative Importance Index (RII) will be calculated based on the weightage assigned to each skill by the participants. Additionally, the planning implementation level will be assessed, indicating how frequently these skills are actively used during project execution. This analysis will help identify the most crucial skills that civil engineers in construction management should possess and highlight areas where there might be a gap between perceived importance and actual implementation.

Data Validation and Industry Insights:

To ensure the comprehensiveness of the findings, follow-up interviews were conducted with industry stalwarts. These interviews served two purposes: data validation and gathering deeper insights into specific technical skills and emerging techniques. By discussing the survey results with experienced professionals, we can confirm the relevance of the identified skills and gain valuable knowledge about the latest trends and advancements in construction management practices. This combined approach provides a more robust understanding of the technical skill requirements for civil engineers in the field.

Skill Gap Analysis and Recommendations:

Based on the RII, planning implementation level data, and insights from industry experts, a skill gap analysis will be conducted. This analysis will identify any discrepancies between the skills deemed important and those currently being implemented on construction projects. By pinpointing these gaps, the study can offer targeted recommendations for educational institutions and construction companies. The recommendations might suggest revisions to civil engineering curriculum to emphasize the most critical skills, or propose training programs for existing professionals to bridge the gap between theoretical knowledge and practical application.

With reference to this survey, we again meet few industry stalwarts for data validation and deeper inside knowledge of skills and specific techniques that are required in the industry.

Following are the Key technical skills required corresponding to each and every topic.

1. Site execution
 - A. Surveying technique by total stations
 - B. Mapping L-Section and cross sections of cross drainage work during preliminary survey.
 - C. Laying of various layer of road and its compaction with optimum moisture content in case of flexible road
 - D. Laying of dry lean concrete according to desired levels of road top level.
2. Construction methods and techniques
 - A. Steel and barb bending of RCC members of various CD Works and structures.
 - B. Pump concreting by these members with high level of safety and precision.
 - C. Use of concrete boom
 - D. Providing pitching and protection work to embankment of the road section.

3. Project monitoring and control
 - A. Project scheduling on software's like Microsoft project and Primavera.
 - B. Finding critical path of the project and following in on site.
 - C. Earned value analysis of project at very small milestone.
4. Communication skills
 - A. Project coordination with various stakeholders
 - B. Noting meeting minutes and following them on site
 - C. Keeping updated with revised /Updated project drawings and following them on site.

- Construction industry is a people oriented one with the presence of various forms of skilled to unskilled labor. These people are multidisciplinary but their focus is to deliver their services to enhance sustainable project performance for the satisfaction of clients and other stakeholders.
- The shortage of necessary skills in the industry has been on the increase as observed from reviewed literature materials, which prompt this study to examine the effect of the phenomenon on sustainability of construction project and the industry at large.
- Skills shortage in the construction industry leads to such issues as project cost increase, project delay, reduction in quality, increase in number of accidents on site, rework and low productivity of workforce. Other effects include reduction in organization's competitiveness, complete failure of the enterprise failure, rise in construction workers' pay and decrease in the number and size of building and construction labor sector.
- The availability of necessary construction skills affects the success of project in terms of sustainability, quality, cost, time, health and safety as well as satisfaction of stakeholders. To manage the situation, there is a need for absorbing and training of more skilled workforce in the construction industry, that is, artisans and professionals, to enhance performance of construction projects.
- In view of this, construction firms and other associated ones from both public and private sectors should invest in training, research and developing their employees cutting across various departments of the organization.
- There is also a need for government agencies such as Construction Education Training Agencies (CETA), to invest in technical schools with a view to introducing youths to construction related disciplines at early stages of their education.

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