Analysing the Impact of Productivity in Indian Transport Infra Projects

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Abstract. The study's purpose is to analyze the impact of productivity in Indian transportation infrastructure projects. The study's methodology is to identify and analyse productivity attributes based on a literature review and expert focus group interviews. The identified attributes were identified and examined based on the respondents' relative weight. The data was gathered using a structured questionnaire across India, using both online and offline methods. SPSS 21 software was used to analyse the collected data. To analyse the collected data, quantitative research methodology was used, and the following tools and techniques were applied to the data: Reliability analysis was used to ensure the consistency of the data collected for the study, and the Relative importance index (RII) was used to set priorities and rank the attributes based on the weighted average score provided by the respondents. The study's findings show that planning and scheduling have the greatest impact on productivity in Indian transportation infrastructure projects, followed by construction methodology, storage area, poor construction method, and direction and coordination, with relative importance indexes (RII) of 0.79, 0.78, 0.77, 0.76, and 0.74, respectively. This study contributes to the current knowledge bank by identifying and analysing the impact of productivity in Indian transportation infrastructure projects. The study provides a solution for construction managers and project managers to apply the study's findings to their projects in order to control the issues of low productivity and project delays.

Keywords: Transportation; Infra Projects; Construction Productivity; Sustainability; Project Management.

1. Introduction
The Indian construction industry is diverse, fragmented, and appears to be un-organized. One of the most pressing issues for the industry has always been a skilled and qualified workforce. Because of the unique nature of the job, coordination, timely delivery, and quality have always been a source of concern. The construction industry in India is unorganized, and the majority of the workforce employed is uneducated and ignorant of sustainable practices, with only commercial viability as a motivator, with all other factors such as quality, sustainability, health and safety, and operability being ignored. The majority of construction projects in India are experiencing construction delays, budget overruns, poor quality, and low productivity. Low construction productivity is one of the major issues affecting the completion of construction projects on time and within budget.

The productivity could be measured at various levels, but there are three main measures of productivity are metronomic, case and pricing studies [1]. On the other hand, site-based productivity comparisons
(case studies) were preferred because they help construction entities to find out the area of improvement and they can easily link them to their activities [2]–[4]. The financial wealth of nations is determined by their productivity growths. The nations experienced higher productivity growth translated into increases in the average wages of the workers, which contributes to the profits and tax revenue collection of the agencies. Although a few researchers try to understand the relationship between skill development and productivity in the construction industry. The trend is not consistent over time due to a number of reasons such as unplanned training sessions, consistency of skill development courses and the decrease in the number of participants [5].

With an average growth rate of 6-7 percent, the Indian economy is one of the fastest growing in the world. The construction industry in India is the second largest employer after agriculture and contributes about 10% to the economy on average. It will expand further as the rate of urbanization, followed by green and brownfield developments. To bridge the gap, the Indian government has implemented a number of policies, including the Smart Cities Mission, the Atal Mission for Rejuvenation and Urban Transformation (AMRUT), the Swachh Bharat Mission, Heritage City Development, and the Augmentation Yojana (HRIDAY). These missions will also help to increase productivity in Indian transportation infrastructure projects [6]–[11]. Construction productivity has been the area of interest for the research since the last 4-5 decades. A number of studies have been conducted in the field which includes: analysis of productivity, measurement techniques, causes of low productivity, factors affecting construction productivity and other studies.

2. Literature review

Table 1 previously identified attributes for productivity

| References | Attributes of productivity |
|------------|---------------------------|
| [12]–[16]  | Planning and scheduling, Rework, Poor supervisor competency and Incomplete drawings |
| [12]–[20]  | Tools and consumables, Coordination, Materials, Labour skills |
| [12]–[23]  | Coordination, rework, supervision errors, drawing management, and construction equipment |
| [12]–[26]  | Drawings, delay in response to information, truck availability, and material availability |
| [12]–[29]  | Shop drawings, equipment’s, motivation and support, and scheduling |
| [30]–[33]  | Coordination and communication, timely feedback, owner’s competence, favourable climatic condition, coordination among all team members, leadership, top management support, budget update, and the flow of funds |

Productivity has been one of the most researched topics in the Indian construction industry in the last few decades. Factors affecting productivity may have a short-term or long-term effect on the project, some affect the productivity for a short duration but have a ripple effect on it. Productivity consists of various attributes like labour, finance, infrastructure, plant & machinery, facilities etc. Various studies in different countries have been carried out to identify the factor affecting labour productivity. Various methodologies and approaches have been adopted by researchers who have come with different schemes in the categorization of factors affecting productivity. [34] Proposed an analysis technique to measure capital productivity changes by the evaluation of factors influencing productivity levels in the
construction industry. And applied it in the Australian construction industry. The research discoveries are relied upon to be useful for settling on strategy and key choices to enhance the capital productivity execution[35], [36].

3. Methodology

For this research paper, a quantitative research approach was used to identify the factors influencing the productivity of transportation infrastructure projects in India. The data was gathered using Question survey. A total of 115 valid questionnaires were received, yielding a response rate of 35%. All of those responded to the survey had prior experience working on transportation infrastructure projects.

3.1. Data collection

The data for the study were gathered through a structured questionnaire survey of 115 construction professionals and academicians from across India in order to attain the intended goal. The questionnaire consisted of 16 questions that attempt to cover the major factors that influence productivity. The factors were discovered with the assistance of various research on construction labour productivity. People with the necessary credentials and experience answered the questionnaires, so it can be safely assumed that the data obtained is accurate that can be used for the study because the respondents are knowledgeable associated with labour productivity and the factors that affect construction labour productivity.

3.2. Relative importance index

The received responses by the respondents were summarised in an Excel data sheet and the data analysed using SPSS software. Relative importance indices (RII) is performed to determine the priority of the significant factors and then followed by Reliability analysis performed to check the consistency of the data received.

\[
\text{RII} = \frac{\sum_{r=1}^{5} r^* n_r}{5N}
\]

r is the rating on a Likert scale (1-5) as for the impact on construction efficiency for a specific element influencing construction profitability, \( r \) is the number of respondents providing a specific Likert scale rating \( r \), \( N \) is the aggregate number of respondents to a specific question [37]–[39]. The respondents were asked to rate the questions using a five-point scale ‘5’ being the very high, ‘4’ high, ‘3’ moderate, ‘2’ low, ‘1’ very low impact on productivity.

4. Results and discussion

4.1. RII

As per the study's findings, the most significant attributes influencing the productivity of transportation infrastructure projects in India are planning and scheduling, followed by method of construction, storage facility, poor workmanship technique, and direction and coordination, with relative importance indexes (RII) of 0.79, 0.78, 0.77, 0.76, and 0.74, respectively. The top five most important attributes have similar RII values. This finding needs to be validated, so a two-step cluster analysis was performed on the top five most important attributes to identify the main prediction models out of the five.

| Rank | Total Responses | Total Score | RII | Attributes affecting the productivity of Indian transport Infra projects |
|------|-----------------|-------------|-----|---------------------------------------------------------------------|

3
5. Conclusion and recommendations
The construction industry's productivity has been studied and documented all over the world, and it advantages from over four decades of studies that has developed models, identified the factors affecting productivity, industry-level studies, the study of equipment and technology to improve productivity, and techniques to measure and improve construction productivity. As a result, construction and labour productivity are both increased [40], [41]. Several studies have been conducted to determine the factors that influence construction productivity, and the findings include the business culture, education level, tools and technologies used, values and ethics of the people and workers involved, politics, local laws and regulations governing the project, HR policies of the organization, importance given to the employee, religion of the peasant, and religion of the peasant. Smart cities and their parameters are being defined. The current study identifies the factors affecting the productivity of the Indian infra transport projects using a structured questionnaire survey approach, followed by the relative importance index. This study also highlights the importance of productivity in transport infra projects and provides a ranking of the most significant attributes impacting the productivity of transport infra projects in India.

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