



## Factors Affecting Worker Productivity in Building Construction: An Analysis of Underlying Causes

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**Abstract** - The construction sector plays a pivotal role in global societal objectives and economic development. Recognizing the significance of construction productivity is crucial, as it directly impacts the economy and costs borne by government agencies. This research paper aims to identify the underlying causes of variables that affect worker productivity in the building construction industry. To accomplish this, a standardized questionnaire is employed to investigate all potential components that may influence worker productivity. The survey results are subsequently analyzed using the Relative Importance Index, a quantitative technique that prioritizes criteria based on their relative significance. The findings of this research can inform decision-makers, project managers, and industry professionals about the critical areas that require attention to optimize worker productivity and minimize delays and cost overruns in building construction projects.

**Keywords** – Construction sector, worker productivity, economic development,

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### 1. INTRODUCTION

The construction industry is widely recognized as the largest and most demanding sector on a global scale. To enhance productivity in this industry, strategic management of human resources plays a crucial role. Maximizing the utilization of human resources can have a significant impact on productivity growth. Construction projects primarily rely on manual labor and the basic use of hand tools and equipment, with labor costs representing approximately 30% to 50% of the total project cost. In India, the construction industry is experiencing rapid growth and ranks among the fastest-growing sectors worldwide, offering the second-largest employment opportunities after agriculture [1]. With a contribution of approximately 8% to the total GDP, it directly or indirectly employs around 35 million people. However, one of the major challenges faced in the construction industry is the availability of unskilled labor, resulting in productivity losses, cost overruns, and delays. The efficiency of the labor force, including their familiarity with the materials, tools, and

machinery used in the construction process, greatly influences the productivity of construction projects.

Extensive research has highlighted the detrimental effects of poor construction management practices, resulting in inefficient performance and wastage of efforts at different phases of construction projects [2]. Although researchers have made efforts to address some of these challenges and improve construction productivity, many issues still remain unresolved. Identifying and analyzing critical factors influencing construction productivity is crucial for the development of effective methods and strategies to enhance productivity in the future.

Productivity has long been a subject of interest for industrial psychologists. Extensive literature, including texts, articles, and research studies, has been devoted to this controversial topic. While the significance of productivity is widely acknowledged, there is still a lack of complete understanding of the concept. Undoubtedly, the maintenance and improvement of productivity have a direct impact on the Indian economy and the standard of living for its people.

## 2. Labor Productivity in Construction

The construction industry is a distinctive sector characterized by its diversity, fragmentation, and the production of unique products. Defining labor productivity within this industry is equally challenging as in other industries. Due to the industry's varied products and inputs, measuring labor productivity remains a complex task. Labor productivity can be understood as the work accomplished (output) by workers (input) within a specific timeframe, considering the labor-capital ratio. For instance, it can be quantified by the number of blocks laid or kitchen tiles installed per hour. Employing this definition uniformly across the construction industry would provide a solid foundation for measuring labor productivity and ensuring consistent standards and shared understanding when discussing this matter [3].

Measuring productivity is essential for identifying inefficiencies within organizations and their departments, allowing for necessary corrective actions. However, there is a lack of consensus among industrial executives and theorists regarding the criteria for designing productivity indices [4].

Economists take a broader perspective when utilizing productivity measures. Their main objective is to study entire economies and compare productivity across industries or companies. They calculate comprehensive indices by considering labor as the primary input and converting other factors into manpower equivalents. This is achieved by dividing the values of these input factors by the average income of the relevant group of employees. The result is a total number of "man-years" that, when divided into the output per year, provides the measure of "output per man-year":

$$\text{Output per man-year} = \frac{\text{Sales output}}{\text{Labour (live)} + \text{Labour (materialised)}}$$

$$\text{Where, Labour (materialized)} = \frac{\text{Capital} + \text{external expenses}}{\text{Average earnings per annum}}$$

On the other hand, engineers, who focus on resource utilization within a company, have a vested interest in measuring productivity based on these resources. Their goal is to assess the effective utilization of resources, typically excluding manpower and cash resources, and instead emphasizing physical assets. Engineers prefer quantitative measures such as production times, labor requirements, material usage, waste levels, space utilization, machine utilization, and similar metrics to gauge productivity, considering it synonymous with efficiency [5].

Increased productivity offers numerous benefits. However, it is important to note that productivity improvement is not without costs. Investments are necessary for research and development, education, training, as well as the direct costs associated with studying existing productivity levels and designing and implementing better methods [6]. Unfortunately, many companies in the construction industry and beyond fail to acknowledge this reality.

This paper focuses on analyzing the elements that impact project performance and lead to a decrease in workers' productivity within the Indian construction industry. It also aims to identify and rank the factors influencing labor productivity in Indian construction projects while critically reflecting on the existing challenges. By addressing these objectives, this research aims to contribute to a comprehensive understanding of the current status of the Indian Construction Industry (ICI) and provide valuable insights into key strategic drivers that can enhance labor productivity. The findings of this study will enable industry professionals and stakeholders to develop effective strategies and interventions to improve productivity levels in the Indian construction sector.

### **3. RELATED WORK**

The construction industry is known for its complex and dynamic nature, involving numerous factors that influence project performance and productivity. This literature review examines several relevant studies that shed light on different aspects of construction safety management, labor productivity, efficiency, and management strategies.

Tam, Zeng, and Deng (2004) conducted a study on poor construction safety management in China. They identified key elements that contribute to safety issues in construction projects and highlighted the importance of effective safety management practices. Their research emphasized the need for improved safety measures to enhance overall project performance.

Kadir, Lee, Jaafar, Sapuan, and Ali (2005) focused on factors affecting construction labor productivity in Malaysian residential projects. Their study explored various aspects such as work environment, labor skills, project management, and resource allocation. They found that effective project planning, proper coordination, and skilled labor were crucial for enhancing labor productivity.

Coelli, Rao, O'donnell, and Battese (2005) provided an introduction to efficiency and productivity analysis, offering a conceptual framework for assessing productivity in different industries. While not specific to the construction sector, their work provided valuable insights into the principles and methodologies of productivity analysis, which can be applied to construction projects.

Kazaz and Ulubeyli (2007) investigated the drivers of productivity among construction workers in a developing country. Their research highlighted the significance of factors such as worker motivation, skill level, work environment, and management practices. They emphasized the need for effective human resource management strategies to enhance productivity in the construction industry.

Doloi (2007) explored the relationship between motivation, productivity, and management strategies in construction projects. The study emphasized the importance of twinning motivation and productivity to achieve successful project outcomes. It highlighted the role of effective management strategies, including clear goal-setting, efficient resource allocation, and collaborative decision-making, in maximizing productivity.

Enshassi, Mohamed, Mustafa, and Mayer (2007) conducted a study on factors affecting labor productivity in building projects in the Gaza Strip. The research identified various factors, including labor-related issues, equipment availability, project management, and economic conditions, that influenced productivity in the region. The study emphasized the need for improved labor management practices and resource allocation to enhance productivity.

Doloi (2007) explored the relationship between motivation, productivity, and management strategies in construction projects, as discussed in the previous literature review. The study highlighted the importance of aligning motivation, productivity, and management approaches to achieve successful project outcomes.

Kazaz, Manisali, and Ulubeyli (2008) investigated the effect of basic motivational factors on construction workforce productivity in Turkey. The study identified key motivational factors, such as fair compensation, career advancement opportunities, and a supportive work environment, and their impact on labor productivity. The findings emphasized the significance of addressing motivational factors to enhance productivity in the construction workforce.

Schmid and Adams (2008) examined motivation from the perspective of project managers in project management. The study explored the role of intrinsic and extrinsic motivation in driving project managers' performance and project success. It highlighted the importance of understanding and addressing motivational factors in project management to ensure effective leadership and team performance.

Kaliba, Muya, and Mumba (2009) focused on cost escalation and schedule delays in road construction projects in Zambia. The study identified factors contributing to cost escalation and schedule delays, including poor project planning, inadequate supervision, and procurement-related challenges. The research highlighted the need for effective project management practices and proper project planning to mitigate cost and schedule overruns.

#### **4. METHODOLOGY**

Extensive research has been conducted on the construction industry within the realms of operations management and civil engineering literature, primarily emphasizing productivity metrics. In this context, Total Factor Productivity (TFP) and Partial Factor Productivity (PFP) have emerged as widely employed measures. TFP quantifies the relationship between total output and total input, encompassing labor, equipment, materials, and capital resources. On

the other hand, PFP concentrates on specific selected inputs. Countless studies have been dedicated to comprehending the pivotal factors that influence labor productivity within the construction industry.

The research design serves as the master plan for a study, offering a coherent framework for the entire research process. It encompasses data collection, data analysis, research methodology, and other essential components and procedures. The explanatory research design employs generalizations to gather information, providing clarity and specific details on various aspects of the research topic. Rather than focusing on determining outcomes or findings, the exploratory research design acquires information by investigating the research questions. Meanwhile, the descriptive research design plays a vital role in presenting a comprehensive understanding of the research study by describing the problem, nature, and diverse characteristics involved. Through the use of different tools and techniques, it facilitates a deep comprehension of the intricacies associated with the study.

After conducting literature research and focus interviews, a plan was formulated to gather field data, develop an evaluation procedure, and establish numerical values for the study. Effective communication with respondents was essential to ensure their understanding of definitions, procedures, and regulations during data collection. The survey findings were analyzed in two ways: prioritizing components based on importance and calculating their Relative Importance Index (RII), as well as determining the significance of factors in the questionnaire.

$$RII = \frac{\sum W}{A} \times N$$

W is the weight given to each factor by the respondents and ranges from 1 to 4.

A is the highest weight = 4.

N is the total number of responses collected for the ordinal scale

**Table 1. Ordinal Scale Used for Data Measurement**

Item	Not applicable	Does not affect it	Somewhat affects it	Directly affects it
Scale	1	2	3	4

Manpower factors, such as lack of work experience, significantly affect labor productivity. Studies by Paulson (1975) and Heizer and Render (1990) support this finding, highlighting the importance of skilled and experienced workers in enhancing productivity. Additionally, employee disloyalty has a notable impact on labor productivity.

External factors also play a role in labor productivity during construction projects. Different levels of disturbances can exist, ranging from not applicable to directly affecting productivity. Previous studies, including Mechanical Contractors of America (1976) and Neil and Knack (1984), have utilized similar severity levels for productivity factors. Clear specifications were provided for each condition to accurately assess the severity of adverse factors.

To accurately measure these factors, an ordinal scale was employed in this research. This allows for the appropriate assessment and evaluation of the influences on labor productivity in building construction.

## 5. RESULTS AND DISCUSSION

The present part of this study now focuses on the outcomes obtained from the field survey that have been extracted from the analysis of the data collected from a respondent. Only building construction projects had been taken into consideration when determining the sort of construction firms that replied. Various professional in building construction projects were contacted to gather the information from web-survey.

### Manpower Factors Affecting Labor Productivity

Labor disloyalty having a significant impact on labor productivity, ranking eighth for the manpower category and 39th overall in terms of its negative impact on labor productivity. Manpower factors have a significant impact on labor productivity. These factors include the level of work experience and employee loyalty, which can greatly influence the efficiency and output of the workforce. Skilled and experienced workers tend to contribute to higher productivity levels, while employee disloyalty can negatively affect overall productivity.

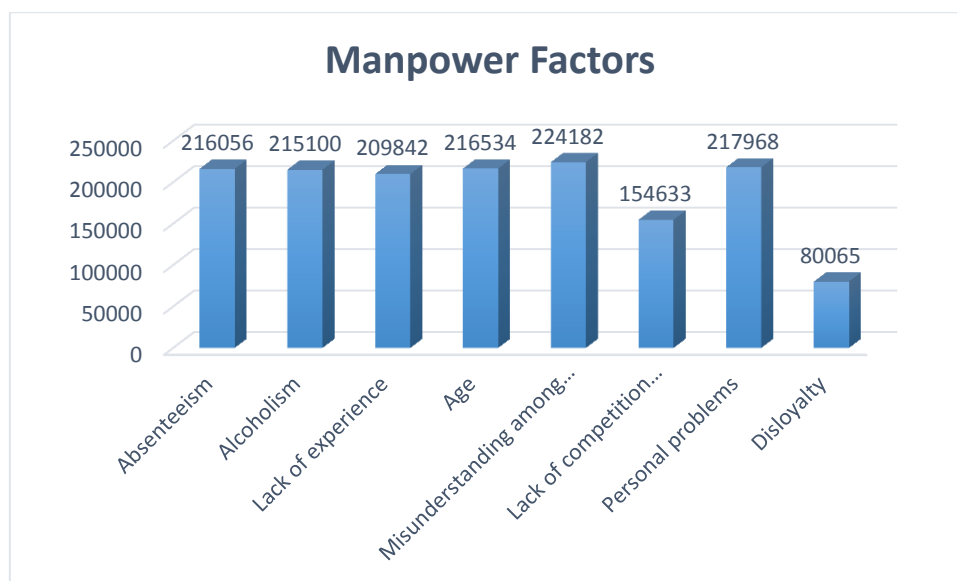


Figure 1 Manpower Factors

### External Factors Affecting Labor Productivity

Supervision delays were ranked 5<sup>th</sup> in the external group, with an RII of 208886, affect labor productivity. External factors have a notable impact on labor productivity. These factors encompass various disturbances that can occur during construction projects. The severity of these disturbances can range from not applicable to directly affecting productivity. Clear specifications are provided to assess and differentiate the level of adverse conditions. Understanding and managing these external factors is crucial for optimizing labor productivity in construction.

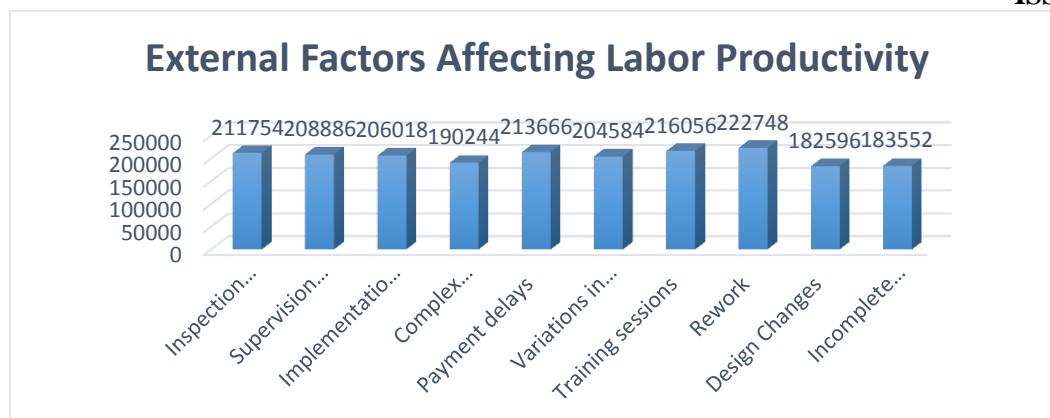


Figure 2 External Factors

### Communication Factors Affecting Labor Productivity

Communication factors play a significant role in labor productivity. Effective communication within a workplace is essential for smooth coordination, clear instructions, and shared understanding among team members. Poor communication can lead to misunderstandings, errors, and delays, negatively impacting productivity. On the other hand, strong communication practices facilitate efficient workflows, improved collaboration, and enhanced overall productivity.

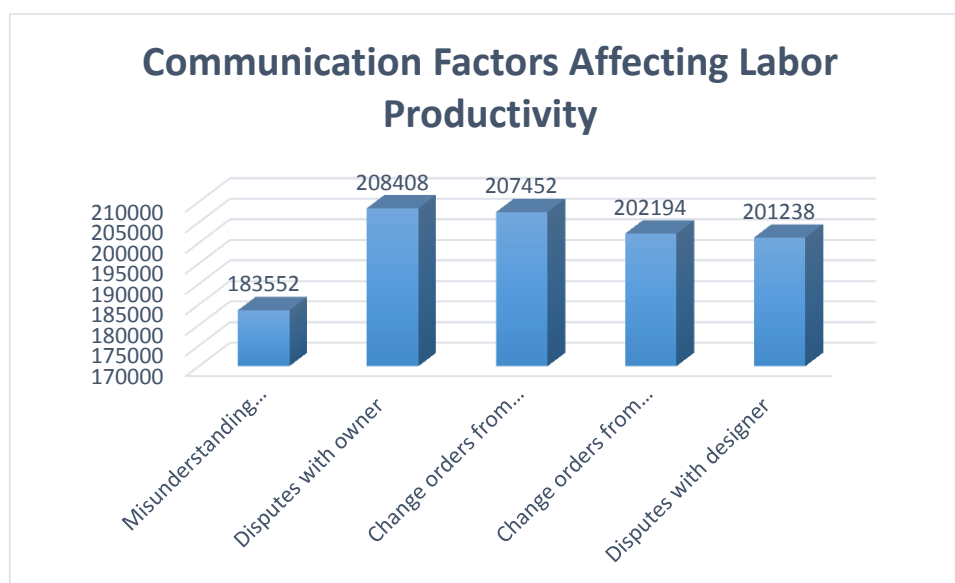


Figure 3 Communication Factors

### Resource Factors Affecting Labor Productivity

There are six resource factors that can significantly affect labor productivity. These factors include the availability and adequacy of resources such as materials, equipment, tools, technology, work environment, and support services. Insufficient or improper allocation of resources can hinder productivity, while ensuring optimal availability and quality of resources can enhance efficiency and output. Proper management and utilization of these resource factors are crucial for maximizing labor productivity in various industries and sectors.

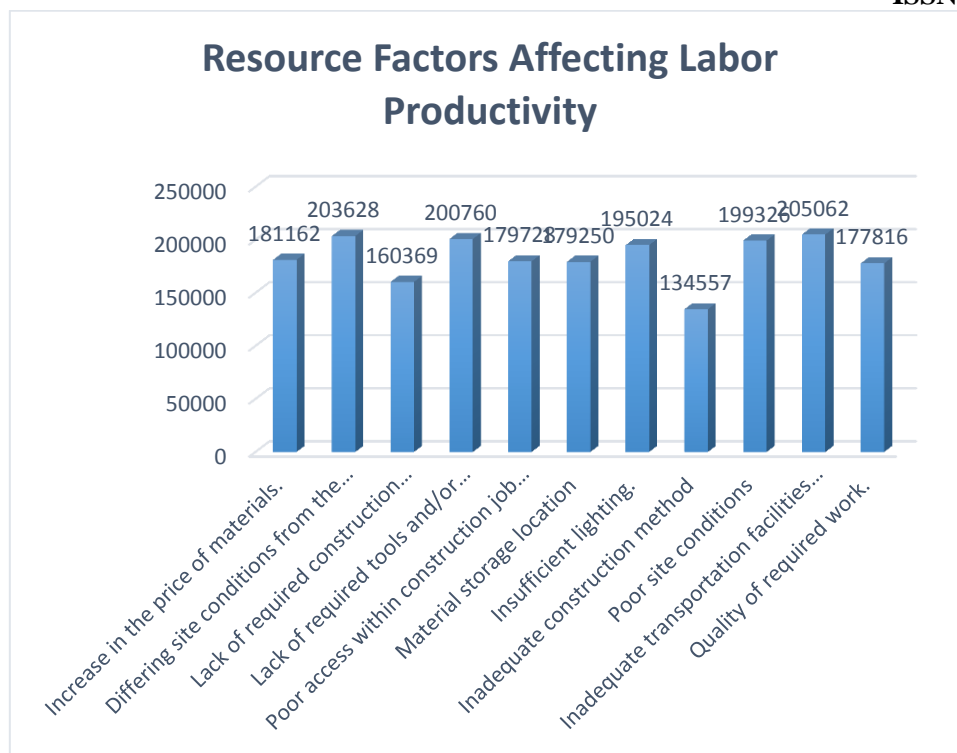


Figure 4 Resource Factors

## 6. CONCLUSION

The construction sector holds significant importance globally, contributing to societal objectives and economic development. Understanding construction productivity is crucial as it impacts the economy and costs incurred by government agencies. Anticipating workforce productivity in advance can lead to cost and time savings in construction projects. Given the high upfront costs and complexities involved, various factors can greatly influence overall productivity, potentially resulting in project delays and increased costs. This study aims to identify the underlying causes of variables affecting worker productivity in building construction. A standardized questionnaire is used to investigate all potential components, and the survey results are analyzed using the Relative Importance Index to prioritize criteria. The primary objectives of this research are to examine multiple factors influencing worker productivity in the construction industry.

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