

A Study on Labour Productivity in Indian Building Construction Projects

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Abstract - Labour productivity is one of the most critical factors influencing the performance of construction projects, as it directly affects project cost, duration, and quality. This study aims to identify, evaluate, and rank the factors affecting labour productivity in building construction projects, specifically focusing on residential and commercial developments. A comprehensive literature review was carried out to identify commonly reported productivity factors, followed by a structured questionnaire survey conducted among construction professionals, including engineers, contractors, and site supervisors in the Vadodara region. The collected data were analysed using statistical techniques such as the Relative Importance Index (RII), Frequency Index (FI), and Severity Index (SI) to determine the significance and impact level of each factor. The study considered a wide range of factors categorized under management, labour, material, financial, and external conditions. The analysis results indicate that holidays, lack of technological advancements in machinery, financial difficulties of the owner, frequent changes in design, and shortage of materials are among the most significant factors negatively affecting labour productivity. Furthermore, the study highlights that ineffective communication, poor coordination among stakeholders, and inadequate planning contribute substantially to reduced efficiency on construction sites. The findings emphasize the importance of adopting modern construction technologies, improving management practices, ensuring timely availability of resources, and enhancing labour skills through training and better working conditions. The outcomes of this research provide valuable insights for construction professionals and project managers to develop effective strategies for improving labour productivity. By addressing the identified factors, it is possible to optimize resource utilization, minimize delays, and achieve better project performance in terms of time, cost, and quality. The study also suggests that future research can focus on different types of construction projects and incorporate real-time productivity measurement techniques for more accurate analysis.

Key Words: *Labour Productivity, Construction Industry, Relative Importance Index (RII), Productivity Factors, Project Management, Building Construction, Resource Management, Communication & Coordination.*

1. INTRODUCTION

Labour productivity plays a vital role in assessing the performance of the Indian construction industry, which significantly contributes to the nation's economic growth and infrastructure development. Being a labour-intensive sector, it largely relies on semi-skilled and unskilled workers, leading to variations and generally lower productivity levels compared to international standards. In construction, labour productivity represents the efficiency with which workers complete tasks within a given time frame. In the Indian context, productivity is affected by multiple factors, including inadequate planning and supervision, shortages of materials and equipment, lack of skilled labour, and poor communication among project stakeholders. Additionally, external influences such as adverse weather conditions,

financial constraints, and frequent design modifications further impact labour efficiency. Enhancing labour productivity is essential for ensuring timely project completion, controlling costs, and maintaining quality standards. Therefore, it is important to identify and evaluate the key factors influencing productivity in order to develop effective strategies that improve overall performance in building construction projects.

1.1 Significant Contribution to Construction Projects

Labour productivity holds immense significance for construction projects, serving as a cornerstone for overall success and sustainability. It directly influences project timelines by enabling faster task completion when workers operate efficiently, helping teams meet deadlines amid tight schedules common in infrastructure developments. Moreover, higher productivity translates to substantial cost savings, as it minimizes labour expenses the largest component in most construction budgets while reducing overheads from delays or rework. Quality also improves with productive labour, as skilled and motivated workers deliver precise outputs, lowering defect rates and enhancing project durability. Ultimately, strong labour productivity boosts profitability, fosters client satisfaction, and strengthens a firm's competitive edge in bidding for future contracts, making it indispensable for long-term viability in the sector.

1.2 Issues arising in labour productivity

Labour productivity in construction projects is often affected by a combination of managerial, technical, and external issues. Poor planning and ineffective supervision can lead to improper scheduling of activities, resulting in delays and idle time for workers. Shortages of materials, tools, and equipment further disrupt workflow and reduce efficiency on site. Additionally, the reliance on semi-skilled and unskilled labour, along with inadequate training, limits the ability of workers to perform tasks effectively. Communication gaps and lack of coordination among stakeholders frequently cause misunderstandings, rework, and delays. External factors such as adverse weather conditions, financial constraints, and frequent design changes also negatively impact productivity. Moreover, low worker motivation, safety concerns, and high labour turnover contribute to inconsistent performance. Altogether, these issues create significant challenges in achieving optimal labour productivity in construction projects.

1.3 Approaches to reduce difficulties during the labour productivity

Reducing difficulties in labour productivity requires a combination of effective management practices, proper resource planning, and workforce development. One of the key approaches is improving project planning and scheduling to ensure smooth workflow and minimize delays. Adequate supply of materials, tools, and equipment should be maintained to avoid interruptions in work. Providing regular training and skill development programs helps enhance the efficiency and capability of labour. Effective communication and coordination among stakeholders are also essential to prevent misunderstandings and rework. Additionally, adopting modern construction techniques and technologies can improve work speed and accuracy. Ensuring safe working conditions, fair wages, and proper motivation can further boost worker morale and productivity. By implementing these strategies, construction projects can significantly reduce productivity-related challenges and achieve better overall performance.

1.4 How labour productivity influence the success of a project

Labour productivity has a direct and significant impact on the overall success of construction projects, as it influences key performance parameters such as time, cost, quality, and stakeholder satisfaction. When labour productivity is high, tasks are completed efficiently within the planned schedule, helping projects meet deadlines and avoid delays. On the other hand, low productivity often leads to extended project durations, which can disrupt project timelines and affect subsequent activities. From a cost perspective, labour constitutes a major portion of construction expenses. Higher productivity means more output per unit of labour, resulting in reduced labour costs and better resource utilization. Conversely, poor productivity increases labour hours, leading to cost overruns and reduced profitability for contractors. Labour productivity also affects the quality of construction work. Skilled and efficient workers are more likely to perform tasks accurately, reducing errors, defects, and the need for rework. This not only improves the durability and performance of the structure but also saves time and additional costs associated with corrections. In terms of project management, high productivity reflects effective planning, supervision, and coordination among stakeholders. It ensures that resources such as materials, equipment, and manpower are optimally utilized. Poor productivity, however, often indicates issues like mismanagement, communication gaps, and inefficient work practices. Furthermore, labour productivity plays a crucial role in worker morale and safety. A well-managed and productive work environment tends

to have better safety practices, fewer accidents, and higher worker satisfaction. This reduces absenteeism and labour turnover, contributing to consistent project progress. Finally, productivity strongly influences client satisfaction and overall project success. Projects completed on time, within budget, and with good quality standards are more likely to meet client expectations and enhance the reputation of contractors and organizations. Therefore, improving labour productivity is essential for achieving successful and sustainable outcomes in construction projects.

1.5 Selecting the Appropriate Labours for Specific Activities in a Construction Project

Selecting the appropriate labour for specific activities in a construction project is essential for achieving high productivity, maintaining quality, and ensuring timely completion. Each construction task requires a particular level of skill, experience, and physical capability, and assigning the right workers accordingly plays a crucial role in efficient project execution. Skilled labour such as masons, carpenters, electricians, and bar benders should be deployed for specialized and technical activities that demand precision, while semi-skilled and unskilled workers can be assigned to supportive tasks like material handling and site maintenance. This proper matching of skill levels with job requirements helps reduce errors, minimize rework, and improve overall work quality. Experience is another important factor in labour selection, as experienced workers are more familiar with construction methods, tools, and safety practices, enabling them to complete tasks more quickly and accurately. In contrast, inexperienced workers may require additional supervision and training, which can affect productivity. Physical fitness and capability must also be considered, especially for labour-intensive activities such as concreting, lifting, and scaffolding work, as these tasks demand strength and endurance to maintain efficiency and reduce the risk of injuries. Furthermore, understanding worker specialization and past performance can help in assigning tasks more effectively, as some workers may perform better in specific activities. In cases where skilled labour is not readily available, providing training and skill development programs becomes necessary to enhance worker capability and flexibility. Effective supervision and proper coordination by site managers are also vital to ensure that labour resources are optimally utilized and that any issues are addressed promptly. Clear communication of roles and responsibilities helps avoid confusion and promotes teamwork on site. Additionally, factors such as labour availability, turnover, and compatibility among workers should be considered to ensure smooth coordination and minimize conflicts. A well-planned approach to labour selection, supported by continuous monitoring and proper management practices, leads to improved productivity, better resource utilization, reduced project costs, and successful completion of construction projects.

1.6 Factors Affecting Labour Productivity

Numerous interconnected factors shape labour productivity in construction, determining on-site work efficiency. These span management practices, workforce traits, resource supply, and environmental influences. Strong planning, timely scheduling, and vigilant oversight prove vital, since inadequate management triggers delays, worker downtime, and corrective rework. Worker characteristics skill levels, prior experience, drive, and access to training hold key importance, particularly in India where semi-skilled employees form the bulk of teams. Reliable access to materials, tools, and machinery remains critical, as disruptions or scarcities halt operations and erode output. Effective dialogue and alignment between parties like contractors, engineers, and laborers ensure seamless task flow. Broader elements, including weather patterns, site limitations, and funding hurdles, also sway performance by altering site conditions and input flows.

- 1. Management and Planning Factors:** Poor planning and scheduling are major causes of low productivity. When project activities are not properly planned, it leads to delays, idle time, and inefficient use of labour. Inadequate supervision and weak site management further reduce efficiency, as workers may not receive proper guidance or monitoring. Frequent changes in design and delayed decision-making also disrupt workflow, causing rework and loss of productive time.
- 2. Labour-Related Factors:** The skill level and experience of workers significantly affect productivity. In India, a large portion of the workforce is semi-skilled or unskilled, which limits efficiency and increases errors. Lack of proper training and technical knowledge further reduces work quality. Additionally, issues such as absenteeism, low motivation, poor health, and high labour turnover negatively impact consistency and performance on site.
- 3. Material-Related Factor:** Lack of adequate tools, equipment, and modern machinery reduces work efficiency. Many construction projects in India still rely on traditional methods, which are time-consuming and labour-intensive.

Frequent breakdown of equipment and lack of maintenance also interrupt work progress. Limited adoption of advanced technologies such as automation and prefabrication contributes to lower productivity.

4. Communication and Coordination Factors: Effective communication among stakeholders such as contractors, consultants, and workers is essential for smooth project execution. Poor communication can lead to misunderstandings, errors, and rework. Lack of coordination between different teams or departments can cause delays and inefficient use of resources

5. Financial Factors: Financial issues such as delayed payments to contractors or workers can slow down project progress. Lack of funds may result in shortages of materials, equipment, or labour. These constraints directly affect productivity and can lead to project delays.

6. Environmental and Site Conditions: Weather conditions such as extreme heat, heavy rainfall, and humidity significantly affect worker performance, especially in India. Poor site conditions, including congestion, inadequate workspace, and unsafe environments, also reduce efficiency. Difficult site locations and accessibility issues can further delay work.

7. Safety Factors: Unsafe working conditions can lead to accidents and injuries, which disrupt work and reduce productivity. Lack of proper safety measures and training can lower worker confidence and efficiency. A safe work environment helps maintain steady productivity levels.

8. Government and Regulatory Factors: Delays in approvals, permits, and inspections can slow down construction activities. Changes in government policies, labour laws, and regulations may also affect project timelines and productivity.

2. REVIEW OF LITERATURE

Patel et al. (2017) presented a comprehensive review of existing research related to labour productivity in the construction industry. It explained productivity as the ratio of output to input and emphasized its importance in achieving project profitability and efficiency. The study systematically reviewed multiple past research works and identified a wide range of factors affecting labour productivity, including inadequate planning, poor site management, material shortages, low labour skills, lack of motivation, and improper supervision. These factors were further categorized into groups such as workforce-related, management-related, material-related, and environmental factors. The paper also highlighted that organizational and managerial aspects played a dominant role in influencing productivity. Additionally, it stressed the importance of adopting modern construction techniques, improving worker training, and ensuring proper planning and scheduling. The study concluded that a holistic approach involving technological advancement, effective management, and improved working conditions was essential for enhancing labour productivity in building construction [1].

Rao et al. (2026) focused on analyzing the impact of labour productivity on overall construction project performance. The study combined a literature review with primary data collection through a structured questionnaire survey conducted among contractors and construction professionals. It identified key productivity factors such as labour skill level, availability of materials, site conditions, supervision quality, and management practices. The study explained that poor labour productivity led to significant issues such as project delays, increased costs, rework, and poor-quality outcomes. It further discussed common causes of low productivity, including poor planning and scheduling, unsafe working conditions, delayed wage payments, lack of motivation, and ineffective communication among stakeholders. The analysis highlighted that proper supervision, effective planning, timely material supply, and improved worker satisfaction could significantly enhance productivity. The paper concluded that labour productivity was a key performance indicator in construction projects, and its improvement was essential for achieving timely completion, cost efficiency, and quality standards [2].

Jaiswal et al. (2022) focused on evaluating labour productivity in the Indian construction industry and identifying critical factors affecting it. The study used a questionnaire survey method involving professionals such as engineers, contractors, and architects. The collected data was analyzed using the Relative Importance Index (RII) method to rank the factors based on their impact. The research categorized productivity factors into four major groups: human factors, site conditions, resource availability, and project planning and management. The study identified key factors such as insufficient lighting, lack of skilled labour, absence of incentive schemes, poor supervision, and ineffective communication as the most influential. A case study on brick masonry work was also conducted to compare actual

productivity with standard values (CPWD norms), highlighting significant deviations due to site conditions and labour efficiency. The study concluded that improving labour productivity through better planning, training, incentives, and resource management could significantly reduce construction time and cost, thereby improving project performance and competitiveness in the industry [3].

Rao et al. (2016) examined the parameters and labour constants used to measure productivity in construction activities in India. It highlighted that construction labour productivity was difficult to measure accurately due to variations in labour performance, lack of reliable data, and differences in regional practices. The study compared labour productivity parameters from different sources such as CPWD (Central Public Works Department), state government schedules, and Indian Standard codes (IS 7272). It identified variations in labour constants for similar construction activities, which could lead to inconsistencies in cost estimation and project planning. The paper also discussed the importance of labour attributes such as skill level, experience, and working conditions in determining productivity. Furthermore, it highlighted limitations in previous research, including lack of follow-up studies and insufficient consideration of worker perspectives. The study concluded that there was a need for updated and standardized productivity data, improved measurement techniques, and inclusion of socio-economic factors to achieve accurate productivity assessment and better project management [4].

Kadu et al. (2020) analyzed various national and international studies to identify factors affecting labour productivity in the construction industry. It emphasized that productivity had been declining in recent years and that improving it was essential for economic growth and project success. The study compiled findings from various research works and used statistical tools such as the Relative Importance Index (RII) and Cronbach's Alpha to identify and rank critical factors. The major factors identified included poor planning and scheduling, lack of skilled labour, material shortages, poor site management, communication gaps, rework, labour absenteeism, and inadequate supervision. The paper also highlighted that productivity factors varied depending on geographical location, project type, and socio-economic conditions. It stressed the importance of conducting region-specific studies, particularly in the Indian context, where labour conditions differed significantly from other countries. The study concluded that effective planning, better management practices, improved communication, and adoption of modern construction techniques were essential to enhance labour productivity and reduce project delays and costs [5].

Hamza et al. (2019) analyzed construction labour productivity by examining 88 research studies from various regions. The authors aimed to identify and rank the major factors affecting productivity using the Jenks classification method. The study emphasized that labour productivity played a critical role in determining project performance, as it directly impacted cost, time, and efficiency. The findings revealed that key factors influencing productivity included poor management and supervision, shortage of materials and equipment, lack of worker skills and experience, communication issues, and low motivation. Although some variations were observed across different geographical regions, management-related factors were found to be the most dominant globally. The study concluded that effective planning, supervision, and workforce management were essential to improving construction labour productivity [6].

Ponmalar et al. (2018) analyzed the factors influencing labour productivity in residential building construction in the Indian context. The study used a questionnaire-based approach and analyzed the data using SPSS, with factors ranked through the Relative Importance Index (RII). The authors categorized the factors into manpower, resource, and management groups. The results indicated that lack of labour experience was the most significant manpower-related factor, while shortage of construction materials and tools was the most critical resource-related issue. Additionally, poor communication, safety concerns, and absenteeism were identified as major contributors to reduced productivity. The study also compared actual and expected productivity in brick masonry work, highlighting a gap caused by inefficient management practices. The authors concluded that improving labour skills, ensuring timely resource availability, and strengthening site management could significantly enhance productivity [7].

Vinod Kumar et al. (2018) explored the current issues and challenges in cybersecurity across global countries. The study defined cybersecurity as the protection of information systems from threats, vulnerabilities, and attacks, emphasizing its growing importance in the digital era. The authors identified various types of cyber threats, including those driven by financial, political, and strategic motives. They also highlighted major challenges such as system vulnerabilities,

increasing complexity of ICT infrastructure, and the difficulty in identifying attackers due to anonymity. The study discussed the impacts of cyberattacks, including data breaches, financial losses, and disruption of services. It concluded that effective cybersecurity required continuous technological advancement, strong policy frameworks, and international cooperation [8].

- **Major Findings from Literature Review**

The following are outcomes based on labour productivity in research:

1. Labour productivity strongly affects project time, cost, and quality performance.
2. Poor planning, weak supervision, and improper management are the most critical factors reducing productivity.
3. Labour skill level, motivation (wages/incentives), and material availability significantly influence productivity.
4. Improving productivity requires better management practices, worker training, and efficient resource planning.

3. RESEARCH METHODOLOGY

3.1 Research approach

This study seeks to evaluate labour productivity in relation to project outcomes, with a primary emphasis on identifying and prioritizing the key factors that influence these processes. To support this objective, a comprehensive review of relevant literature was conducted to establish a strong theoretical foundation. In addition, to understand real-world practices within building construction projects, a structured research methodology was adopted. Accordingly, primary data was collected and analyzed to examine actual practices related to labour productivity and project outcomes, as well as to determine the critical factors affecting productivity. Data can be gathered in a variety of ways. The methods of observation, interviews, surveys, and timetables are important. We use questionnaires to gather data for this study. This approach to gathering data is quite well-liked, especially for large requests. This approach involves sending a questionnaire to the person in issue, asking them to respond and send the form back. A questionnaire is made up of several questions that are typed or printed on a form or series of forms in a specific order.

Both primary and secondary sources were used to gather data for this investigation. A questionnaire sent to stakeholders working on construction projects was used to collect the primary data. The secondary data was gathered from books, journals, the internet, and earlier studies. The secondary data served as a criterion for creating and evaluating the primary data as well as a source for identifying problems. A questionnaire is used as a research tool to collect information.

3.2 Survey Questionnaires

The primary research instrument used in this study is a structured questionnaire, carefully designed to align with the study's objectives and organized into multiple sections. The first section gathers background information about the respondents and their organizations, including project details, work experience, and employment status. The second section focuses on assessing respondents' knowledge and understanding of labour productivity in building construction projects. The third section presents various factors affecting productivity, which respondents are asked to evaluate and rank, along with insights into their general experiences in addressing project delays caused by poor communication and coordination among stakeholders.

The parameters identified from previous studies formed the basis for developing the questionnaire, enabling an assessment of their influence on labour productivity. The questionnaire was designed to be simple, clear, and easy to understand for respondents, while also ensuring that the responses could be effectively interpreted and analyzed by the researcher.

3.3 Research Population and Sampling

The study population for this research consists of stakeholders from various building construction sites located in Central Vadodara, Gujarat.

A. Data Analysis

The data collected through the questionnaires was analysed using basic statistical methods, including classification, tabulation, and examination based on the selected measurement scale. To enhance clarity and facilitate interpretation, the results were primarily presented using tables, pie charts, and bar graphs.

B. Ranking methods

Ordinal scales were employed in this study. As seen in Table 1, an ordinal scale is a rating or ranking of data that typically employs numbers in either ascending or decreasing order. The allocated numbers 1, 2, 3, 4, and 5 are only labels.

Table 1: Ordinal Scale Used for Measuring of the level of Effect

Item	Critical Effect	High Effect	Medium Effect	Low Effect	No Effect
Scale	5	4	3	2	1

The effect level in this investigation was ascertained using an ordinal measurement scale ranging from 1 to 5. Respondents were requested to rank the elements influencing labour productivity (5 = very large degree affects, 4 = large degree affects, 3 = average degree affects, 2 = small degree affects, and 1 = not affected).

The following formula was utilized to assign a Relative Importance Index (RII) to each element in order to analyze the data using an ordinal scale:

$$\text{Relative Important Index} = \frac{5n_1 + 4n_2 + 3n_3 + 2n_4 + n_5}{5(n_1 + n_2 + n_3 + n_4 + n_5)}$$

Where, n_1 = number of respondents who answered "Critical effect"

n_2 = number of respondents who answered "High effect"

n_3 = number of respondents who answered "Medium effect"

n_4 = number of respondents who answered "Low effect"

n_5 = number of respondents who answered "No effect"

As indicated in Table 2, an ordinal measuring scale ranging from 1 to 4 was employed to ascertain the level of the effect in order to investigate the frequency of occurrence. Respondents were asked to rate the elements influencing stakeholder communication and coordination based on the significance level (4 = incredibly large degree frequency, 3 = substantial degree frequency, 2 = small degree frequency, and 1 = nil occurrence frequency).

Table 2: Ordinal Scale Used for Measuring of the Frequency of Occurrence

Item	Very often	Often	Sometimes	None
Scale	4	3	2	1

The following formula was used to assign a relative significance index (RII) to each element in order to analyze the data using an ordinal scale.

$$\text{Frequency Index} = \frac{4n_1 + 3n_2 + 2n_3 + n_4}{4(n_1 + n_2 + n_3 + n_4)}$$

Where, n_1 = number of respondents who answered "Very often"

n_2 = number of respondents who answered "Often"

n_3 = number of respondents who answered "Sometimes"

n4 = number of respondents who answered "None"

C. Questionnaire Design

The questionnaire is created using the study methodology that will be applied following a comprehensive review of the literature and the identification of numerous elements influencing labour productivity during building development. There are two sections to the questionnaire. The company and responder profile information is covered in the first section, while the primary questionnaire is covered in the second. It includes a few elements that impact the labour productivity in building construction, and respondents are required to select only one option to express their viewpoint on that element based on their comprehension, expertise, and experience. The questionnaire was created such that respondents would have to rate the frequency of occurrence on a scale of one to four and the intensity of effect on a scale of one to five in order to rate both factors.

D. Survey Work and Data Collection

The survey will be conducted among the sample's chosen respondents and within the parameters of the study. Respondents will receive the questionnaires, and information will be gathered once they have completed them. These surveys will be used to ascertain respondents' opinions about the elements influencing coordination and communication.

4. DATA COLLECTION & ANALYSIS

A. Stakeholder Details

Three categories of stakeholders are the focus:

1. Owner/client
2. Engineer, Architect.
3. Contractors

The cities in which survey is to be carried out are

1. Central Vadodara

B. Questionnaire Distribution and Collection

Distributing the questionnaire to different stakeholders involved telling them about the goal of the study and asking whether they would be interested in taking part. The responders were given a questionnaire after demonstrating their initial willingness.

A total of 105 questionnaires were given out to various respondents in Central Vadodara. For this study, a total of 64 respondents submitted their responses. Appendix C is a list of the 64 stakeholders who responded to the survey. The distribution of responses across the research area is shown in Table 3.

Table 3: Distribution of Responder

Stakeholders	City
	Vadodara
Owner/client	10
Engineer, Architect	34
Contractor	20
Total	64

The following analysis was done for stakeholder interpretation using Microsoft Excel. Figures 1 through 9 display the respondents' overall ranking for each individual component.

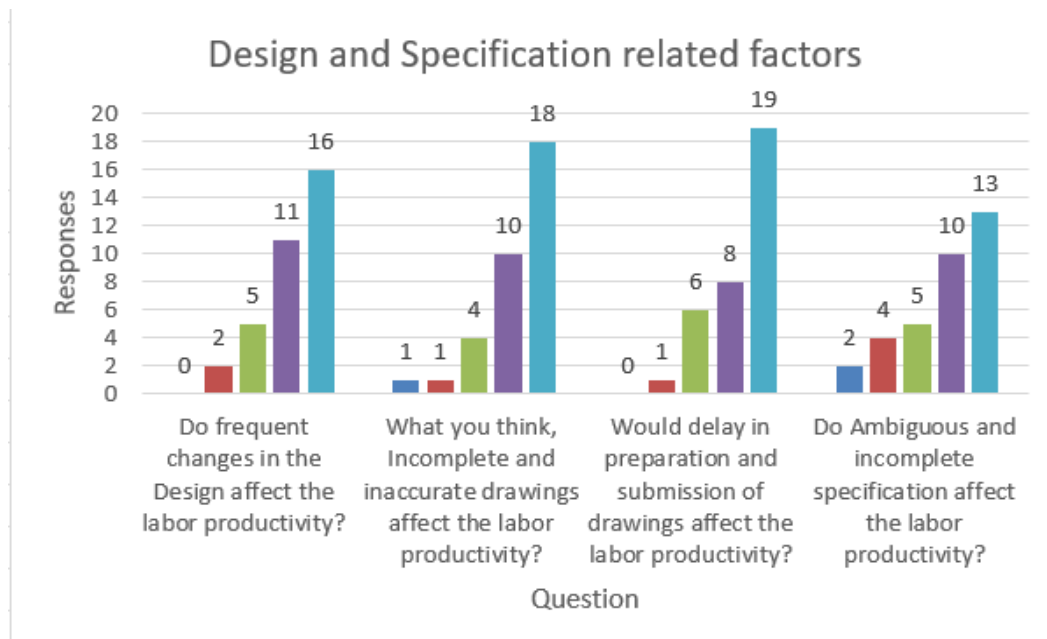


Figure 1: Design and Specification Related Factors

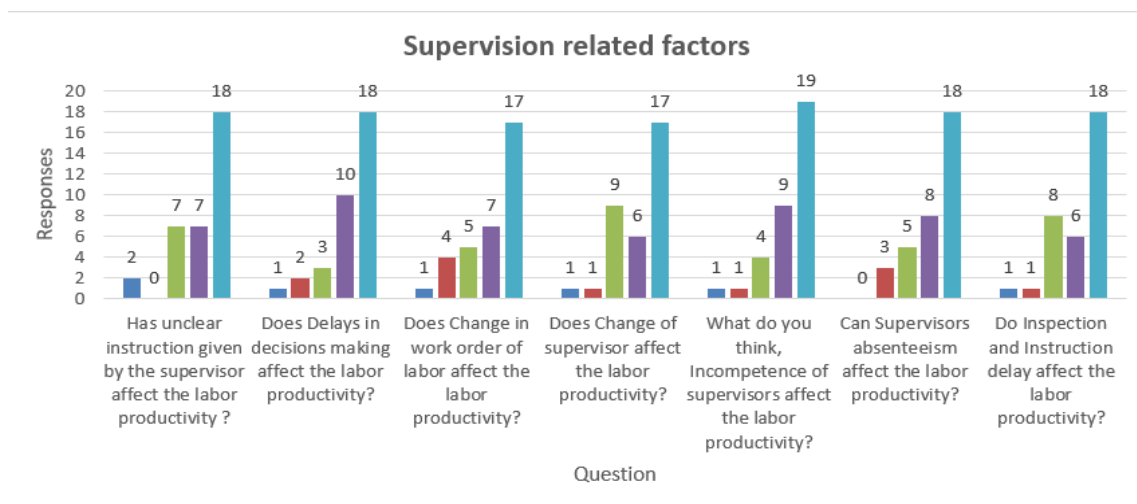


Figure 2: Supervision Related Factors

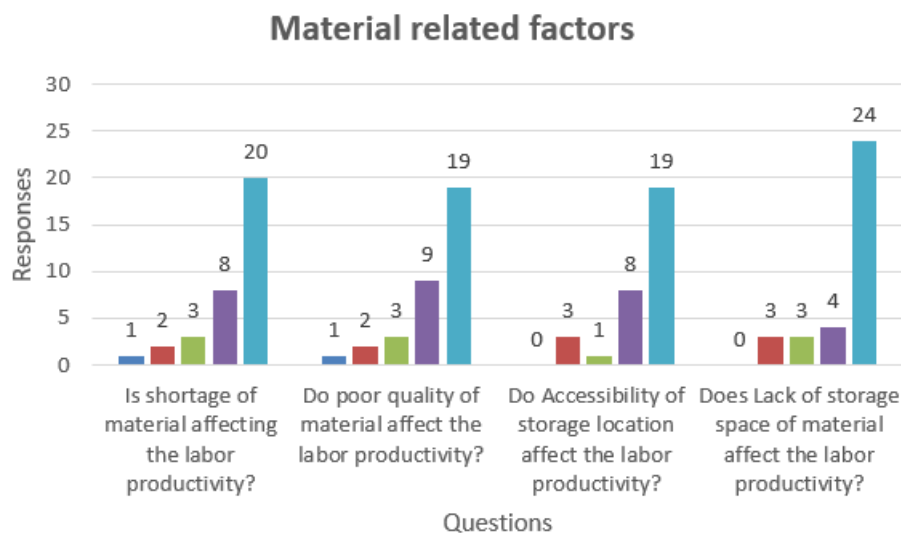


Figure 3: Material Related Factors

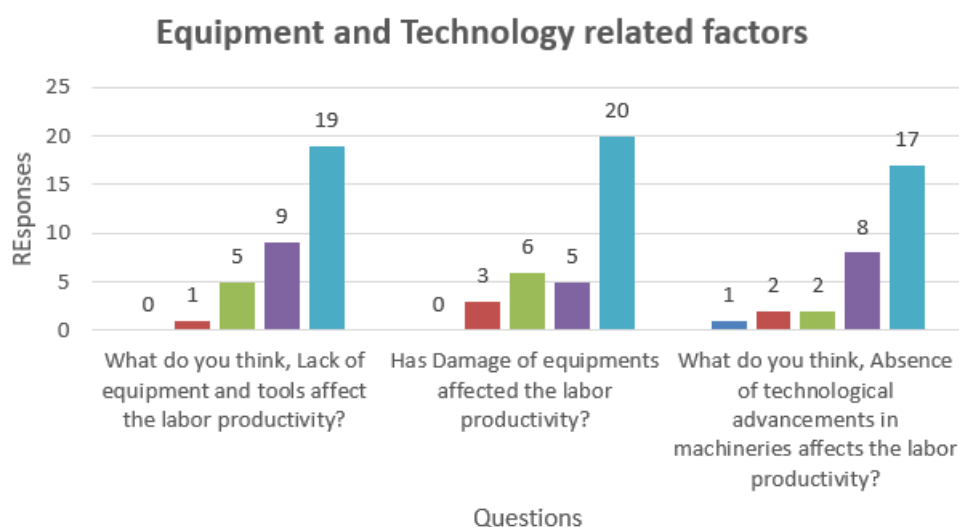


Figure 4: Equipment and Technology Related Factors



Figure 5: Project Related Factors

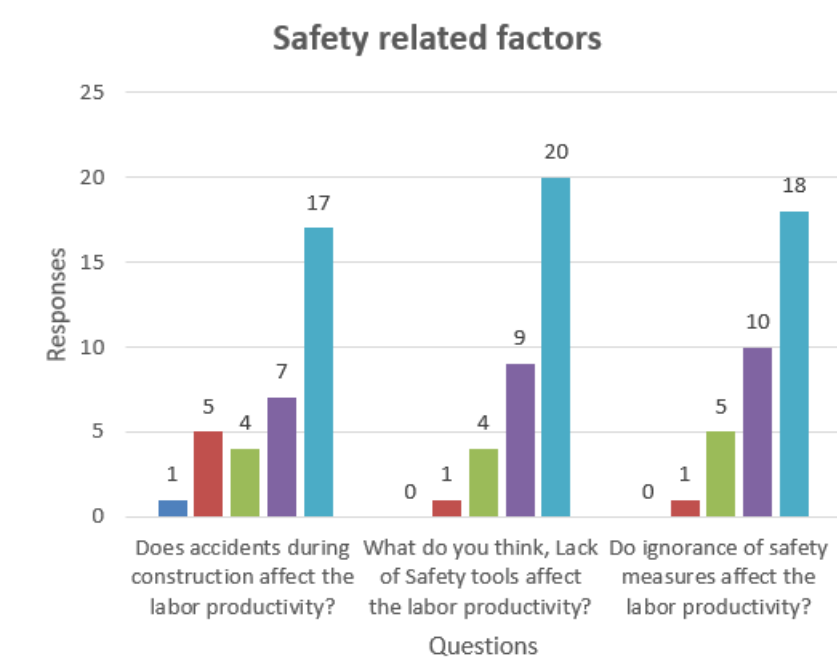


Figure 6: Safety Related Factors



Figure 7: Contractor And Management Related Factors

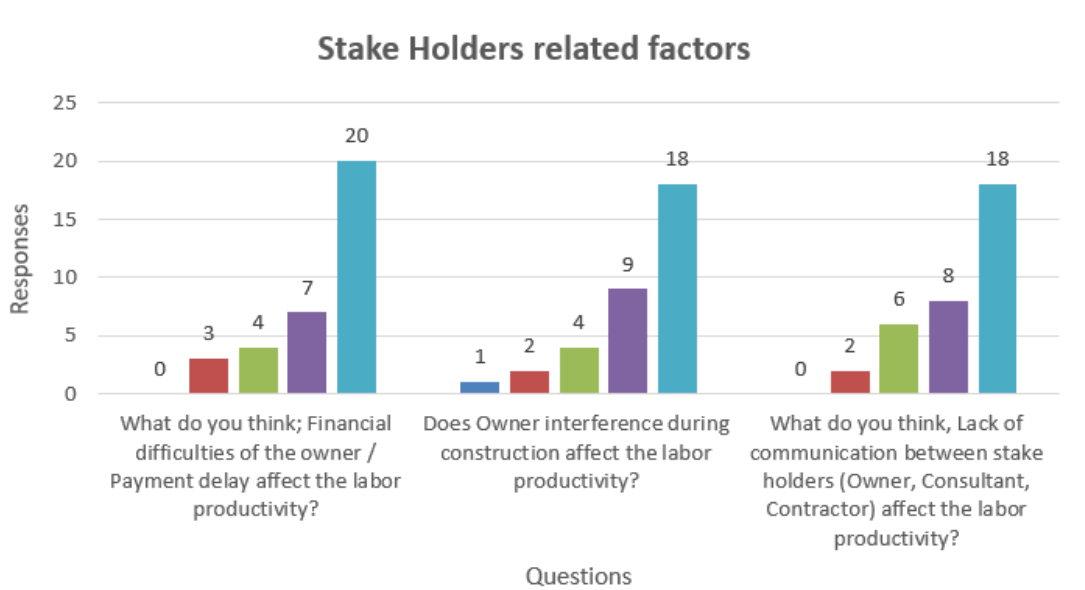


Figure 8: Stakeholder Related Factors

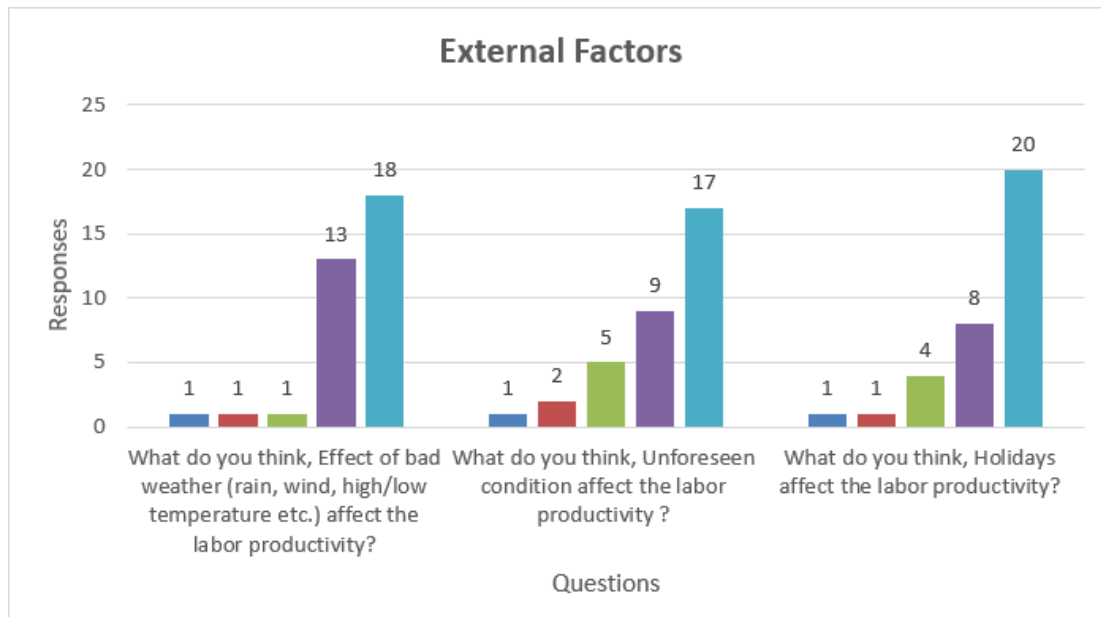


Figure 9: External Related Factors

C. Data Analysis by Relative Importance Index (RII) Method

The Relative Importance Index approach was used to rate each aspect from the viewpoints of Owner/client, Engineer, Architect, contractors to examine the primary data gathered from the questionnaire survey.

The computed RII and responses from the viewpoints of Owner/client, Engineer, Architect, contractors are as shown.

D. Ranking of Overall Response by RII Method

The study's RII was computed by taking into account the respondents' rates for the 20 parameters influencing labour productivity in building construction. RII values are used to rank the factors. The most significant element influencing stakeholder's communication & coordination in building construction can be determined from the rankings given to each component. The entire answer is ranked using the RII approach in Table 4.

Table 4: Ranking of Overall Response by RII Method

Factors	RII	Rank
A. Design and Specification related factors		
A1 Frequent changes in the Design	0.84	7
A2 Incomplete and inaccurate drawings	0.85	6
A3 Delay in preparation and submission of drawings	0.76	13
A4 Ambiguous and incomplete specification	0.76	13
B. Supervision related factors		
B1 Unclear instruction given by the	0.83	8
B2 Delays in decisions making	0.85	6
B3 Change in work order of labor	0.80	11
B4 Change of supervisor	0.82	9
B5 Incompetence of supervisors	0.86	5
B6 Supervisors absenteeism	0.84	7
B7 Inspection and Instruction delay	0.83	8

C. Material related factors		
C1 Shortage of material	0.86	5
C2 Poor quality of material	0.85	6
C3 Accessibility of storage location	0.88	3
C4 Lack of storage space of material	0.89	2
D. Equipment and Technology related factors		
D1 Lack of equipment and tools	0.87	4
D2 Damage of equipment's	0.85	6
D3 Absence of technological advancements in machineries	0.85	6
E. Labour related factors		
E1 Absenteeism of labors	0.86	5
E2 Incompetence of labors	0.89	2
E3 Overcrowded labor force	0.88	3
E4 Misunderstanding / poor relationship between labors	0.87	4
E5 Increased labor Age	0.83	8
E6 Indiscipline labour	0.86	5
E7 Use of alcohol and drugs	0.85	6
E8 Lack of training	0.86	5
E9 Labor rotation	0.78	12
E10 Personal Problems	0.85	6
F. Safety related factors		
F1 Accidents during construction	0.80	11
F2 Lack of Safety tools	0.88	3
F3 Ignorance of safety measures	0.86	5
G. Project related factors		
G1 Lack of temporary facilities	0.86	5
G2 Congestion of site	0.87	4
G3 Type of contract	0.89	2
H. Stake Holders related factors		
H1 Financial difficulties of the owner / Payment delay	0.86	5
H2 Owner interference during construction	0.84	7
H3 Lack of communication between stake holders	0.85	6
I. Contractor and Management related factors		
I1 Poor resources management	0.91	1
I2 Too much work load	0.87	4
I3 Lack of motivation	0.81	10
I4 Mistakes during construction (Rework)	0.86	5
I5 Lower wages of labor	0.82	9
I6 Incentive given to labor	0.82	9
J. External Factors		

J1 Effect of bad weather	0.87	4
J2 Unforeseen condition	0.83	8
J3 Holidays	0.86	5

E. Major factors affecting labour productivity with respect to level of effect

Below is a list of the top five factors influencing labour productivity,

1. Poor resources management-0.91
2. Lack of storage space of material-0.89
3. Incompetence of labors-0.89
4. Type of contract-0.89
5. Lack of Safety tools-0.88

F. Data Analysis by Frequency Index (FI) Method

The Frequency Index approach was used to rank each element from the viewpoints of Owner/client, Engineer, Architect and Contractors in order to examine the primary data gathered from the questionnaire survey.

The computed FI and answers from the viewpoints of Owner/client, Engineer, Architect and Contractors are as shown .

G. Ranking of Overall Response by FI Method

To determine how frequently a factor occurs in a building project, its frequency index (FI) is calculated. The frequency index values are used to rank the factors. One can determine the most common factors labour productivity by looking at the rankings given to each one. The overall response is ranked using the FI approach in Table 5.

Table 5: Ranking of Overall Response by FI Method

Factors	FI	Rank
A. Design and Specification related factors		
A1 Frequent changes in the Design	0.82	3
A2 Incomplete and inaccurate drawings	0.67	17
A3 Delay in preparation and submission of drawings	0.63	19
A4 Ambiguous and incomplete specification	0.68	16
B. Supervision related factors		
B1 Unclear instruction given by the	0.71	13
B2 Delays in decisions making	0.74	10
B3 Change in work order of labour	0.73	11
B4 Change of supervisor	0.64	18
B5 Incompetence of supervisors	0.69	15
B6 Supervisors absenteeism	0.68	16
B7 Inspection and Instruction delay	0.72	12
C. Material related factors		
C1 Shortage of material	0.79	5
C2 Poor quality of material	0.71	13
C3 Accessibility of storage location	0.76	8
C4 Lack of storage space of material	0.75	9

D. Equipment and Technology related factors		
D1 Lack of equipment and tools	0.78	6
D2 Damage of equipment's	0.73	11
D3 Absence of technological advancements in machineries	0.83	2
E. Labour related factors		
E1 Absenteeism of labours	0.70	14
E2 Incompetence of labours	0.74	10
E3 Overcrowded labour force	0.73	11
E4 Misunderstanding / poor relationship between labours	0.74	10
E5 Increased labour Age	0.78	6
E6 Indiscipline labour	0.74	10
E7 Use of alcohol and drugs	0.69	15
E8 Lack of training	0.69	15
E9 Labor rotation	0.72	12
E10 Personal Problems	0.71	13
F. Safety related factors		
F1 Accidents during construction	0.77	7
F2 Lack of Safety tools	0.76	8
F3 Ignorance of safety measures	0.73	11
G. Project related factors		
G1 Lack of temporary facilities	0.74	10
G2 Congestion of site	0.75	9
G3 Type of contract	0.74	10
H. Stake Holders related factors		
H1 Financial difficulties of the owner / Payment delay	0.80	4
H2 Owner interference during construction	0.68	16
H3 Lack of communication between stake holders	0.72	12
I. Contractor and Management related factors		
I1 Poor resources management	0.78	6
I2 Too much work load	0.73	11
I3 Lack of motivation	0.76	8
I4 Mistakes during construction (Rework)	0.80	4
I5 Lower wages of labour	0.77	7
I6 Incentive given to labour	0.78	6
J. External Factors		
J1 Effect of bad weather	0.82	3
J2 Unforeseen condition	0.78	6
J3 Holidays	0.85	1

K. Major Five factors affecting labour productivity with respect to frequency of occurrence

Below is a list of the top five factors influencing labour productivity ,

1. Holidays-0.85
2. Absence of technological advancements in machineries-0.83
3. Frequent changes in the Design -0.82
4. Financial difficulties of the owner / Payment delay-0.80
5. Mistakes during construction (Rework)-0.80

I. Data Analysis by Severity Index (SI) Method

The Severity Index approach was used to rate each element from the viewpoints of Owner/client, Engineer, Architect, PMC firm, contractors, and Users/End users in order to examine the primary data gathered from the questionnaire survey.

The computed SI and responses from the viewpoints of Owner/client, Engineer, Architect, PMC firm, contractors users are as shown.

J. Ranking of Overall Response by SI Method

To determine which factors are the most severe, the severity index (SI) is calculated for each factor. The severity index values are used to rank the factors. It is feasible to determine the most significant factors influencing stakeholder's communication & coordination in building construction based on the rankings given to each component. The entire answer is ranked by the SI method in Table 6.

Table 6: Ranking of Overall Response by SI Method

Factors	SI	Rank
A. Design and Specification related factors		
A1 Frequent changes in the Design	0.69	3
A2 Incomplete and inaccurate drawings	0.57	15
A3 Delay in preparation and submission of drawings	0.48	18
A4 Ambiguous and incomplete specification	0.52	17
B. Supervision related factors		
B1 Unclear instruction given by the	0.59	13
B2 Delays in decisions making	0.63	9
B3 Change in work order of labour	0.58	14
B4 Change of supervisor	0.52	17
B5 Incompetence of supervisors	0.59	13
B6 Supervisors absenteeism	0.57	15
B7 Inspection and Instruction delay	0.6	12
C. Material related factors		
C1 Shortage of material	0.68	4
C2 Poor quality of material	0.6	12
C3 Accessibility of storage location	0.67	5
C4 Lack of storage space of material	0.67	5
D. Equipment and Technology related factors		
D1 Lack of equipment and tools	0.68	4

D2 Damage of equipment's	0.62	10
D3 Absence of technological advancements in machineries	0.71	2
E. Labour related factors		
E1 Absenteeism of labours	0.6	12
E2 Incompetence of labours	0.66	6
E3 Overcrowded labour force	0.64	8
E4 Misunderstanding / poor relationship between labours	0.64	8
E5 Increased labour Age	0.65	7
E6 Indiscipline labour	0.64	8
E7 Use of alcohol and drugs	0.59	13
E8 Lack of training	0.59	13
E9 Labor rotation	0.56	16
E10 Personal Problems	0.6	12
F. Safety related factors		
F1 Accidents during construction	0.62	10
F2 Lack of Safety tools	0.67	5
F3 Ignorance of safety measures	0.63	9
G. Project related factors		
G1 Lack of temporary facilities	0.64	8
G2 Congestion of site	0.65	7
G3 Type of contract	0.66	6
H. Stake Holders related factors		
H1 Financial difficulties of the owner / Payment delay	0.69	3
H2 Owner interference during construction	0.57	15
H3 Lack of communication between stake holders	0.61	11
I. Contractor and Management related factors		
I1 Poor resources management	0.71	2
I2 Too much work load	0.64	8
I3 Lack of motivation	0.62	10
I4 Mistakes during construction (Rework)	0.69	3
I5 Lower wages of labour	0.63	9
I6 Incentive given to labour	0.64	8
J. External Factors		
J1 Effect of bad weather	0.71	2
J2 Unforeseen condition	0.65	7
J3 Holidays	0.73	1

K. Major factors affecting labour productivity with respect to severity

The five most significant factors influencing labour productivity,

1. Holidays-0.73
2. Absence of technological advancements in machineries-0.71

3. Poor resources management-0.71
4. Frequent changes in the Design -0.69
5. Financial difficulties of the owner / Payment delay-0.69

5. CONCLUSION

1. The study identified key factors affecting labour productivity using RII, FI, and SI methods.
2. Both internal (management, labour) and external (financial, environmental) factors significantly influence productivity.
3. Holidays, lack of technological advancements, and financial difficulties of the owner are the most critical factors.
4. Frequent design changes and poor resource management negatively impact labour efficiency.
5. Poor communication and coordination among stakeholders lead to delays and reduced productivity.
6. Proper planning, supervision, and timely decision-making are essential to improve productivity.
7. Adoption of modern equipment and technology can significantly enhance labour performance.
8. Improving labour skills, training, and working conditions helps in increasing efficiency.
9. Effective resource allocation and management reduces delays and cost overruns
10. Overall, better management practices and coordination can improve project time, cost, and quality performance.

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