# Factors Affecting Improvements in Labour Productivity in Building Construction Projects—India

**B. Srikanth, Ashwin Raut, Anuja Charpe, and Rahul Reddy**

**Abstract**  The construction industry's productivity is mostly determined by three factors: labour factors, management methods, and external challenges. Over the years, various aspects affecting labour productivity in building sector have been identified. It is critical to understand the degree of productivity in order to design innovative methods to improve construction productivity. The objective of this paper is to find the improvement measures in labour productivity. This paper presents a combination of a literature review and a data analysis of questionnaire survey on the aspects of labour productivity. The identified productivity factors have been divided into five groups, i.e., communication, labour management, management factor, supervision and leadership, and use of construction methods. During the data collection, a total of 86 responses has been collected from various contractors, project managers, consultants, and site engineers working in the building construction sector. The analysis of the study provides a better understanding of productivity concerns in India and directs their efforts to enhance productivity for construction professionals.

**Keyword**  Labour productivity · Labour utilization · Communication · Team management

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# 1   Introduction

Construction productivity, which is generally described as the ratio of output to input, is a well-studied issue. The significance of construction productivity comes from the fact that it is a key indicator of a project's success. Organizations must increase construction productivity performance in order to survive in today's highly competitive business climate (Park 2006). Because construction is a labour-intensive business with labour being the most adaptable resource accessible to management, the bulk of scholars and researchers have focused on increasing construction labour productivity.

The construction business is the world's largest and the most difficult industry. In the construction business, human resources play a critical role in increasing productivity. The efficient and effective utilization of human resources can contribute to increased productivity. Construction projects are mostly labour intensive, using just the most basic hand tools and equipment, with labour costs accounting for between 30% to the 50% of overall construction costs. India has one of the world's fastest growing construction industries. After agriculture, the construction industry employs the second-largest number of people (Kumar 2013) When a construction project is completed on schedule and on budget, it is called a success. Productivity must be efficient for this to happen. In strategic and operational planning, productivity forecasting is critical. For many complicated scenarios, quantitative forecasting is employed in the decision-making process (Sherif Mohamed et al. 2005).

Site productivity is a challenging characteristic to evaluate since it varies greatly depending on the dimension of site and the location of measurement. Average labour productivity, one factor input, overall productivity, performance evaluation, changeover time, and other methods of measuring and analyzing site productivity have been determined by some researchers for the purposes of establishing a baseline and improving construction productivity (Agrawal and Halder 2020). Increased productivity results in bigger profits and more investment opportunities. Productivity gains can result in greater compensation and improved working conditions for employees. Increased productivity is also crucial for job generation in the long run. One of the most important factors affecting the physical development of a building project is labour productivity. Construction workers should be knowledgeable with the resources, equipment, and machinery they utilize in order to carry out work effectively (Murodif and Erizal 2016).

The main objective of the paper is to identify the factors which will improve the labour productivity on construction projects in the buildings in India. Based on various literature reviews, it is observed that many studies focus on overall factors of labour productivity, especially factors which decrease the labour productivity. However, not much emphasis is given on strategies which enhance productivity in positive way. The practitioners and researchers emphasize on negative factors and try to find a way to tackle them, but do not realize the potential to improve further ways to make labour efficient. Thus, in this paper our focus is to tap into the areas where there is potential to gain further improvements in productivity. Further, during the

research ranking of the factors affecting positive labour productivity factors. This will provide practitioners the much-needed strategy to carry out work within stipulated time and with better precision.

## 2 Literature Review

Atfal et al. (2016) studied to examine productivity using work sampling approach. They classified worker's activities into three categories, (i.e. effective work, important contributing labour, and inefficient work). The labour utilization rate (LUR) study revealed that formwork had a 47.32% success rate, reinforcing had a 43.17% success rate, and concrete had a 49.76% success rate. LUR was 45.60% of the total value of all three works. They ran a questionnaire survey and received 53 replies out of 60 questionnaires. After that, they conducted a reliability study to determine the average correlation between the data using the split-half approach. According to the findings of the study, there were eight separate categories that influenced labour productivity: (1) Manpower, (2) Management, (3) Environment, (4) Motivation, (5) Material and equipment, (6) Timetable, (7) Safety group, and (8) Quality group.

In another research, authors emphasized on establishing the relation between various factors and productivity of labours involved in masonry works. They investigated productivity based on following criteria such as; (1) What form of productivity is being investigated? (2) What degree of productivity is being reviewed? (3) The strategy to data collecting. The research focused on six categories of improvements: measurement, improvement assessment, factor identification and ranking, influence and relationship (Dolage and Chan 2013). Shoar and Banaitis (2019) compiled a list of investigations carried out by various scholars throughout the Middle East and Africa. Individual elements relative relevance has been observed to differ depending on location. However, certain of the elements, such as labour competence, site manager leadership skill, adequate tools and equipment, and choice of construction technique have consistently been reported in the top 10 factors by different researchers in different places.

In another research conducted by Tangen (2004) categorized the labour productivity in 10 major groups, those are poor site management, lack of communication, improper supervision, poor material planning, tool and equipment issues, improper drawing management, project management incompetency, craftsmen issues, lack of meetings, and poor labour motivation. He identified material waste is the critical factor influencing labour productivity in Kerala, which found that material issues had the greatest impact on productivity. Further to fill the gap of Tangen (2004), Ghate et al. (2016) conducted a questionnaire survey in the Mumbai region, India and discovered that skilled labour, on-site safety, work schedule, availability of material, building method, and other factors impact labour productivity. The most important component in increasing productivity has been stated to be the use of skilled labour. This is due to competent labour that can accomplish more work in the same amount of time with better quality and greater precision. Skilled labour, by definition, may

create more high-quality work than unskilled labour. Productivity will be significantly greater if it is calculated by the number of hours spent working and the value of work generated. This is due to the fact that experienced labour will be able to create more and rework will be reduced. However, if productivity has been measured by the wages paid to workers and the value of the labour they create, it may not be significantly greater skilled labour costs up to 50% more than unskilled labour. Aside from that, competent labour is frequently found to be in limited supply. One of the primary risks in building construction projects is a labour shortage, which may turn a well-performing project into one with cost and schedule overruns (Ghodrati et al. 2018; Attar et al. 2012; Kazaz et al. 2016; Gomez et al. 2015). As a result, hiring specialized labour for all jobs is not always possible or financially practical.

The focus of current research is to establish the relationship between the factors affecting productivity and in what way they correlate with the masonry labour productivity. As the labour lacks knowledge on steps to be adopted for enhancing the productivity, managers need to step up with this analysis and try to overcome the issue of lack of productivity, which affects the project's completion timely.

## 3 Methodology

The research methodology comprises of systematic literature to identify the factors, gathering data from relevant industry professionals and analyzing the data using relative important index (RII) method. For the collection of the data, the industry professionals from various hierarchy levels were chosen. The chosen professionals were selected from Hyderabad region, the professionals were involved in the building construction works. The data was collected from the contractors (8 Nos.), project managers (15 Nos.), planning engineers (32 Nos.), and site engineers (68 Nos.) during the month of February 2022. Factors that improve labour productivity were adopted from the previous studies described from the literature review. A total of 25 factors was grouped into five major groups which will improve the labour productivity. The five major groups are communication, labour management, management team, supervision and leadership, and use of construction methods as shown in Fig. 1.

To generate a reasonable sample of that population, Eq. (1) was used (Alaghbari et al. 2019).

$$n = \frac{m}{1 + \left(\frac{m-1}{N}\right)} \tag{1}$$

where, $n$ = sample size of limited population,

$m$ = unlimited population, and

$N$ = available population.

In total 123 responses have been collected from the project managers, contractors, consultants, and site engineers who have experience in building construction projects in India. The questionnaire has design based on considerations of cost, time, and
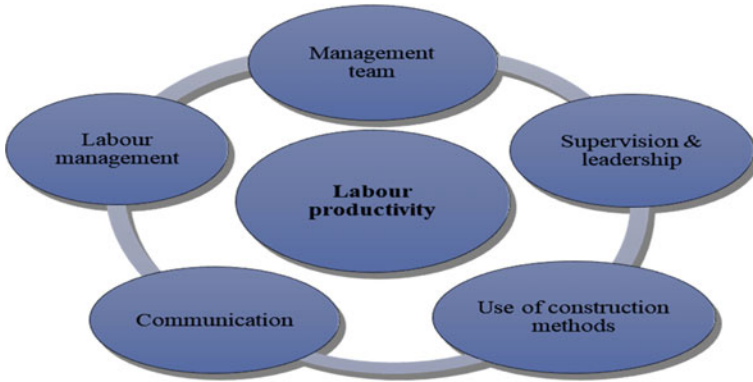
**Fig. 1** Categories of positive labour productivity factors

quality. The individual's opinions on the presented inquiries were evaluated using a Likert scale for this study. On a scale of 1—extremely low, 2—low, 3—moderate, 4—high, and 5—very high, respondents were asked to rate the factors impacting the productivity in building construction projects. For ranking factors, the relative importance index (RII) technique was used which is well-known statistical technique used to understand the importance of parameters (Agrawal and Halder 2020). The RII method is used to determine and understand the criticality of factors based on quantification of factors using weightages, for this technique Likert Scale is used. RII can be calculated by using the following equation.

$$\text{RII} = \frac{\sum_{i=1}^{n}[w_i x_i]}{AN} = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1}{5(n_5 + n_4 + n_3 + n_2 + n_1)} \tag{2}$$

where,

   $W$ = weight assigned by the respondents—1 to 5,

   $A$ = highest weight,

   $N$ = total no. of respondents participated in survey, and

   $X$ = frequency of each weightage.

   The RII approach is a tried and tested method for assessing employee satisfaction, making it the perfect fit for our study.

## 4 Results and Discussion

The factors improving labour productivity in construction projects have been divided into five major groups, a total of 25 factors (Hamza, et al. 2022; Alaghbari et al. 2019; Hasan et al. 2018; Javed et al. 2018). The factors were ranked using RII values with

**Table 1** Relative important index of labour management

| S. No. | Sub-criteria | RII (%) | Rank |
|---|---|---|---|
| 1 | Using repeating construction crews | 66.97 | 1 |
| 2 | Increasing the number of laborers | 66.27 | 2 |
| 3 | Using part-time laborers | 64.18 | 3 |
| 4 | More number of skilled laborers | 61.86 | 4 |
| 5 | Creating a sense of ownership for individual tasks | 59.76 | 5 |

the greatest value indicating the highest rank, positive factors affecting on labour productivity factors were studied.

## 4.1 Relative Importance Index (RII) of the Labour Management

When on a job site, the staff would be working all of the time. That level of output would offer you the more productivity and better profitability. However, the majority of the time, though, you'll observe a group of construction workers sitting about doing nothing. In the majority of situations, they are—awaiting the start-up of a piece of heavy machinery, they are awaiting the arrival of goods at their work area, they're waiting for their work area to be ready for a project, they're waiting for directions from a foreman on what to do next. That's a lot of time spent waiting and all of that waiting is something you want to avoid as much as possible. You want your staff to be actively involved in tasks which need to be completed, rather than waiting for them to begin for whatever reason by using the repeating construction crews the waiting may be reduced. If you can reduce the time spent waiting and motivate your foremen to keep their employees actively engaged in projects, labour productivity will increase (Table 1).

## 4.2 Relative Importance Index (RII) of the Communication Factor

It becomes evident where the firm is now, where it needs to go in the future, and what measures need to be done to get there with the support of effective communication among management and staff. All of this information gives all staff clear directives, which improves productivity and reduces uncertainty. Employees' jobs become less stressful, quicker, more efficient, and happier when they are given specific instructions. Effective communication may help your firm enhance productivity, but you may believe that developing strong internal communication is costly and complicated. There are, however, a few non-expensive options (Table 2).

**Table 2** Relative important index of communication factor

| S. No. | Sub-criteria | RII (%) | Rank |
|---|---|---|---|
| 1 | Giving laborers clear and direct instructions | 75.58 | 1 |
| 2 | Clear roles and responsibility | 73.02 | 2 |
| 3 | Regular and effective communication on construction status with project stakeholders | 72.79 | 3 |
| 4 | Effective site communication | 71.62 | 4 |
| 5 | There is a better flow of information between workers | 66.97 | 5 |

When employees in a firm have effective communication skills, they are more likely to hold one another accountable. Because clear instructions are provided via efficient workplace communication, employees know what is expected of them. This enhances responsibility, which in turn increases productivity. There will be no motivation to improve if there is no responsibility in the workplace. When information is not properly passed to the appropriate individuals, there may be miscommunication and misunderstanding, which can lead to a company's downfall. Confusion is constantly prevalent in the workplace when there has been a lack of good communication. Some employees believe their bosses stated one thing, while others believe they said something quite different. How can everybody work toward the same objective and maximize productivity in this situation? It's critical to have a robust communication system in place so everyone understands the objectives and can work together to achieve them.

## 4.3 Relative Importance Index (RII) of the Management Team

Another factor that affects productivity is management. It's more efficient to arrange work and establish a priority list for the entire team. It's also more efficient to use team management software to keep track of what task each person is working on. That isn't to say that employees can't communicate with one another. Productivity is accomplished through a top-down strategy in which leadership plays a central role. Leaders must communicate effectively, establish process norms, establish a hierarchy of significance, empower employees, and implement a strong training program. Because materials are such a large part of the building budget, lowering procurement or purchase expenses may save a lot of money. Poor material handling can also lead to significant and needless expenses, as well as a reduction in construction productivity (Table 3).

**Table 3** Relative important index of labour management

| S. No. | Sub-criteria | RII (%) | Rank |
|---|---|---|---|
| 1 | Materials and supply chain management | 67.44 | 1 |
| 2 | Improvement of equipment and tools | 67.20 | 2 |
| 3 | Periodic meeting with labour | 66.97 | 3 |
| 4 | Material management | 63.95 | 4 |
| 5 | Safety, healthy and, wages | 63.02 | 5 |

## *4.4 Relative Importance Index (RII) of the Supervision & Leadership*

Supervisors may help their staff be more efficient and productive by creating a competitive working atmosphere with clearly stated standards, extensive job training, flexible designs, and performance-based compensation. The primary focus of supervision is on overseeing or measuring the progress of workers within his authority. He is a key part of the managerial structure. He is the one who has direct contact with the employees and serves as a critical connection between management and the employees. At the bottom of the management hierarchy, a supervisor would be a leader. He is a worker's companion, philosopher, and leader. He encourages people to work as a team and to give their all. He is the one who can assist in maximizing workforce use. A supervisor organizes his group's operations and resources in a systematic manner. He delegated power to workers and assigned duties to each of them. When the work they are doing is not adequately organized, workers become frustrated. If labour is not appropriately assigned, some workers may be idle while others may be overburdened. In an organization's structure, that the very first line supervisor has a crucial role. He is personally responsible for upholding an organization's rules and regulations. He can employ both financial and non-financial incentives to improve worker productivity. Any act of disciplinary problems is dealt with quickly and appropriately (Table 4).

**Table 4** Relative important index of supervision and leadership

| S. No. | Sub-criteria | RII (%) | Rank |
|---|---|---|---|
| 1 | Providing project management training for the site supervisors | 66.27 | 1 |
| 2 | Improving first-line leadership which may include training/coaching/mentoring | 64.41 | 2 |
| 3 | Enhancing leadership and decision-making for the supervisors | 63.95 | 3 |
| 4 | For managing workforce there will be sufficient number of supervisors | 62.32 | 4 |
| 5 | Experienced supervisors | 60.93 | 5 |

**Table 5**  Relative important index of use of construction methods

| S. No. | Sub-criteria | RII (%) | Rank |
| --- | --- | --- | --- |
| 1 | Lean construction | 74.88 | 1 |
| 2 | Building information modelling (BIM) | 73.95 | 2 |
| 3 | Industrialization | 69.76 | 3 |
| 4 | Modularization | 66.27 | 4 |
| 5 | Constructability | 58.83 | 5 |

## *4.5  Relative Importance Index (RII) of Construction Methods*

Once a potential area for increased construction productivity has been identified, management should seek to achieve and maintain the gains over time. In this regard, the current study introduces "lean construction," an alternative control system with well-defined technologies, to aid in optimizing the building process and increasing productivity. Eliminating waste in such a process, which is a result of interruptions that impair construction productivity, is one of the main concerns in lean construction theory. In addition, a long list of lean theory advantages has been compiled, including the following: a decrease in waste, production costs, production cycle time, labour, and inventory; an improvement in overall, profit, and flexibility; and an increase in cash flow and current facility capacity. Construction is a field where advances in communication and technology have a significant impact. BIM systems are becoming more popular on construction sites, and for good reason. The benefits of increased productivity and organization cannot be overstated, and BIM was included to every project manager's toolkit (Table 5).

## *4.6  RII of Overall Positive Factors Improving Labour Productivity*

The overall factors which will improve the labour productivity are given in Table 6, a total of 25 subfactors was identified and their significant values have been found, the top 10 factors which may improve labour productivity are: Giving laborers clear and direct instructions, Lean construction, Building information modelling (BIM), Clear roles and responsibility, Regular and effective communication on construction status with project stakeholders, Effective site communication, Industrialization, Materials and supply chain management, Improvement of equipment and tools, Using repeating construction crews, There is a better flow of information between workers, Periodic meeting with labour.

Giving laborers clear and direct instructions has ranked first with an RII of 75.58%, while lean construction placed second rank with an RII of 74.88%, building information technology (BIM) placed third rank with an RII of 73.95%, clear roles and

**Table 6** RII of overall positive factors improving labour productivity

| Factors | RII | Overall RANK |
|---|---|---|
| Giving laborers clear and direct instructions | 75.58 | 1 |
| Lean construction | 74.88 | 2 |
| Building information modelling (BIM) | 73.95 | 3 |
| Clear roles and responsibility | 73.02 | 4 |
| Regular and effective site communication on construction status with project stakeholders | 72.79 | 5 |
| Effective site communication | 71.62 | 6 |
| Industrialization | 69.76 | 7 |
| Materials and supply chain management | 67.44 | 8 |
| Improvement of equipment and tools | 67.2 | 9 |
| Using repeating construction crews | 66.97 | 10 |
| There is a better flow of information between workers | 66.97 | 10 |
| Periodic meeting with labour | 66.97 | 10 |
| Increasing the number of laborers | 66.27 | 13 |
| Providing project management training for the site supervisors | 66.27 | 13 |
| Modularization | 66.27 | 13 |
| Improving first-line leadership which may include training/coaching/mentoring | 64.41 | 16 |
| Using part-time laborers | 64.18 | 17 |
| Material management | 63.95 | 18 |
| Enhancing leadership and decision-making for the supervisors | 63.95 | 18 |
| Safety, healthy, and wages | 63.02 | 20 |
| For managing workforce there will be sufficient number of supervisors | 62.32 | 21 |
| More number of skilled laborers | 61.86 | 22 |
| Experienced supervisors | 60.93 | 23 |
| Creating a sense of ownership for individual tasks | 59.76 | 24 |
| Constructability | 58.83 | 25 |

responsibility will be placed fourth rank with an RII of 73.02%, regular and effective communication on construction status with project stakeholders ranked fifth with an RII of 72.79%, and effective site communication ranked sixth with an RII of 71.62%, these factors which have RII > 70%, as shown in graph 1, the factors which has less significant value and RII < 60% are creating a sense of ownership or control for individual task with an RII of 59.76% and constructability with an RII of 58.83% has the less significant value among all.

## 5 Conclusion

The study has looked into the factors that improve the labour productivity in the construction industry and found total of 25 factors which will improve the labour productivity positively. These 25 factors have been divided into five major groups, those are communication, labour management, management team, supervision and leadership, and use of construction methods. The data received from respondents using the questionnaire survey technique was further reduced by utilizing the RII approach to rate them. Giving laborers clear and direct instructions, lean construction, BIM, clear roles and responsibility, regular and effective communication on construction status with project stakeholders are the top five factors which may improve labour productivity. The factors which have less significant value are constructability and creating a sense of ownership or control for individual tasks among all the factors. In most Indian construction sites, low labour productivity is a constant issue. However, on building sites, labour productivity is rarely assessed; therefore the losses are never discovered. The research has identified elements that have a positive influence on labour productivity in India, the findings will assist building construction professionals in their attempts to enhance productivity.

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