

To Study of Labour Productivity Management in Construction Project

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Abstract: *The world's largest construction business offers many investment opportunities in allied sectors. By taking the owners' perspective, we can focus on the entire project management process for built facilities, not just the historical roles of planners, architects, engineering designers, constructors, fabricators, material suppliers, financial analysts, and others. Each speciality offers advanced building project implementation methods and tools. In Nagpur, skilled and unskilled labourers are in limited supply. The timeline, cost, and performance of contractors and project completion are all affected by this scarcity. This study seeks to identify the situation, its causes, and cost- and schedule-effective solutions. Our analysis relied on multiple reports, newspaper clippings, and other data. Enhancing long-term productivity requires structural changes to factor, product, and labour markets. The rating agency has stressed that land acquisition, goods and services tax, and labour market changes should be resolved quickly to boost economic growth. Labour productivity is crucial for the construction industry, which has absorbed many agricultural workers. Its delayed adoption of new technology and unorganised operations are concerns.*

Keywords: Labour Input, Labour Output, Capability, Relative Important Method, Survey.

I. INTRODUCTION

The term "productivity" in the construction industry refers to the average number of hours of direct labour required to finish a project. It also indicates how effectively resources such as labour, materials, and technology are utilised. A higher level of productivity leads to an increase in output while maintaining or reducing the costs of inputs. Productivity is of the utmost importance in the construction industry, since labour costs account for thirty to fifty percent of the overall cost of a project. On the other hand, construction productivity has decreased, which means that more hours of labour are required for ongoing projects. The reduction in productivity indicates that the industry has not properly embraced labor-saving techniques or equipment, which presents a substantial challenge to productivity despite the fact that some breakthroughs have been made.

1.1 Importance of Labour Productivity/ Output

The expansion of productivity is significant because it plays a role in the expansion of output, income, and living standards.

In the form of a growth rate, the definition can be expressed as follows:

Growth in Productivity = Output of worker – Input of worker

In other words, the increase of output is influenced by both the growth of inputs and the rise of productivity.

Following this, we make the observation that the growth of output is equivalent to the growth of income (assuming output is measured as value added). Therefore, an increase in productivity in an economy will result in an increase in income. In addition to being a measure of both income and output, the Gross Domestic Product (GDP) is also a measure of labour productivity. The GDP per hour worked is a measure of the GDP. As a consequence, a rise in production will lead to an increase in the amount of money earned by each individual. In practice, another term that is used is that the number of hours worked by each individual only varies gradually and by a relatively modest amount over the course of time. This definition is used to describe the situation.

At the level of the company or the industry, the benefits of increased productivity can be distributed in a variety of different ways. These include:

- The workforce, through improved wages and working conditions;
- Shareholders and superannuation funds, through increased profits and dividends or distributions;
- Customers, through reduced prices;
- The environment, through environmental protection that is more stringent; and
- Governments, through increases in tax payments

The purpose of determining the many factors that influence the labour productivity in the building enterprise.

1. Assign a ranking to each of these criteria in order to determine which of them has the greatest impact on the amount of work that is accomplished.
2. To use a case study conducted on the premises in order to conduct an investigation into the elements that are accountable for the lack of productivity and delays in activity.
3. Determine possibilities to cut down on activities and delays that are not productive, and then advise that these opportunities be reduced.

Issues pertaining to productivity can be broken down into two categories: macro and micro. Contracting methods, labour regulations, and labour organisation are all topics that are discussed at the macro level. On the other hand, the management and operation of a project, mostly at the job site, are discussed at the micro level. That we are able to quantify production is necessary if we are to improve it. Also, we need to be able to measure the impact that the changes we make have on the systems, processes, and efforts that we use. Comparisons can then be made between the values of productivity that were measured and either the numbers that were used to generate the estimate or certain production standards.

1.2 Factors Studied for Labour Productivity

There are 40 factors studied which can effect on the labour productivity. These factors are divided into four groups.

1. Technological group
2. Human group
3. Management group
4. External group

Table-1 Factor studied for labor productivity

Sr. No.	Factors in technological group	Factors in human group	Factors in management group
1	Technical specifications clarity	Abilities in the work	The absence of supervision of workers
2	Alter execution order	Exhaustion of the body	Techniques of construction
3	Coordination between design disciplines	A driving force behind labours	A delay in payment
4	Level of design complexity	A scarcity of workers with relevant experience	Putting in extra hours,
5	Rework,	Diseases and conditions	Quantity of crew members and make-up
6	site layout,	Arrangements made available to workers	The percentage of work that was subcontracted
7	inspection delay	Hygiene conditions in the	Due to a lack of leadership, the

		vicinity of them	construction manager
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II. METHODS AND CASE STUDY

In order to collect information for this inquiry, a structured questionnaire survey was conducted in Nagpur, Maharashtra. The survey included 35 criteria that influence the number of construction workers who are productive. Technology, human/labor, management, and external factors were the four categories that were used to categorise these aspects, which were identified based on prior studies and feedback from local industry experts. There were thirty responses from site engineers, project managers, consultants, and supervisors that participated in the survey, which was directed towards medium and big businesses. An analysis of the data that was gathered was performed using a method known as the Relative Importance Index (RII), which assists in determining the significance of each individual element. The RII values were derived from the scores obtained on a scale that ranged from one (negligible effect) to five (extremely strong effect), and the scale was used to measure the effect.

2.1 Relative importance index.

$$RH = \frac{5(n_5) + 4(n_4) + 3(n_3) + 2(n_2) + n_1}{5(n_1) + n_2 + n_3 + n_4 + n_5} * 100$$

Using this formula of relative importance index (RII), we can find the factor affecting labor productivity having maximum effect.

2.3 Case Study

Show how to monitor labour utilisation and boost direct productivity. Estimate the percentage of direct labour hours wasted on non-productive and delayed work. Analyse nonproductive and delay causes.

1. Assess labour availability.
2. Examine usage
3. Review productivity.

a. Work sampling

Work sampling, rooted in statistical sampling theory, is a more advanced method than field rating for assessing worker activities. It involves observing and categorizing workers' activities as productive, non-productive, or semiproductive. The percentages of each activity type are calculated from these observations. While work sampling provides an indirect measure of productivity, it may not accurately reflect specific tasks, like the efficiency of a carpenter. Consequently, its results should be carefully considered and used prudently in decision-making.

b. Study of specific activity to analysis the reasons of delay in project Study of RCC activity of slab

The Basic Information from the case study as Area of slab: - 28 x 42 = 1176 sqft = 109.29 sqm.,

No. of Columns are 12 no. No. of observer are 3 no. for supervision, Duration of work are 10 days/2 week

Each activity's labour and scheduled days are listed. We must investigate activity obstacle delays.

1. Beam bottom shuttering, supporting, centering, and binding are immediate. The scheduled days' activities were completed. Oil was scarce when supporting and slab bottom ply shuttering and oiling. It takes 1 hour to deliver oil because it finishes in between due to low quantity. No slab/beam steel centering delays.
2. Structural designer, architect, and engineer needed for cleaning and checking activities. A structural designer found a design flaw during inspection. That takes 2.5 hours to fix. A bit of rework. All available labour is needed for slab casting. The equipment needed for casting is accessible, but lack of maintenance or ancient vibrator hinders production. Repairing that 1.5-hour time takes No beam-side DE shuttering or curing delays.

Table – 2 Sample Causes of Delay and Recommended Remedial Action

Delay Causes	Measure to be taken
Awaiting the order	Prepare and assign work responsibilities in advance.

Locating content	Improve site layout
Obtaining supplies	Material management and site layout should be investigated.
Individual breaks	Discipline and management of human resources should be investigated.
Awaiting equipment repair	Use equipment that is on standby whenever it is possible, make a plan in advance to reassign staff to other operations, and schedule maintenance on equipment to ensure that it remains in good operating condition.

III. ANALYSIS AND RESULT

The Result of the questionnaire survey as summarized below in tabular form the shows the RII in percentage for each above factor that we study from literature. The following table and graph will represent the result and conclusion

A. Technological Group Factor RII percentage of technological group: - From the technological group, we found out the following result for each factor.

Table-3 Technological Group Factor RII Percentage of Technological Group

Technological Group Factor	Technical specifications clarity	Alter execution order	Coordination between design disciplines	Level of design complexity	Rework	Site layout	Inspection delay
RII	79	71	66	67	73	60	71
RANK	1	4	6	5	2	7	3

According to the participants in the questioner survey, the most significant element that has an effect on labour productivity is the technology group, which has a RII which is eighty percent. This component receives the highest rank among all the factors. Of all the criteria, "Site restricted areas" is the least important one, with a relative importance index (RII) of 53.33%, making it the last one on the list.

B. Human group

From the human group, we found out the following result for each factor

Table-4 RII Percentage of Human Group

Skill	Fatigue	Motivation	A shortage of experienced	Health	Facilities	Hygienic
83	67	75.33	86	62	68	67
2	4	3	1	7	5	6

According to the participants in the questioner survey, the most significant element that has an effect on labour productivity is the human group, which has a RII of 84% and receives the top position in this group. And the "Health conditions" component is the least important one, accounting for 62.67% of the total.

Management group

From the management group, we found out the following result for each factor.

Table 5 RII Percentage of Management Group

Sr. No.	Management Group	% of Factor	Position
16	The absence of supervision of labour;	77	3
17	The method of construction;	70	8
18	The delay in payment;	72	5
19	Working overtime;	71	6
20	The size and composition of the crew;	70	8
21	The proportion of work that is subcontracted;	68	9
22	The absence of leadership on the part of the construction manager;	79	2
23	The shortage of materials;	68	9
24	The unsuitability of the storage location;	61	10
25	Unrealistic scheduling and expectations of labour performance	76	4
26	Accidents that occurred as a result of inadequate site safety	82	1
27	A deficiency in hardware and tools on the premises	76	4
28	An uneven allocation of resources	70	7
29	A lack of sufficient funding for the project	79	2

According to the participants in the questioner survey, the most significant element that has an effect on the labour productivity is the management group, which has a RII of 82.67%. Furthermore, "Unsuitability of storage location" is the component with the lowest relative importance, with a RII of 61.33%.

C. External group

From the external group, we found out the following result for each factor

Table 6 RII Percentage of External Group

High Humidity	High Temperature	High Wind	Rainy Season	Various Festivals	Political Instability Or Change In Govt. Policies
59	75	66	87	76	60
5	3	4	1	2	6

As can be seen in Table 6, the "rainy season" is the most significant element that has an impact on the labour productivity of the external group. It has a relative importance index (RII) of 86.67%, which places it at the top of the list of all the factors, according to the participants in the questioner survey. Furthermore, the "Political instability or change in government policies" is the element with the lowest relative importance, with a RII of 57.33%.

IV. CONCLUSION AND RECOMMENDATION

Based on the findings of the preceding study, the concluding remark for the outcome, and based on the results, we may adopt the recommended strategy to reduce delays caused by labour productivity and other factors. In this case, we are able to make use of the outcome as well as the suggested measure for work and circumstances that are comparable. The following is a summary of the findings and conclusions of the investigation.

A. Result for labour availability, productivity

From the observations taken from site, percentage works calculated are as below calculated work

- Direct productive work 58%
- No productive work 35%
- Down time 10 %
- Possible productive work 67 %

B. Result for delay causes

Time lost in non-productive activities is 6 hrs.

Causes of delay:

- Improper management of materials – 1.2 hr. loss in productive work
- Lack of supervision cause the rework – 3.2 hr. loss in productivity
- Reduced maintenance of tools and equipment results in a loss of production of one and a half hours.
- 40 different elements that have an impact on the productivity of the workforce have been discovered.
- The results of the questionnaire survey that were presented earlier indicate that the most significant elements that influence the level of labour productivity across all of the categories, according to the ranking, are as follows: Factors of high rank from each and every group

Table- 7 Rank of Factor

Sr. no.	Factors	RII	Rank
1	The impact of rainy days on production is significant during the rainy season	86	1
2	An insufficient number of experienced workers	84	2
3	Inadequate safety measures can result in accidents	85	3

D. Action to be taken to improve Labour work capacity

The impact of rainy days on production is significant during the rainy season. The rain is so intense that it has stopped most of the work. In this day and age, it is necessary to carry out internal work such as plastering, brickwork, tiling, and other similar tasks. The time can be utilised in this manner, which also contributes to an increase in the level of productivity. An insufficient number of experienced workers: If there is a fresh labour force that does not have any prior experience or awareness of the work responsibilities, then the labour force should initially get fundamental training. Interaction between the labour force and the new methods of work, which allow them to work more efficiently and save time at the time that they are really doing their functions.

Inadequate safety measures can result in accidents. The workers should be given with everything that is necessary for their safety, including the necessary equipment. For example, when working at heights, you should wear safety jackets, helmets, shoes, and safety nets. It is recommended that a seminar on safety be given for workers in order to increase their knowledge of safety. It is possible to limit the number of accidents that occur as a result of inadequate safety measures by making appropriate use of safety equipment and having a fundamental understanding of safety.

REFERENCES

- [1]. Shree Raja Gopal T G1 and Murali K2 “Analysis of Factors Affecting Labour Productivity In Construction” International Journal of Recent Scientific Research Vol. 7, Issue, 6, pp. 11744-11747, June, 2016.
- [2]. Saravanan. M and Surendar. G “Analysis of Various Factors Influencing Labour Productivity In Construction Project” International Journal of Emerging Technology in Computer Science & Electronics (IJETCSE) ISSN:0976-1353 Volume 22 Issue 2 – MAY 2016.
- [3]. Dharani K “Study on Labours Productivity Management in Construction Industry” (2015) International Journal of Latest Trends in Engineering and Technology (IJLTET).
- [4]. Kirti D. Bhonsle “A study of urbanization in Nagpur district” Institute of Town Planners, India Journal 7 - 3, 88- 95, July - September 2010.
- [5]. Sherif M. Hafez, Remon F. Aziz, Enas S. Morgan, Madeha M. Abdullah, Eman K. Ahmed (2014), Critical factors affecting construction labour productivity in Egypt-American Journal of Civil Engineering. Vol. 2, 35-40.
- [6]. K.S Pribadi, B.W. Soemardi, and R.D. Wirahadikusumah “Factors Relating to Labour Productivity Affecting the Project Schedule Performance in Indonesia” 1-8.
- [7]. Mr. A.A. Attar, Prof. A.K. Gupta, Prof.D.B.Desai Soekiman, A Study Of Various Factors Affecting Labour Productivity And Methods To Improve It” Second-Journal of Mechanical and Civil Engineering 11-14.
- [8]. Anurag Sangole, Amit Ranit (2013) ‘Identifying Factors Affecting Construction Labour Productivity in Amravati’ International Journal of Science and Research (IJSR) ISSN (Online): 2319-706.
- [9]. Vaishant Gupta1, R. Kansal “Improvement of construction labour productivity in Chambal region” ijret: International Journal of Research in Engineering and Technology eISSN: 2319-1163 | pISSN: 2321-7308.
- [10]. B.Vijay Antony Raj and Mrs.P.S.Kothai “Study on the Factors Affecting The Performance Of Labours in Indian Construction Industry” International Journal of Innovative Research in Science, Engineering and Technology.
- [11]. Serdar Durdyev, Syuhaida Ismail, and Nooh Abu Bakar “Construction Productivity in Turkmenistan: Survey of the Constraining Factors” (2013) International Journal of e-Education, e-Business, e-Management and e-Learning, Vol. 3, No. 1, February 2013.