

Identifying Factors Affecting Construction Labour Productivity in Amravati

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Abstract: Poor labour productivity is a problem faced by the construction industry in developed as well as developing country. It is essential that attempts be made to improve labor productivity. Any improvement in productivity cannot be achieved without understanding the factors that adversely affect productivity. The objective of this research is to identifying the factors affecting the labour productivity in the construction projects in Amravati, Maharashtra. The study was carried out through questionnaire based survey. Questionnaire was composed of 30 productivity factors, classified under the following four primary groups: (1) management; (2) technological; (3) human/labor; and (4) external. Among these 30 factors the top 5 most significant factors in their effects on labor productivity: (1) clarity of technical specifications; (2) the extent of variation/change orders during execution; (3) lack of labour supervision; (4) coordination level among design disciplines; (5) design complexity level. The results obtained fill a gap in knowledge of factors affecting labor productivity in Amravati, which can be used by industry practitioners to develop a wider and deeper perspective of the factors influencing the efficiency of operatives and provide guidance to construction managers for efficient utilization of the labor force, hence assist in achieving a reasonable level of competitiveness and cost-effective operation.

Keywords: Construction, Labour Productivity, Labour Productivity factors, Relative Importance Index (RII).

1. Introduction

Construction is one of the largest and most challenging industries. As it has the largest potential for creating employment. In most countries labour cost comprises 30 to 50% of the overall project's cost. Human resource today has strategic role for productivity increase of any organization, and this makes it superior in the industrial competition. Construction is key sector of the national economy for countries all around the world, as traditionally it took up big portion in nation's total employment and its significant contribution to a nation's revenue as a whole. A successful construction project is one that is completed on time, within budget, meets specified standards of quality, and strictly conforms to safety policies and precautions. All of this is possible only if the premeditated levels of productivity can be achieved. However, productivity, or lack of it, is perhaps one of the main problems faced by the construction industry, the construction firms and the construction project. As a consequence of the importance of construction industry, the nature of construction projects and the available economic resources, more emphasis should be given to improving productivity.

Productivity is one of the most important issues in both developed and developing countries. The developed countries are aware of the importance of economic growth and social welfare. The developing countries which face unemployment problems, inflation and resource scarcity seek to utilize resources and in such a way as to achieve economic growth and improve citizens lives. Productivity is one of the most important factors that affect overall performance of any small or medium or large construction industry. The concept of productivity is importantly linked to the quality of input, output, and process.

There are many challenges that are faced by construction in India, but one of the important challenges is labour productivity in construction. Labour productivity is one of the most important factors that affect the physical progress of any construction project. Construction labourers are responsible to operate a variety of equipment. To perform their jobs effectively, construction labourers must be familiar with the duties of other craft workers and with the material, tools and machinery they used. There are number of factors that directly affect the productivity of labour, thus it is important for any organization to study and identify those factors and take an appropriate action for improving the labour productivity. Achieving better labour productivity require detail study of actual labour cost. Various labours have different variables affecting their productivity levels. For every project, productivity, cost, quality, and time have been the main concern. Better labour productivity can be achieved if project managers includes the skill of education and training, the work method, personal health, motivational factors, the type of tools, machines, required equipment's and materials, personal skill, expected work quality, work location and some others labours related factors.

Objective of study:

- To identify various factors which affect labour productivity in construction industry.
- To give the ranking to these factors by RII (relative importance index) techniques.

2. Literature Review

A number of studies have been carried out to determine the factors affecting labor productivity in construction projects. The word productivity was invented in 1766 when it was first mentioned in an article by Quesnay, Veggi (1987). More than

a one century later 1883, the productivity is defined as “faculty to produce” by the changes of time the modification was made in the definition “the relationship between output and means employed to produce that output” was developed. The American association of cost engineers, moreover, define the productivity as a “relative measure of labour efficiency, either good or bad, when compared to a stabilized base or norm” (Salmon et al. 2000) while Arditindmochtar (2000) regard to productivity as “the ratio between total output expressed in dollars and total inputs expressed in dollars as well” honer and duff (2001) expressed productivity as “how much is produced per unit input”

In 2006 M.R. Abdul Kadir, W.P. Lee, M.S. Jaafar, S.M. Sapuan and A.A.A. Ali from Malaysia did survey of 100 respondents consisting of 70 contractors, 11 developers and 19 consultants. They used relative importance index (RII) method to carry out the ranking of criteria affecting labour productivity as per their study critical factors were: (1) technology, (2) human/labour, (3) management, (4) external. In 2012, Abdulaziz M. Jarkas, and Camille G. Bitar carried out a survey in Kuwait. The objective of this research was to identify and rank the relative importance of factors perceived to affect labour productivity on construction sites. To achieve this objective, a statistically representative sample of the contractors was invited to participate in questionnaire survey, comprising 45 productivity factors. As per their finding important factor were: (1) Clarity of technical specifications, (2) Extent of variation/change orders during execution, (3) Coordination level among various design disciplines.

In 2013 Khaled, Mahmoud El-Gohary and Remon, Fayek Aziz from Egypt carried out the survey. The questionnaire comprised thirty productivity factors where they classified them under the following three primary categories: (a) human/labor; (b) industrial; (c) management. They used relative importance index method. This index was computed for every factor for each specific year of the participant’s experience.

In 2013 Wen Yi and Albert P.C. Chan carried out the study of a systematic review on labor productivity in the construction industry. The aims of this review were to investigate the state of the art and trends in CLP (critical labour productivity) research, and to identify key research areas. Above researches are carried out in countries other than India. Such study is required to be carried out in India. The present study aims to carry out study of labour productivity factors.

3. Research Methodology

The relevant data for this investigation were collected by a structured questionnaire survey. On the basis of related previous studies on labour productivity and the input of local industry experts, professionals, and practitioners, 30 factors were identified which are having an influence on construction labour productivity in the Amravati city of Maharashtra.

The target population included civil engineering and building construction firms that are classified by the contractors.

Survey was having a target population of only Amravati city in Maharashtra.

To obtain statistically representative sample size of the population following equation was used: $n = \frac{m}{1 + \frac{(m-1)}{n}}$

Where n, m and N = the sample size of limited, unlimited available population, respectively. m is estimated by

following Equation: $m = \frac{z^2 * p * (1-p)}{e^2}$

Where z = the statistic value for the confidence level used, i.e., 1.96, and 1.645 for 95% and 90% confidence level respectively; p = the value of the population that estimated and e = the sampling error to be estimated. Because the value of p is unknown sincich et al. (2002) suggest the value 0.50 to be used in sample size.

$$m = \frac{1.645^2 * 0.50 * (1-0.50)}{(0.05)^2} = 271$$

Here confidence level is taken as 90%. Accordingly, for the total number of classified contractors, the sample size is 152.

$$n = \frac{271}{1 + \frac{(271-1)}{344}} = 152$$

This study received total 52 responses which are 30% of the required sample size. The 30 factors surveyed into four groups: (1) technology, (2) human/labour, (3) management, and (4) external.

The 30 factors surveyed were classified into the four previously indicated major groups, that is: (1) management; (2) technological; (3) human/labor; and (4) external. The frame work of the factors is given in table 1.

Table 1: Framework of factors affecting construction labour productivity

Sr. No.	Group	Factors
1	Technological	Clarity of technical specification
2		The extent of variation/change order during execution
3		Coordination level among design disciplines
4		Design complexity level
5		Rework
6		Site layout
7		Inspection delay/stringent by the engineer
8		Site restricted access
9	Human/labour	Motivation of labour
10		Skill of labour
11		Physical fatigue
12		A shortage of experienced labour
13	Management	Type A (labour management)
14		Construction managers lack of leadership
15		Lack of labour supervision
		Working overtime

16		Crew size and composition
17		Unsuitability of storage location
18		Accidents as a result of poor site safety program
19		Communication problem between site management and labour
20		Lack of providing labor with transportation
	Management	Type B(Material management)
21		Proportion of work subcontracted
22		Unrealistic scheduling and expectation of labour performance
23		Shortage of materials
24		Unavailability of suitable tools
25		Construction method
26		Payment delay
27	External	High/Low temperature
28		High humidity
29		High wind
30		Rain

Data Analysis:

The data collected were analyzed using the relative importance index technique. Relative Importance Index (RII) method helps to determine the relative importance of the various factors affecting on labour productivity. The five-point scale ranging from 1 (low important) to 5 (very important) is adopted and it is transformed to relative importance indices (RII) for each factor as follows: The relative importance index was calculated by the formula shown below.

Relative importance index (%)

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

Where n1, n2, n3, n4, and n5 = the number of respondents who selected: 1, for not important; 2, low important; 3, for moderately important; 4, for important; and 5, for very important respectively. For illustration purposes, assuming that for a certain productivity factor investigated, the total number of respondents who selected 1, i.e., not important, was 5, and those who selected 2, i.e., low important, were 20, whereas those who selected 3, 4, and 5, i.e., moderately important, important, and very important, were 90, 40, and 2, respectively, then the relative importance index for this particular factor is determined by,

Relative importance index (%)

$$= \frac{5(2) + 4(20) + 3(90) + 2(40) + 2}{5(2 + 40 + 90 + 20 + 2)} \times 100 = 61.78\%$$

4. Results and Discussion

From Relative Importance Index techniques (RII) ranking of factors which affect labour productivity were worked out. Following table gives this ranking.

Table 2: Ranking of factors affecting labour productivity by Relative Importance Index (RII) Technique.

Sr. No.	Group	Factor	RII (%)	Rank
1	Technological	Clarity of technical specification	87.69 %	01
2		The extent of variation/change order during execution	83.15 %	02
3		Coordination level among design disciplines	80.61 %	04
4		Design complexity level	79.23 %	05
5		Rework	69.16 %	09
6		Site layout	58.18 %	17
7		Inspection delay/stringent by the engineer	70.15 %	07
8		Site restricted access	59.61 %	16
9	Human / labour	Motivation of labour	57.30 %	18
10		Skill of labour	69.96 %	08
11		Physical fatigue	57.20 %	19
12		A shortage of experienced labour	65.18 %	12
	Management	Type A (labour management)		
13		Construction managers lack of leadership	65 %	13
14		Lack of labour supervision	80.76 %	03
15		Working overtime	56.92 %	20
16		Crew size and composition	53.07 %	23
17		Unsuitability of storage location	70.38 %	06
18		Accidents as a result of poor site safety program	53.59 %	22
19		Communication problem between site management and labour	52.12 %	25
20		Lack of providing labor with transportation	49.10 %	27
	Management	Type B(Material management)		
21		Proportion of work subcontracted	61.15 %	14

22		Unrealistic scheduling and expectation of labour performance	56.22 %	21
23		Shortage of materials	67.53 %	11
24		Unavailability of suitable tools	60.45 %	15
25		Construction method	68.07 %	10
26		Payment delay	52.69 %	24
27	External	High/Low temperature	50.83 %	26
28		High humidity	42.69 %	29
29		High wind	39.23 %	30
30		Rain	46.92 %	28

5. Conclusion

A questionnaire survey was carried out in Amravati to determine the factors that significantly affect construction labour productivity. 52 sites were visited to collect responses on the questionnaire.

The top five important factors influencing construction labour productivity that emerged from the survey were Clarity of technical specification, the extent of variation, lack of labour supervision, coordination level among design disciplines and design complexity level. The factors that have been identified are in close agreement with studies carried out in other countries.

All the factors give the importance of proper project management in the construction industry. Project managers should concentrate their efforts on eliminating the factors negatively impacting labour productivity to achieve productivity improvement. With better project management and proper project programming construction labour productivity can significantly improve.

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