

Importance of Labour Efficiency in Dry Dock Construction



Govind Singh, Ankit Kumar, Samyak Jain, Shanmuga Priya T

Abstract: This research paper aims to define and evaluate factors affecting labor productivity in the construction site. A formal questionnaire survey was used as the tool for collecting data from the workforce from dry dock construction. The data collected were analyzed using the index of relative importance (RII) to rank the variables based on their relative importance. Suitable recommendations were made to working pattern considering the survey results and this showed an increment in the labour productivity. In this study the responses was collected from the thirty professionals working on the dry dock construction site. Based on the RII value the responses were analyzed and top ten factors were selected that influences the labor productivity the most. After implementing suggestive measures in four teams, productivity was improved and as a result baseline productivity for all four teams was almost around 350 kg/man. Improving productivity can help to reduce time and cost at the construction field.

Keywords: Labour Productivity, Lean construction, Dry Dock Construction, RII Value

I. INTRODUCTION

The construction industry plays a major role in the social, economic and especially infrastructure development of any region. The construction industry is one of the labor-intensive industries and hence it relies on its labour skills [1]. One most focus seeking problem in the construction industry is unskilled labor which results in loss of productivity and affects cost and schedule. The importance of labour productivity is considerable with respect to concern for determining the success of a construction project from a financial perspective [2].

Labour productivity directly influences the physical process of construction projects [3-4]. For an effective job, labour should know prospective material, techniques, and machinery.

Identification and rectification of factors influencing labor productivity becoming a laborious issue for project managers for a long time to improve productivity. A clear understanding of factors influencing productivity can lead to draft a plan and strategy to mitigate inefficiencies and to increase the rate of the performance of the project [5]. A lot of researches have been done so far on labour productivity related to the construction industry. Hashim Abdallah Al-Saleh (2011) found that one important scale to identify the performance of the construction projects at the primary level depends on its relation to financial improvements [6].

Basic planning elements of projects are time, quality and cost these elements are intensively related to each other even labour productivity is an important factor influencing construction management which is directly related to above-discussed elements [7]. The implementation of project performance can be considered as an output of the process as implied that time of construction plays a significant role which frequently fills in as a benchmark to identify the performance varieties such i.e. individuals, health and safety [8]. Finishing projects in an anticipated way of time (Inside calendar) is one of the significant markers of success. One of the frequent problems for construction projects is cost overrun and contractors are responsible for the common presence of cost overrun like monetary profit, material wastage, cost of design and labour productivity [9-11].

Several studies have been conducted on labour productivity with different construction projects in India [12-14]. Doloi et al. (2012) found that the labour productivity is the main cause for delays in Indian construction projects. In their study, they examine a set of 45 attributes which causes a delay in Indian construction industry out of which lack of commitment of individuals, poor site management and inefficient site coordination. Finally, poor labour performance influences at most cause for delay of a project [15]. Jarkas and Bitar conducted the questionnaire survey for 45 factors that affect the productivity of labour. From their analysis they classified factors in four divisions like management related, human-related, technological related and external factors related. They concluded that the efficiency of construction managers needs to be improving for efficient utilization of the labor and proper training should be given to labours to improve construction productivity improvement. [16]

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Talhouni (1990) [17] grouped four classes in charge of influencing profitability on building sites: (a) Management, (b) Site, (c) Design, (d) Weather, while Herbsman & Ellis (1990) [18] detailed two-gathering principle Parts of factors: first is Technological and second is Administrative. In addition, Sugiharto (2003) [19] later dispense the main elements impinging upon development profitability in Indonesia into the accompanying three classifications: (a) qualities of temporary workers, (b) insufficient administration methodology, and (c) association's core interest.

Heizer and Render (1996) [20] arranged efficiency elements into three important categories: (a) work qualities, (b) site conditions, and (c) non-beneficial exercises. Additionally, Enshassi [21] et al.

(2007) reviewed 45 variables influencing work profitability of structure extends in Gaza Strip, and circulated such elements under the accompanying 10 important categories: (a) materials/instruments, (b) supervision, (c) authority, (d) quality, (e) time, (f) labor, (g) site, (h) external, (i) inspiration, and (j) security.

Limited studies were done related to measure the labour productivity at Indian construction sites; hence, there is productivity losses are never recognized. The current scenario of the Indian construction industry thereby warrants research in construction labour productivity, particularly in identifying opportunities

In this study, Relative Importance Index (RII) has been used to analysis the Questionnaire. The RII method was successfully used by several researchers to evaluate the relative importance of attributes given by the respondents [22-24]. The construction industry is having numerous internal and external factors that are not changeable. A regular variation in productivity is caused by these factors. Examining and rectifying the factors influencing labour productivity is an important issue for management to improve productivity. A clear understanding of factors influencing productivity can lead to draft a plan and strategy to mitigate inefficiencies and to increase the rate of the performance of the project. This particular study questionnaire survey to be conducted based on factors affecting the labour productivity in the Dry dock construction site at Cochin. The responses from the questionnaire survey to be analysed and suggest preventive measures to improve labour productivity.

II. METHODOLOGY

A. Data Collection

In the Dry dock Construction site they were facing the problem of low productivity. Projects were exceeding the estimated cost and the deadline. Therefore it was essential to recognize the effect of the factors affecting labour productivity in the rebar cage fabrication.

During the rebar cage fabrication data have been collected to find the efficiency of four teams with 350kg/man-day as the baseline efficiency. Identified the critical elements affecting efficiency in rebar cage fabrication and necessary recommendations has been implemented to improve the efficiency. The pattern gives the actual situation of

efficiency in construction industry. A questionnaire that will provide management group and technological group with aefficiency tool that will improve project efficiency. The survey results can be used in the planning stage and serve as a checklist to guarantee a more productive completion of projects.

B. Elements affecting labour productivity

From the literature survey a total of twenty factors that are affecting labour productivity are divided in to four major categories (Management, Technological, Labour and Others). The detailed lists of factors are presented in the Table1.

Table 1: List of elements considered for the study

Management Group	
Labour Supervision	Postponement in Inspection by Site Management/Engineer
Construction methods	Material Shortage
Payment Delay	Inadequacy of project management
Delayed Arrival, Quitting early and Periodic Casual Breaks.	Lack of Suitable Rest Area Offered to labour on Site
Sequence of Work	Crew Size and Composition
Communications between Site Management and Labour	Lack of Providing Labour with Transportations
Unreasonable Scheduling and Labour performance expectation	
Technological Group	
Explanation in Technical designation	Degree of variables or Change Order During Executions
Rework	Containment of Working Space
Site Layout	
Labour Group and Other Group	
Rain	Availability of Experienced Labour

Productivity improvement in construction industry may have a significant impact on improving Gross Domestic Product (GDP). Varieties in the construction labour productivity can normally have an incredible effect on national economy and productivity. Deficiency of security, absence of abilities, inappropriate quality of materials, insufficient wages and correspondence obstructions mainly raise the mental stress level of the workers. This influences the labour productivity to a large extent. Construction labour productivity has just been picking up significance recently and it is one of the most looked subjects in the construction field now. In many nations, work cost involves 30 to 50 per cent of overall project costs and therefore considered a true representation of the operation's economic success.

The effect of construction productivity on the exhibition of construction related project, an organized questionnaire survey technique was considered. Based on these traits, an organized questionnaire was prepared.

C. Assessing the productivity

In the Dry dock Construction site they were facing the problem of low productivity. Projects were exceeding the estimated cost and the deadline. It was therefore necessary to determine the impact of the labour productivity variable in the Rebar cage fabrication.

There are four sub-contractors for fabricating the rebar cage and are named hereby as group (1, 2, 3, 4)

The total number of workers and work time each team take to complete the fabrication of a rebar cage is noted down.

Based on this, the efficiency per man day can be calculated as:

$$X = \text{Number of workers} * \text{total work hours} / 11(\text{Shift})$$

$$\text{Efficiency} = \text{Weight of steel fabricated} / X.$$

Questionnaire survey is to be done among different construction experts.

The Questionnaire will comprise of general data of respondents and questions focusing on the components influencing the productivity dependent on the four distinct gatherings that is management, technological, labour and other groups.

The Table 2 gives to the scale utilized for impact of various components on work effectiveness.

Table 2: Scale utilized for portrayal of impact

Impact of Element on Labour Efficiency				
Type of Impact	Zero influence	Low influence	Medium influence	High influence
Scale	1	2	3	4
Elements	A ₁	A ₂	A ₃	A ₄

D. Relative Importance Index (R.I.I.) method

Relative importance index is used to figure out the average of the various traits chosen for the examination. RII is determined as per the formula mentioned below. Where 'A' is the quantity of respondents. Various analysts seeks RII to break down the ascribes and to assigned them according to weighted average value determined.

$$RII = \frac{4(A_4) + 3(A_3) + 2(A_2) + 1(A_1)}{4(A_1 + A_2 + A_3 + A_4)} * 100$$

Where

A₁= number of respondents who chose element for no impact, A₂= number of respondents who chose element for little impact, A₃= number of respondents who chose element for moderate impact, A₄= number of respondents who chose element for solid impact.

III. RESULTS AND DISCUSSION

A. Relative Importance Index (R.I.I.) Value

The factors affecting the labour productivity was prepared and twenty elements were divided under four primary groups: Management, Technological, Labour and Other Groups. From the questionnaire analysis these twenty elements a total of 10 elements which were relevant in this site were chosen based on questionnaire survey conducted on 30 professionals from the Dry dock site had

responded. After consultation with the planning department, execution department and project management team, the identified elements have been mentioned in the Table 3.

Table 3: Elements affecting labour productivity

Rank	Element	RII	Related group
1	Explanation in technical designation	73.81	Technological
2	Payment delay	72.12	Management
3	Construction methods	71.2	Management
4	Labour Supervision	70.34	Management
5	Degree of variables or Change order during Execution	69.87	Technological
6	Communication between Site Management and Labours	69.23	Management
7	Availability of Experienced Labour	68.68	Labour
8	Containment of Working Space	68.38	Technological
9	Storage Locations	68.04	Management
10	Rain	67.74	Other groups
11	Material Shortage	67.23	Management
12	Delay in inspection by site engineer	65.43	Management
13	Layout of site	65.17	Technological
14	Rework	63.27	Technological
15	Delayed arrival, Quitting early and Periodic Casual Breaks.	60.28	Management
16	Inadequacy of project management	58.73	Management
17	Sequence of work	55.61	Management
18	Crew size and composition	54.81	Management
19	Unreasonable Scheduling and Labour performance expectation	51.24	Management
20	Lack of suitable rest area offered to labour	48.55	Management

From the above table for 20 parameters influencing labour productivity on the basis of Relative Importance Index we picked out 10 elements that are influencing the labour productivity and presented in Figure 1.

From Figure 1, the most critical components influencing development works profitability of development extends in dry dock competition was determined after finding the RII of the following parameters as given in Table 3 top most elements who were affecting the labour productivity most are Classification in technical designation having RII value 73.81, second most impacting element was Delay in payments having its RII value 72.12 and Method of construction with value of RII as 71.2.



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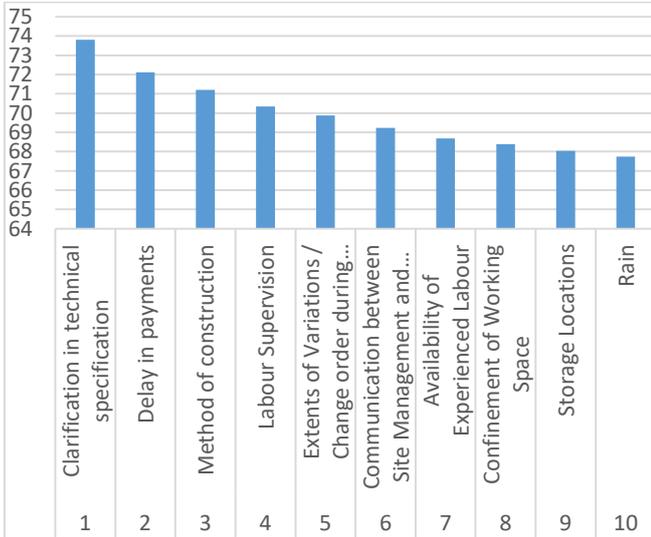


Figure 1: Relative Importance Index (RII)

B. Improvement in Labour productivity

The piling works in site was running behind schedule because of the unavailability of the rebar cage which caused a delay in the whole project. This called for a need to improve the productivity in steel fabrication. Four teams were involved in the cage fabrication process. The productivity was measured in kg/man-day with the baseline productivity as 350 kg/man-day to get accurate results. So we identified the productivity of team1, team2, team3 and team4 before implementing the necessary recommendations is given in the Figure 2

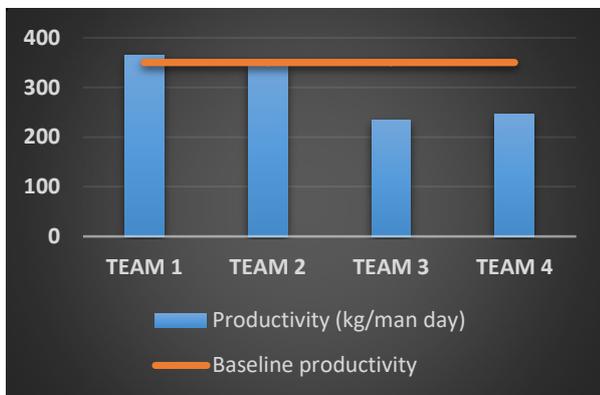


Figure 2: Labour Efficiency in Teams

The following proposals for improving productivity in the construction industry are given in Table 4.

Table 4: Recommendations for improving labour efficiency

Proper training to the labourers	Clear & in time supervision
Inspiration to workers towards task consummation	Clearance of legal documents before commencement of work
Legitimate and in flourish material acquisition and management	Maximum use of machinery and automation system
On time payment to the workers	Facilities to the labourers
Systematic flow of work	Advance site layout
Proper training to the	Clear & in time

labourers	supervision
Systematic planning of funds in advance	Maintain work discipline
Plan to avoid work stop	Advanced equipment planning.

After implementing the recommended activities can be used in any construction site to improve the labour productivity in rebar/steel cage fabrication and it has showed a considerable increase in the productivity of labours in fabricating the rebar cage is given in the Figure 3

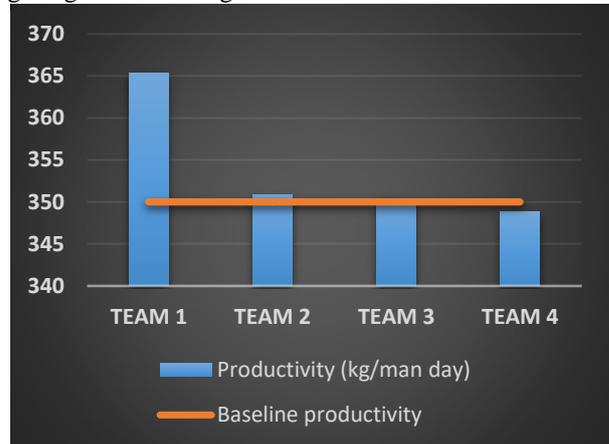


Figure 3: Labour Efficiency after Implementation of recommended actions

To understand the labour productivity we have divided it into 4 teams and initially team 1 was having productivity of 360kg/man day, team 2 was having productivity of 350kg/man day, team 3 was having productivity of 240kg/man day and team 4 was having productivity of 250kg/man day and after implementing the recommendations as suggested in table 3 productivity of all the four teams have increased positively and team three and four productivity have increased significantly as shown in figure 3 and we were able to achieve our baseline productivity of 350kg/man day.

IV. CONCLUSION

Based on the outcomes, the discoveries are required to add to the development area in dry dock construction in Kochi by informing the construction managers regarding the positive and negative effect of elements. By telling about the elements affecting their labour productivity most and suggesting them some preventive measures this helped them in sparing time and expenses in Construction projects and to moderate the lagging and slowed down activities in project.

From the outcomes the below mentioned conclusions were drawn:

- Top five factors that was affecting the labour productivity was Classification in technical specification, Delay in payments, Method of construction, Labour supervision and change order during execution of project.

- Some preventive measures were suggested as proper training to the labourers, proper and in advance material acquirement and management, Maximum use of machinery and automation system, etc.
- By applying the following suggestion labour efficiency has increased for team one by 1.3%, for team two it has increased by 0.6%, for team three has increased by 46% and for team four it has increased by 39.2%.
- From the above results we can say that from the above suggested preventive measures we can increase the labour efficiency significantly.

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