Factor Affecting Labour Productivity in Construction Industry and It's Improvement

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Abstract: Construction project suffer various problem and complex factors such as cost, duration, quality and safety. Advances in productivity are one of the means to achieve economic growth and to improve the quality of life and living standards. Poor productivity of construction labour is one of the causes of cost and time overruns in construction projects as construction is a labour-intensive industry. The aim of this paper is to identify factors affecting labour productivity for construction industry. Construction sector is diverse as it contains, contractors, consultants, project manager, site engineer, owners, and others. Through, literature review and factors recommended by experts were considered to categorize the factors. 72 factors, categorized into 8 groups, were analyzed and ranked considering Relative Importance Index. And check reliability test in SPSS. The questionnaires were distributed to Project Manager, Site Engineer. productivity improvement ultimately means reduced cost of construction and better value for money. In most countries, labour cost involves 35% to 55% of the overall project's cost. It's suggested to develop human resources through proper and continuous training programs to overcome the disturbances on the performance of the construction projects. The discussed factors are predicted to assist in concluding construction projects successfully. Future scope has been mentioned keeping in mind a big issue of the global pandemic of COVID-19 prevailing during the time of this research.

IndexTerms – **Labour Productivity, Construction and Productivity Management, RII, SPSS, Construction Factors, Construction industry.**

I. INTRODUCTION

Construction performance and productivity development are key focus area in construction industry for any country. Indian construction industry forms an essential part of economy. The most challenging issue in construction industry is to improving the efficiency. Construction constitutes 45% to 55% of India's capital expenditure on different project like as building, road & highways, airport etc. Improving productivity is foremost concern for any profit turned organization. Construction industry is the second largest industry in India after agriculture. It accounts for about 12%of India's GDP. Due to pandemic COVID-19 became aware about the importance of social disturbing and healthy habits this impact hug difference in productivity of where the activity need more than one worker at the same place and at the same time consider the situation of brick masonry where at least three workers are required one for laying the brick second for mixing the mortar and the third for the delivering the mortar mixing from mixing place to the brick laying place. now consider the situation of social distancing in such a case in fact currently activities are going on with minimum workers so further or reducing worker people all around the world. There are many challenges that are faced by construction industry, but one of the important challenges is labour productivity in construction. Every project has some difficulty in construction like material, money, tools and contractor's construction cost. Seeing to the present scenario of continuous downfall of labour productivity, it is extremely necessary to recognize the factors which affect it and then work out the critical ones out of the total available factors. Achieving better labour productivity requires accurate studies of the actual labour cost. Various labours have different type of variables affecting their productivity levels. For each and every project, productivity, cost, quality, and time have been the main concern.one of the huge concerns for any company is to improve their productivity, representing the effective and efficient conversion of resources into marketable products and affect business profitability.

II. NEED FOR STUDY RESEARCH METHODOLOGY

The purpose of this study is to identify the factors affecting labour productivity in construction project and based on that to be carried out to improve productivity in construction industry. And to improve occupational education, training and living standards of construction labour. confirm safety and healthy environment for a construction labour and reach better economic and social development. Not only that Reduced efficiency causes high cost and time run over-runs, which can be avoided with proper study and remedies.

The objective of this research was to explore the following aspects:

➢ To study the Labour productivity that are useful for consolation of work in the construction industry. Afterward, by using the outcomes of the analysis prepare the Questionnaire and equally distribute among the key construction sectors.

➢ At the end, to study Labour productivity awareness and their various factors effect of productivity in building industry, after having received response.

III RESEARCH METHODOLOGY

In this study, factors that affect the productivity of building construction has been obtained from various literature studies. Questionnaires were designed on structural basis to get Iaformation about the personal data of the respondents and their experience on issues related to productivity in construction. About one hundred questionnaires were sent to the construction industry by mail and interviews were conducted among construction personnel namely contractor, client, consultant, engineer and labour. The data collected were analysed using the relative importance index (RII) method to rank the factors contributing to productivity on construction sites. The RII for each factor was computed from the analysis of the rating indicated by the respondents with the use of five-point likert scale. The value of 5,4,3,2 and 1 were respectively defined as below. After ranking suggestions can be provided for improving the productivity.

Table I-Importance scale for ranking the factors:

Unaffected	Partially affected	Moderately affected	Intensively affected	High intensively affected
1	2	3	4	5

3.1 Literature Review

Literature review of 26 paper showed that the factor affecting labour productivity and its improvement. After sorting the papers and publication which were relevant to the topic. Furthermore, these papers & publications which were sorted to the relevancy of the current topic. Many other sources such as techno social platform (Quora, LinkedIn), books were referred. Here, the key factors labour productivity in construction industry which imparted their effect directly or indirectly for the company profitability. Many methods of analysis, such as Reliability Index method, Reliability test method, ranking method, Literature Review Method, Case study, where studies, analysed and concluded by researchers Exposure was made to the method employed for data collection and analysis.
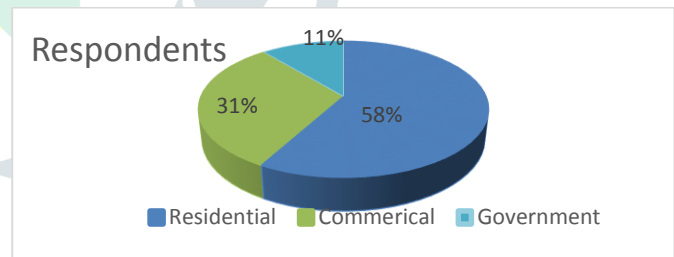
3.1.2 Critical Review

This critical review is defining for all the literature paper. Productivity is one of the significant factor by which construction company leaders measure and evaluate the overall performance of construction companies. Construction company leaders highlighted that numerous issues affect labour productivity even with the advanced technology and new project management methodologies. Identifying, understanding, and evaluating the issues affecting labour productivity enables construction company leaders to overcome the issues, improve labour productivity, and ensure long-term sustainability. By improving labour productivity, construction company leaders can complete construction projects faster with lower construction costs. Some factors which are highly effective are: skill to unskill ratio, shortage of material, methodology and management. Moreover, for large companies, equipment factors have also extremely effective. While in small and medium companies, owner/consultant factors also need special observation because it has high effect too. Research findings also show that health and safety factors have not been a concern of small, medium companies and has some effect, while in large companies are better, although not as major concern and has average effect. Construction sector endure from various problems and complex factors which influence each phase of the project life cycle. The review showing losses in productivity clearly indicates the improper management of a construction project. Only 60-70 % of time the labours found working. Even by closing the difference between baseline productivity and normal productivity rates, performance can be improved.

IV. DATA COLLECTION

Data collection in general means a plan of action which the research objectives can be questioned, and it can be classified into two types namely, quantitative approach and qualitative approach. Qualitative approach seeks to gain insights and to understand people's perceptions, or opinion towards a particular object. As well, it is used when a limited amount of knowledge about the topic are available. Quantitative approach seeks to collect factual data and to study relationship between facts and how such facts and relationships accord with theories and findings of any research executed previously. The research through literature reviews and discussion with some person involved in the construction project identified a total of 72 factors which are mainly affecting in the labour productivity at construction site. The data will be collected from residential and commercial construction projects located in Ahmedabad, Vadodara and Gandhinagar.

Table 4 Types of Organizations that Responded

Construction organizations	Respondents
Residential	58
Commercial	31
Government	11

4.1 QUESTIONNAIRE DESIGN:

The questionnaire was formulated by seeing the relevant literatures in the area of labour productivity of Construction Company. The engineer interview questionnaire is shown in below. The questionnaire was validated with experts for clarity, ease of use, and value of the information that could be gathered. The questionnaire survey is divided into two parts. The first part consists of general information like type of company, experience; value of their project etc. and the second part consists of the identified causes of labour productivity affected in construction project. These causes are classified into eight groups: factors related to Environment, Technology, Human/labour, Management, Motivation, Safety, Equipment, External.

Sample Size Calculation

For a representative population statistical sample, the formula shown below:

When population= 135, New sample size= 100

$$ SS = \frac{Z^2 * p * (1-p)}{C^2} $$

Where, Z = statistic value for the confidence level (e.g. 1.96 for 95% confidence level)

p = Percentage picking a choice, expressed as decimal (0.5 used for sample size needed)

C = Confidence interval, expressed as decimal (e.g. 0.05)

Table 4.1 Sample size determination

Number of distributed questionnaire	Number of respondents	Number of valid respondents	Percent of valid respondents to no. of distributed questionnaire
118	115	111	94 %

V. DATA ANALYSIS

Relative Importance Index method will be utilized to rate the different parameters. These evaluations make it possible to analyse the relative importance of the parameters as observed by the arrangements of respondents. Below formula will be used to compute the Relative Important Index Method.

$$RII = \frac{\sum W}{A*N}$$

Where,

W = Ratings provided to each parameter (ranging from 1 to 5),
A = Highest rating (i.e. 5 in this circumstance),
N = Total respondents.

5.1 RELIABILITY TEST:

we may choose to use questionnaire items. These questionnaire items are part of the measurement procedure. This measurement procedure should provide an accurate representation of the construct it is measuring if it is to be considered valid. For example, if we want to measure the construct, intelligence, we need to have a measurement procedure that accurately measures a person's intelligence. Reliability test to the consistency of the results in research. Reliability is highly **important** for psychological research. This is because it tests if the study fulfils its predicted aims and hypothesis and ensures that the results are due to the study and not any possible extraneous variables. Here spits half reliability test has been done.

Split-half reliability is subtype of internal consistency reliability. the split-half reliability is obtained by determining the correlation between the two total "set" scores. i.e. if it is reliable (more than 0.6) than it more likely to get similar results on various other places. Split-Half Reliability Method for Likert Scale: The Spearman Brown formula is used to compute reliability where Likert scale is adopted.

$$Rsb = \frac{2Rhh}{1 + Rhh}$$

Where, Rhh indicates the correlation of the scores in two half tests. After the division of data in two halves. After having two halves of the test, the correlation between them is calculated.

$$Rhh = \frac{\sum(X - \bar{X})(Y - \bar{Y})}{\sqrt{\sum(x - \bar{x})^2 * (y - \bar{y})^2}}$$

Where,

X = one respondent's score for the first half,
$\bar{X}$ = Ratio of the mean of the first half and total no of questions
Y = One respondent's score for the second half,
$\bar{Y}$ = Ratio of the mean of the second half and total no of questions.

Calculations of Rhh and α,

$$Rhh = \frac{143323.61}{\sqrt{188884.23 * 135288.65}} = 0.8965380$$

2Rhh = 1.7931

$$\alpha = \frac{2Rhh}{1 + Rhh} \quad \frac{1.7931}{1 + 0.8965} = 0.94$$

After the calculation **α = 0.94 > 0.60**, hence it has good reliability.

5.2 STATISTICAL ANALYSIS THROUGHT SPSS SOFTWARE

Analysis is done by the SPSS software to analysis the questionnaire responses with RII analysis method and check reliability test. These analyses have determined that the all the questions in survey form are given that analysis result to identify each question response. This will help me to find out the result of my survey.

Table 5: Reliability test result in SPSS

Reliability Statistics

Cronbach's Alpha	N of Items
0.94	72

5.2.1 DATA ANALYSIS PROCEDURE & OUTPUT IN RII

    Find out relative index of each factor

    Find out relative ranking of each factor

The result shows the relative index for each factor which shows an importance of each factor as compare to others. The relative index is calculated by summation of total ratings of each factor, which is divided by a multiplication of highest Likert scale and number of respondents. After finding the relative importance index, they are arranged in a hierarchical order (i.e. from top to bottom). So, by finding out the relative ranking of each factor we can know about the most important and least important factor out of all the factors.

5.2.2 Top factors affecting productivity

Table 5.1 Top factors affecting productivity

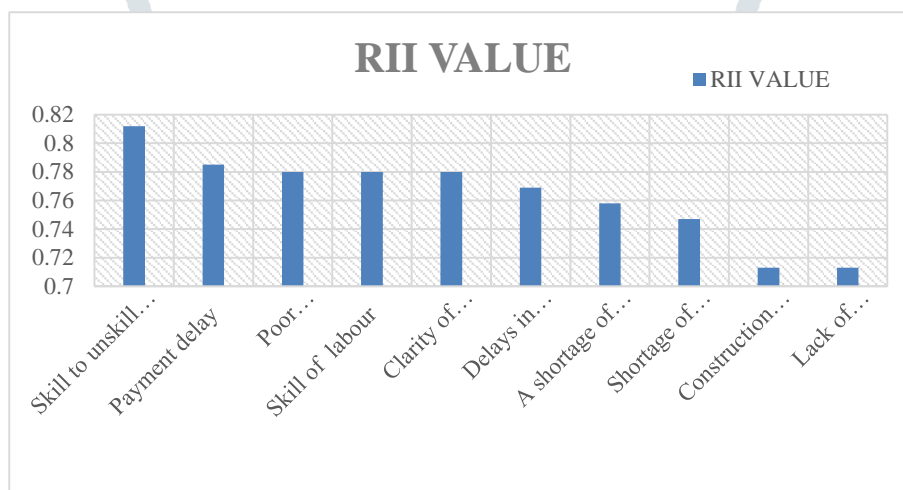| Sr.No.	Factors			
		∑W	RII=∑W/5*111	Rank
1	Skill to unskill labour ratio	440	0.8127	1
2	Payment delay	436	0.7855	2
3	Poor communication between site engineer & labour	433	0.7801	3
4	Skill of labour	433	0.7801	4
5	Clarity of technical specification	433	0.7801	5
6	Delays in decision Making	427	0.7693	6
7	A shortage of experienced labour	421	0.7585	7
8	Shortage of materials / equipments / tools / funds	415	0.7477	8
9	Construction method	396	0.7135	9
10	Lack of motivation of labour	396	0.7135	10

Fig. 5 Ranking of top ten factors

VI. CONCLUSION

    In today's world, the construction industry is grade as unique of the crucial industries. It helps in increasing and achieving the goal of organization. Education and awareness of construction productivity are very vital because they cause losses to the governing agencies and also impact the economics of the construction industry. Advance comprehension of labour productivity during construction can save money and time. Saving for these projects are very extreme and because of the difficulty in construction, several factors can extremely affect global productivity, thus the project can end up adding even more time and money in order to be completed. Practically it is challenging task to all to expand labour productivity up to 100%. But if you have accurately control on above factors, productivity can be improved up to huge amount.

6.1 Future scope

    Future scope of this research paper, investigate other manipulating factors affecting construction productivity at all stages of the procurement practice such as Properly training to the labourers, Advance site layout, On time payment to the labour, Motivation to labour regarding project completion, Pre plan to avoid work stop, Facilities to the labourers, Advance equipment and material planning, Properly and in advance material procurement and management, Efficient planning of funds in advance.

6.2 Recommendations

    Construction tasks are expensive cause in arguments and claims, which generally affects progress of construction projects. The environment of construction industry should be suitable to implement projects with successful completion. In the construction industry, it is necessary to find the weaknesses of particular task in order to solve and overcome them. Mentioned below are the recommendations which were found to be important factors for improving labour productivity in the construction industry.

Sr.No.	Factors	Recommendations

1	Skill to unskill labour ratio	Skilled labour refers to labour that requires workers who have specialized training to complete the work. Whereas, Unskilled labour does not require workers to have special training or skills. The jobs that previously required little or no training now require training. For example, labour that was once done manually now it may be assisted by computers or other technology, requiring the worker to have technological skills. Therefore, the ratio of skilled to unskilled labours has been increasing due to the technological advancement.
2	Payment delay	Labour are the backbone of any organization because their productivity is the main reason for upliftment of the organization. Now, the only source of motivation for a labour is to get their daily wages / compensation to make the ends meet. Therefore, any delay in payment will have adverse effect on their productivity as they will be demoralized by such kind of performance of the organization.
3	Poor communication between site engineer & labour	Communication is fundamental to the survival of humans as well as to an organization. It is a process of creating and sharing ideas, information, views, facts, etc. for a common understanding. It is thus very important to have a very good communication between the engineer and a labour in order to get the job done from them effectively in a safe manner.
4	Skill of labour	Skill of a labour plays a major role in delivering quality project. It is essential to employ a worker on a particular job which suits his skills to get quality work and avoid unwanted accidents.
5	Clarity of technical specification	Technical specification is a document that explains the deliverables of a project. Hence, it is imperative to create a clear and precise document so that it becomes easy for a labour to understand and execute the job.
6	Delays in decision Making	Decision making is a process of choosing between different alternatives. The delay in decision making in an organization has an extremely bad impact on their labours, contractors etc. as they will start losing faith in the reputation of the organization.
7	A shortage of experienced labour	Experienced labour knows what to do whereas inexperienced labours need training. Experienced labours have varied skills as they have worked in different organizations. Shortage of such experienced labours will increase the overheads of the organization and put them into a difficult situation during challenging circumstances.
8	Shortage of materials / equipments / tools / funds	Just like a soldier cannot fight a war for longer time with shortage of weapons, the same way a labour cannot perform the work properly with shortage of materials, equipment, tools and funds.
9	Construction method	Methodology must be easy and the labour must be aware as new methodology adopted would not be familiar to the labour and reduce the productivity in return.
10	Lack of motivation of labour	Motivation of a labour is vital to extract maximum productivity from them. This can be achieved by introducing rewards system for better performance, giving incentives annually to boost their morale.

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