

# Study on the Critical Factors Influencing Labor Productivity in Construction Industry

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**ABSTRACT:** In construction the migration of labors is high. Labors are the main and precious resource of construction industry. The study examines the critical factors influencing labor productivity in construction industry. From the study nine factors affecting labor productivity are identified, each factors having their own sub factors. Based on the factors the questionnaire is designed and the respondents for distribution of questionnaire are selected. The labors are selected as the target respondents and the total of 111 questionnaires are completed by the respondents. The collected data are analyzed using statistical package for social sciences (SPSS) software. From the analysis result the major factors influencing labor productivity are identified and the solutions are given for all the impacts.

**KEYWORDS:** Labor productivity, Critical factors, Construction, Data collection and Analysis.

## I. INTRODUCTION

The construction industry just like the manufacturing industry requires a number of resources for achieving set goals and objectives. The resources can be classified into money, materials, machine, men and manpower. Human resources play the role of seeing to the effective utilization of other resources in project execution. Thus, human resource is the determinant of the efficiency of construction resources [2]. Productivity is one of the most important factors affecting the overall performance of any organization, large or small. Construction productivity is influenced by many factors other than labor, including: material; equipment; tools; construction method; and management skills. However, these resources are inanimate, and meaningless if not transformed into productive tools by the human element. Labor productivity plays a key role in determining the financial success of a project [4]. Therefore any improvement in labor productivity will contribute a high deal to the improvement of the overall productivity and improvement in the whole performance (cost, time, and quality) in construction industry. The term productivity expresses the relationship between outputs and inputs. Output and input differ from one industry to another. Also, the productivity definition varies when applied to different areas of the same industry [5]. Labor is one of the basic requirements in the construction industry. Labor productivity usually relates manpower in terms of labor cost to the quantity of outputs produced. In other words, the definition of labor productivity is the amount of goods and services produced by a productive factor (manpower) in the unit of time [11]. This study gives information about construction labors in various parts of Tamilnadu.

## II. LITERATURE REVIEW

AynurKazaz et al (2008) stated that manpower is main and precious resource of construction industry. If we consider only manpower as an input in productivity, then productivity will be called construction labor productivity [3]. Khaled M et al (2011) estimated that the labor productivity plays an important role in providing success to construction industry. However, labor productivity is decreased every year because of increase in complexity in construction projects. One of the most important factors in improving labor productivity is the motivation of labor force [10]. Tran V et al (2011) observed that the labor productivity insufficiency will affect the performance of the overall project. Construction labor productivity has become a big problem in construction industry [13]. Allmon et al (2000) estimated that productivity plays a major role in the construction industry in which labor power is the only productive resource and the industry is mainly dependent upon human effort and performance [1]. Ibrahim Mahamid

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et al (2013) ascertained that there are many factors that influencing productivity in construction industry. Labor productivity is one of the most factors that affect the physical progress of any construction project [7].

## III. RESEARCH OBJECTIVE

The objectives of this research are stated below

- To identifying the critical factors affecting labor productivity in construction industry.
- To suggest recommendations to improve the labor productivity in construction industry.

## IV. METHODOLOGY

The methodology of this study is described and explained based on the objectives of the project. This research commenced by reviewing the relevant literatures. From the literature study the factors affecting labors in construction projects are identified. Based on the factors the questionnaire in prepared and the questionnaire survey is conducted among various labors in different construction companies. The data collected through survey are analyzed using SPSS software.

### a) Factors Affecting Labors

From several reviews of literature, the factors affecting labors in construction are identified.

#### 1. Physical factors

The physical factors that affect labors in construction are access to site, site congestion factor, type of project and method of construction.

#### 2. Economic factors

The factors come under economic factor are on time payment, sufficient amount of payment and bonus and incentives.

#### 3. Motivational factors

It includes following sub factors such as high wages, motivational plan and activities and providing performance rewards.

#### 4. Psychological factors

Psychological factor includes job satisfaction, work as per the workers' capacity, job security and participation in part of decision making by management.

#### 5. Organizational factors

The organization factors that affect labors in construction are good supervision, providing proper training and education, proper communication, maintaining the flow of information, providing canteen, medical, accommodation and transport facility.

#### 6. Technological factors

Technological factor includes the following factors such as innovative/complexity in design, construction error, quality of materials, type of equipments, accidents due to malfunctioning of equipments and guidance to operate special equipment.

#### 7. Safety factors

The factors come under safety factor are safety precautions, allocation of special person for regular inspection and conducting safety programs.

#### 8. Environmental factors

Environmental factor includes the following factors such as climatic condition, noise level and HVAC systems.

#### 9. Cultural factors

The cultural factors that affect labor are fair treatment among labors and cultural characteristics.

### b) Questionnaire Design

A questionnaire is designed based on the fact that they had to be simple, clear and understandable for the respondents and at the same time they should be able to be interpreted well by the researcher. The questionnaire was designed in a linkert scales running from very often, often, sometimes, seldom, and never [6]. These five positions were given

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weights of 1, 2, 3, 4 and 5 for scoring purposes. Questionnaire consists of two sections, first section includes the respondents profile and the second section includes the set of questions based on the factors affecting labors in construction projects.

### c) Questionnaire Survey

In this study, the respondents are selected for the distribution of the questionnaire form. Labors are selected as the targeted respondents. The prepared Questionnaire on human resource management among labors in Construction industry is distributed to 111 labors and their response has been extracted.

## V. DATA ANALYSIS

The collected data is analyzed using SPSS [12]. The software name originally stood for **Statistical Package for the Social Sciences (SPSS)**. **SPSS Statistics** is a software package used for statistical analysis. Long produced by SPSS Inc., it was acquired by IBM in 2009. The current versions (2015) are officially named **IBM SPSS Statistics**. It is also used by market researchers, health researchers, survey companies, government, education researchers, marketing organizations, data miners, and others. It is one of the most widely used software programs for analyzing data. Based on the analysis the most important factors affecting the labor productivity are identified.

### a) Reliability Analysis

This was conducted for each group in order to assess the reliability of the questionnaire. Cronbach's alpha method was used for reliability analysis. The Cronbach's alpha obtained for respondents are given in Table I. Cronbach's alpha value obtained is 0.648. The value must be in the range of 0.6 to 1.0 if the data has to be reliable. Hence the data values are reliable.

**Table I Reliability Statistics**

Cronbach's Alpha	No of Items
0.648	30

The coefficient alpha value for physical Factors, economical factors, motivational factors, psychological factors, organizational factors, technical factors, safety factors, environmental factors, and cultural factors were well above the criterion of 0.60 as recommended by Nunnally (1978) for assessing reliability of the scale [8].

### b) Principle Component Analysis

Principal components analysis is a variable-reduction technique that shares many similarities to exploratory factor analysis. Its aim is to reduce a larger set of variables into a smaller set of variables, called 'principal components', which account for most of the variance in the original variables [9]. The result obtained from the principle component analysis is given in Table II, which shows the number of variable in each factor, Eigen values of the factors affecting labors, percentage of variation and cumulative percentage of variance. Using the principle component analysis all 30 factors affecting labor productivity are grouped under 8 main factors such as

- Organizational factor
- Human factor
- Economic and motivational factor
- External factor
- Job related factor
- Safety factor
- Material and communication factor
- Technical factor.

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**Table II Principle Component Analysis**

Factors	No. of Variables Included	Eigen Value	Percent of Variance Explained	Cumulative Percent of Variation Explained
Organizational Factors	4	3.073	10.596	10.596
Human Factors	4	2.751	9.486	20.086
Economic and motivational factors	4	2.402	8.287	28.369
External Factors	3	1.890	6.518	34.887
Job related Factors	2	1.805	6.225	41.113
Safety Factors	5	1.597	5.508	46.621
Material and Communication Factors	3	1.306	4.250	56.141
Technical Factors	4	1.217	4.195	64.586
KMO Measures of sampling Adequacy: 0.522		Bartlett's test of sphericity: Chi-Square Value: 891.756		

Factor 1, which was named as Organizational Factors, was composed of four items and accounted for 10.596 per cent of the variance. Factor 2, comprised of four items that related to the human factors accounted for an additional 9.486 percent of the variance. Factor 3, was labelled as economic and motivational Factors that included four items and it accounted for the additional 8.287 percent of the variance. Factor 4, was the external factors that contained three items which accounted for the additional 6.518 per cent of the variance. Factor 5, was interpreted as job related factors and comprised two variables, it accounted for an additional 6.225 percent of the variance. Factor 6 was labelled as safety factors; it consisted of five items and accounted for an additional 5.508 percent. Factor 7 was labelled as material and communication factors; it consisted of three items and accounted for an additional 4.250 percent. Factor 7 was labelled as technical factors which consists of four variables and account for 4.195 percent of the variance.

*c) Descriptive Statistics Analysis*

The descriptive statistical analysis is performed to obtain the mean, standard deviation and coefficient of variation for 8 major factors which are given in Table III. The frequency analysis method was carried out for descriptive statistical analysis. The frequency analysis is based on the number of occurrences chosen by the respondents. It is then followed by measure of central tendency and dispersion analysis.

**Table III Descriptive Statistics Analysis**

S. No	Factors	Mean	Standard Deviation	Coefficient of variation
1	Organizational Factors	2.18	0.634	0.402
2	Human Factors	2.89	0.577	0.332
3	Economic and motivational factors	3.40	0.830	0.689

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4	External Factors	2.81	0.883	0.779
5	Job related Factors	2.28	0.502	0.252
6	Safety Factors	2.35	0.463	0.215
7	Material and communication Factors	2.00	0.478	0.228
8	Technical Factors	2.54	0.459	0.210

The result shows that the human, economic and motivation factors having greater mean value of 3.40 and 2.89 have the higher influence on labor productivity. Human, Economic and Motivational factors are taken into consideration to improve labor productivity in construction industry.

#### d) Multiple Regression Analysis

The results of regression analysis for the factors affecting labor productivity are presented in Table IV, which standardized coefficient of independent variables, t value and colinearity statistics of variables. The result findings revealed that human factors ( $\beta=0.275$ ,  $t=2.712$ ,  $p<0.05$ ) and economic and motivational factors ( $\beta=0.175$ ,  $t=1.807$ ,  $p<0.05$ ) have significant influence on the labor productivity in construction projects than the other factors.

**Table IV Multiple Regression Analysis**

Independent Variables	Standardized coefficient	t value	Significance	Colinearity Statistics	
				Tolerance	VIF
Constant		0.262	0.794	2.432	0.016
Organizational Factors	0.198	2.130	0.777	1.528	0.129
Human Factors	0.264	2.760	0.007	2.742	0.007
Economic and motivational factors	0.024	0.284	0.036	-0.017	0.986
External Factors	0.089	0.932	0.354	2.594	0.011
Job related Factors	0.150	1.585	0.116	3.426	0.001
Safety Factors	0.116	1.182	0.240	0.142	0.887
Material and Communication Factors	0.088	0.929	0.355	1.796	0.075
Technical Factors	0.045	0.492	0.624	1.704	0.091
R Square					0.197
Adjusted R Square					0.137
F-Value					3.137
Significance					0.003

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## VI. CONCLUSION

From the present study, a total of 30 factors affecting labor productivity are identified. Project manager should focus on these factors to improve the labor productivity and performance, which ultimately leads to higher profit from the construction projects. The result indicates that the most significant factors affecting labor productivity are job related factors and economic and motivational factors. Job related factors which include job security provided by the firm, cultural factors and facilities available at work place. The economic and motivational factor includes providing bonus to the workers, higher wages to motivate the workers, providing performance rewards and conducting motivational plan and activities.

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