

Identifying the Factors which affects the Labour Productivity and Improving the Labour Productivity in Construction using Statistical Tests

Sibiya R

PG Scholar, Construction Engineering and Management, Department of Civil Engineering, Arunachala College of Engineering for Women, Kanniyakumari, Tamil Nadu-629203, India

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ABSTRACT

Construction is the second largest industry after agriculture in India. The most challenging issue in construction industry is effective productivity and good labour performance. The performance of labour is affected by many factors and is usually linked to the performance of time, cost, work pressure, safety measures and quality. Proper labour management increases productivity and makes the project to complete on time with optimum cost. The main objective of this project is to identify the factors which affects the labour productivity in construction using Chi-square test of independence using SPSS software and appropriate solutions are given for all impacts. In this paper, a thorough literature review was conducted and a total of 20 papers were analyzed based on labour productivity. Through a systematic review of selected research papers major research areas such as factors affecting labour productivity and methods for labour productivity improvement are identified.

KEYWORDS: Labour productivity, SPSS software, Chi-square test.

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I. INTRODUCTION

Construction industry faces challenges with regard to problems associated with effective productivity and good labour management. Proper labour management can help in effective productivity. Insufficient labour management on construction to result in low productivity. Most construction industry 30% to 50% of total cost of project is spent on labours and labour management. Labour is an essential aspect of construction industry hence sound labour management cannot be disregarded. It is that

process which has a view point of extracting the required work from the labours to achieve the set goals. It is a scientific methodology which takes care of both the parties such that the required work is extracted without exploitation of the labour class. Improving productivity is significant concern for benefit oriented association. Labour productivity and its management is a very important concept in civil industry. In today's era, one of the biggest concerns for any organization is to improve their productivity, representing the effective and efficient conversion of resources into

marketable products and determining business profitability.

II. LABOUR PRODUCTIVITY

Productivity can be defined in many ways. The term “productivity” expresses the relationship between outputs and inputs. Output and input differ from one industry to another. Productivity is the ratio of output to all or some of the resources used to produce that output.

Productivity = Output/labour Cost

In other words, the definition of labour productivity is the amount of goods and services produced by a productive factor (manpower) in the unit of time. At the project site, contractors are often interested in labour productivity. It can be defined in one of the following ways,

Labour productivity = Output/Labour cost

Or

Labour productivity = Output / Work hour There is no standard definition of productivity and some contractors use the inverse of above,

Labour productivity = Labour cost /Work hour Output

III. ABOUT SPSS SOFTWARE

SPSS is a widely used program for statistical analysis in social science. It is now 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. The original SPSS manual has been described as one of “sociology’s most influential books” for allowing ordinary researchers to do their own statistical analysis. In addition to statistical analysis, data management (case selection, file reshaping, creating derived data) and data documentation (a metadata dictionary was stored in the data file) are features of the base software.

Statistics included in the base software

- Descriptive statistics: Cross tabulation, Frequencies, Descriptive, Explore, Descriptive Ratio Statistics.
- Bivariate statistics: Means, t-test, ANOVA, Correlation (bivariate, partial, distance), Nonparametric tests.
- Prediction for numerical outcomes: Linear regression.
- Prediction for identifying groups: Factor analysis, cluster analysis (hierarchical, two-step, K-means), Discriminate.
- The graphical user interface has two views which can be toggled by clicking on one of the

two tabs in the bottom left of the SPSS Statistics window.

IV. CHI-SQUARE TEST

CHI-SQUARE TEST is a non-parametric test not based on any assumption or distribution of any variable. In general, the test we use to measure the differences between what is observed and what is expected according to an assumed hypothesis is called the chi-square test. It was developed by Karl Pearson in 1900. This test is an important test amongst the several tests of significance developed by statisticians. This statistical test follows a specific distribution known as chi-square distribution.

V. SCOPE AND OBJECTIVE

The objective of this paper is to study various literatures about labour productivity and identify the factors that affect the labour productivity in construction and to reduce the impacts in construction.

The Scope of this paper includes:

- To study the critical factors affecting labour productivity in the construction projects.
- To study how to improve construction labour productivity towards project performance.

VI. LITERATURE REVIEW

The following are the previous literature review based on labour productivity in construction.

1. Factors Affecting Labour Productivity in Building Projects in the Gaza Strip: Adnan Enshassi, Sherif Mohamed, Ziad Abu Mustafa and Peter Eduard (2007) This paper describes the factors affecting labour productivity in building projects, and to rank these factors according to their relative importance from a contractors viewpoint. Here 45 factors are considered in a survey. The main factors negatively affecting labour productivity are material shortage, lack of labour experience, lack of labour surveillance, misunderstandings between labour and superintendent and drawings and specification alteration during execution. Therefore it is necessary to conduct training courses to improve productivity in construction projects.
2. A Study of Factors Affecting Labour Productivity and Methods to Improve It: Mr.A.A.Attar and Prof. A.K. Gupta (2017)

This paper focuses on labour productivity in the construction industry and this provides a guideline to improve construction labour productivity. This paper reports a survey made on project managers and experienced engineers of building projects in

Sangli, Kolhapur and Pune districts. Respondents were required to rate using their experience and the survey was carried out by a questionnaire and responses. The ten most significant factors affecting labour productivity for small, medium and large companies are identified.

3. Factors Affecting Construction Labour Productivity Using Questionnaire Survey: Madhan.A and Gunarani G.I (2018)

In this paper most recent data and key factors that affects the labour productivity in and around Thanjavur was collected through a questionnaire survey. Respondents who work in Thanjavur were asked to rate the factors using their experience. Relative Important Index (RII) and Importance Index (IMPI) methods are used. The point of this report was to distinguish the postpone factors in development ventures, since delays are thought to be a significant issue in the development business.

4. Factors Relating to Labour Productivity Affecting the Project Schedule Performance in Indonesia: A. Soekimana and K.S. Pribadib (2011)

This study reports the latest information on key factors that affect project performance in terms of project completion time. Respondents were required to rate using their experience. 113 factors identified from past researches are grouped into 15 groups. The result show that the group of factors that give high effect are supervision factors, material factors, execution plan factors and design factors. The results provide guidelines to improve the performance of project completion time and labour productivity in Indonesian construction industry.

5. A Review of Impact on Labour Management in Construction Industry: Srilakshmi V. Annigeri and Prof. Amey A.Kelkar (2018)

This study mainly focuses on the various factors related to labours that have a great impact on the project productivity. The productivity of any project relies mainly on labour force as labour play an integral part in the success of the project. Proper management of labours increases the productivity along with this the project is completed on time with optimum cost. In order to increase the productivity it is necessary to make use of some strategies and techniques to overcome the factors influencing labour productivity and management.

6. Factors Affecting Construction Labour Productivity in Trinidad And Tobago: Brent G. Hickson and Leighton A. Ellis (2013)

This study highlights the factors affecting labour productivity of the construction industry in Trinidad and Tobago (T&T). A questionnaire was

used to gather the relevant data. It involved ranking 42 predefined factors divided into 4 categories: Management; Technological; Human /Labour and External. The relative importance of indices (RII) was determined and the factors were ranked.

7. An Investigation into the Labour Productivity Trends in the North-West Province of South Africa: Dineo Moswane and Clinton Aigbavboa (2018)

This research focuses on construction labour productivity, the labour working conditions and the factors that affect productivity in the South African construction industry. The finding shows the most critical factors affecting labour productivity are management factors, material factors, human / labour factors and technical factors. In order to improve productivity certain measures are provided such as training, seminars etc.

8. Labour Productivity in the Construction Industry- Factors Influencing the Spanish Construction Labour Productivity: G.Robles and S. Gentes (2014)

This research paper identifies, analyze and rank factors affecting labour productivity in Spain with respect to their relative importance. Here 35 factors was considered and a structured questionnaire survey was performed. Findings reveal the top five ranked factors are shortage or late supply of materials, clarity of the drawings and project documents, clear and daily task assignment tools or equipment shortages, level of skill and experience of labourers. In order to improve labour productivity Lean techniques could be implemented.

9. A Study on Factors Affecting Labour Productivity by Application of Relative Importance Index: Srilakshmi V. Annigeri (2018)

This paper describes the critical factors affecting labour productivity and how to overcome them. The technique used in this research is application of Relative Importance Index (RII). It is a technique that is used to rank the different factors that results in reduced labour productivity and cause delay in construction projects. In this method the various factors listed are rated on the scale of 1 to 4 depending on the basis of their impact on the construction project. Higher the value of RII, that factor affect the labour productivity more.

10. A Study of Various Factors Affecting Labour Productivity in Road Construction and Suggestions to Improve It: Mr. D. Sukumar and Mr. V.Rajesh Kumar (2016)

This research paper is to identify and analyze the factors that affects the productivity of labour in road construction. The questionnaire is prepared and the most significant factor that affects the productivity is identified through the RII method. The findings indicate the top factors affecting the productivity of the labour are work area restriction, inspection delays, construction method, poor soil condition, unavailability of experienced labours, delays in decision making, high quality of required works and lack of training.

11. Identification of Factors Affecting Construction Productivity in Pakistan Industry: Muneer Annes, Muhammad Saqib and Darya Memon (2016)

This research paper highlights the factors which affect the labour productivity in Pakistan focusing Karachi. This study is to identify the main factors affecting labour productivity of contractor, consultant and perspective of client. The data collection was carried out by one hundred sixty (160) questionnaire surveys. The results showed that feeble management and worst site conditions are responsible for degradation in both efficiency and output of the project.

12. Factors Affecting Construction Labour Productivity for Malaysian Residential Projects: M.R. Abdul Kadir and W.P.Lee (2005)

This paper evaluates and ranks the importance, frequency and severity of project delay factors that affects the labour productivity. A total of 100 respondents consisting of 70 contractors, 11 developers and 19 consultants participated in this study. The respondents were asked to indicate which factors affect the labour productivity and data was analyzed by important indices. This study could be used by the project managers and it helps them to minimize the time and cost overrun.

13. Critical Factors Affecting Construction Labour Productivity in Egypt: Sherif M. Hafez (2014)

This research paper evaluates and rank the relative importance of factors that affect labour productivity on Egyptian construction projects. A sample of contractors was invited to participate in a structured questionnaire survey, comprising 27 productivity factors classified under the four primary groups: Technological, Management, Human/Labour and External. Based on the outcomes of this research paper, certain measures such as special programs, training to improve skills are taken to improve labour productivity. 14. Effective Productivity in Construction through Labour Management: S.Sivaraj and Dr.B. Vidiwelli (2018)

This paper describes the effective productivity in construction through labour management. This research is to identify factors reducing and increasing productivity in construction through labour management. Data for the survey are obtained through a structured questionnaire and are given to 122 respondents. The respondents involve 80 labours and 42 managerial peoples. The responses from all respondents are analyzed by using SPSS software using statistical analysis is used to check the opinions of all respondents.

15. Labour Productivity Analysis Using Multi-variable Linear Regression Technique: Jisha Chakkappan and Lakshmi G. Das (2016)

This research explores an accurate measurement of labour productivity in selected sites. The data required for the study are to be collected through questionnaire survey. Here 10 factors are considered and data analysis was done using the statistical software package, SPSS19.0, for determining the labour productivity. That the data analysis will help to prepare a Multiple Linear Regression model to predict productivity of the selected work with high accuracy.

16. Factors affecting the performance of labour in Nigerian construction sites: Fagbenleolabosipo and Ogunde Ayodeji (2011)

This paper describes the factors negatively affecting the performance of labour in Nigerian construction industry. Questionnaires were administered on contractor and labour on 40 construction sites. A Likert statistical technique was used for this analysis and data was analyzed by RII method. The factors that affect the labour performance are identified as poor communication, motivation and specification. Those factors are improved by sufficient management to improve labour performance.

17. Factors Affecting the Productivity of the Construction Industry in Thailand: The Project Managers' Perception: Arun Makulsawatudom (2001) In this paper factors affecting construction productivity in Thailand was identified. For that purpose, 34 project managers working in the construction industry in Thailand were asked to complete the questionnaire survey. The factors were ranked using a Relative Importance Index. This study forms the initial investigation of the Thailand construction industry, which leads to overall productivity improvement.

18. Identifying Factors Affecting Construction Labour Productivity in Amravati: Anurag Sangole and Amit Ranit (2013)

This research focuses the factors affecting labour productivity in the construction projects in Amravati, Maharashtra. Questionnaire was composed of 30 productivity factors, classified under four groups. The top 5 most significant factors affecting labour productivity are technical specifications, the extent of change orders during execution, lack of labour supervision, coordination and design complexity level. The result provide guidance to managers for efficient utilization of labour force.

19. Factors Affecting Labour Productivity in Building Projects in Great Cairo: Hashem Y.M and Ali (2007)

This paper summarizes the productivity problems through a structured questionnaire survey of 41 project managers working on construction building projects in Greater Cairo. Respondents were required to rate how 30 factors affecting labour productivity with respect to importance and frequency of occurrence. Reliability of those factors was tested using Cronbach's Alpha measurement. The result indicates that the 30 factors are reliable for future use in assessing the severity of the productivity problems.

20. Factors Affecting Construction Labour Productivity in Yemen: Wael Alaghbari and Basel Sultan (2017)

This paper reports and rank factors affecting construction labour productivity in Yemen. The questionnaire included 52 predefined factors, which were categorized into four groups. They are human/labour, management, technical and external. The RII was determined and the factors were ranked. The results showed that the technical and technological factors ranked first among the four groups. This study provides awareness and better understanding of factors affecting labour productivity in construction projects in Yemen.

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