

Comparison of Productivity across Various Construction Projects

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Abstract— Productivity plays an important role in the construction industry. It is one of the key components of all company's success and competitiveness in the market. It helps construction industries to achieve goals and to meet the stakeholder's valuable propositions. The objectives of the project are; to investigate factors affecting the labour productivity across various nature of projects. To improve productivity and identify the factors affecting the project performance. The above objectives have been achieved through the analysis of questionnaires and the result of this analysis shows that, there are seven main groups which have significant impact on the construction productivity projects. They are man power group, project management, drawings /procedures, site management, safety/quality, labour motivation and environment. Factor analysis and reliability analysis was carried out before analyzing.

The result of the study is recommended by conducting Multiple Linear Regression and correlation using statistical package social science (SPSS) which should explain the total variance regarding the factors affecting labour productivity in construction projects.

Keywords: *construction labour productivity, regression analysis.*

I. INTRODUCTION

Productivity has been generally defined as the ratio of outputs / inputs. Construction projects are mostly labour based with basic hand tools and equipment, as labour costs comprise 30 % to 50 % of overall project cost. Productivity in economics refers to measures of output from production processes, per unit of input. Productivity may be conceived of as a measure of the technical or engineering efficiency of production.

Productivity enables an organization to be competitive, achieve set goals, meet stakeholder value propositions and maintain strategic and financial health. At the industry level, productivity enables the sector to maintain satisfied clientele, attract investment, remain viable and contribute to the economic growth and well-being of the nation.

A successful construction project is one that achieves the intended objectives in terms of cost, time, quality and safety. This is possible only when the planned levels of productivity are attained. However, the productivity, or lack of it, is perhaps one of the major problems confronting the construction industry, as well as construction firm and the

construction project. Since due to consequences of the importance of the construction industry along with the nature of construction projects and the available economic resources, should be given to improve productivity.

All the stated things leads this study to raise the questions, "What are the factors affecting construction productivity" and "How to evaluate the effects of this factor on the fluctuation of labour productivity; To answers this questions, it is necessary to conduct the topic Factors Affecting the Fluctuation of Productivity in the Construction Projects.

II. OBJECTIVES OF STUDY

This study is conducted to achieve the following objectives.

- To investigate factors affecting the labour productivity across various nature of projects.
- To improve productivity and identify the factors affecting the project performance.

III. SCOPE

- Capture the productivity in projects of different nature
- Compare them with industrial standards and analyze the variance
- Observe the best/worst practices adapted
- Propose measures to improve them

IV. LITERATURE REVIEW

Productivity in construction is often broadly defined as output per labour hour. Since labour constitutes a large part of the construction cost and the quantity of labour hours in performing a task in construction is more susceptible to the influence of management than are materials and capital, then productivity measured is often referred to as labour productivity. Hence, it is important to state that, labour productivity is a measure of overall effectiveness of an operating system in utilizing labour, equipment and capital to convert labor efforts into useful output, which is not a measure of the capabilities of labour alone.

Homyun Jang et al (2009) identified 25 critical variables and were grouped into 4 groups, namely work management; work technique; work characteristic and worker component. Durdyev and Mbachu (2011) identified 56 variables affecting construction productivity, and categorized them into eight factors of internal group and external group.

Enshassi (2007) classifies factors affecting productivity in the construction projects into 10 groups, namely: factors associated with the internal workforce, factors associated with leadership, factors associated with work motivation factor associated with time, factors associated with materials and equipment, factors related to supervision, factors related to project characteristic, factors related to security, factors related to quality and external factors.

Soekiman et al (2011) identified 113 variables affecting construction labour productivity and these variables were grouped into 15 groups of factors according to their characteristics, namely: Design, execution plan, material, equipment, labor, health and safety, supervision, working time, project factor, quality, financial, leadership and coordination, organization, owner/consultant and external factor.

Nabil Ailabouni et al (2007) identified 32 significant variables affecting the productivity in the construction industry and these were grouped into 4 groups based on their characteristic, namely: environment factors, organizational factors, group dynamics and personal factors.

In summary, based on the previous research, 44 factors are selected and grouped into 7 groups according to their characteristics, namely: Man power group, project management, drawings /procedures, site management, safety/quality, labour motivation and environment.

Table I - Factors Affecting Labour Productivity

S. NO	GROUP	FACTORS
A	MANPOWER	
1		Lack of experience
2		Increase of labor age
3		Labor absenteeism
4		Lack of training
5		Labour personal problems
6		Changing supervisors
7		Changing workers
8		High rate of labour turn over
9		Discipline
B	PROJECT MANAGEMENT	
10		Improper scheduling of work
11		Shortage of materials
12		Poor supply chain management
13		Unsuitable material storage
14		Increase in price of materials

15		Crew size
16		Stop work orders because of site accidents
C	DRAWINGS & PROCEDURES	
17		supervision in delays
18		Variation in drawings
19		Incomplete drawings
20		Inspection delays from authorities
21		Accessibility or availability of work procedure
D	SITE MANAGEMENT	
22		Poor site management
23		Poor communication
24		Misunderstanding between labors and supervisors
25		Lack of periodic meeting with labors
26		Incidences e.g. equipment breakdown & planning errors
E	SAFETY & QUALITY	
27		Working at high places
28		Unavailability of safety devices
29		Insufficient lighting
30		Poor access and egress housekeeping
31		Low quality raw materials
32		Rework
33		Quality inspection delay
34		No safety awareness programme
F	LABOUR MOTIVATION	
35		Lack of motivation program
36		Little or no financial rewards
37		Late payments
38		Low amount of pay
39		Poor coordination of camping
G	ENVIRONMENT	
40		Weather changes
41		Project location
42		Working with confined space
43		Large project size

V. RESEARCH METHODOLOGY

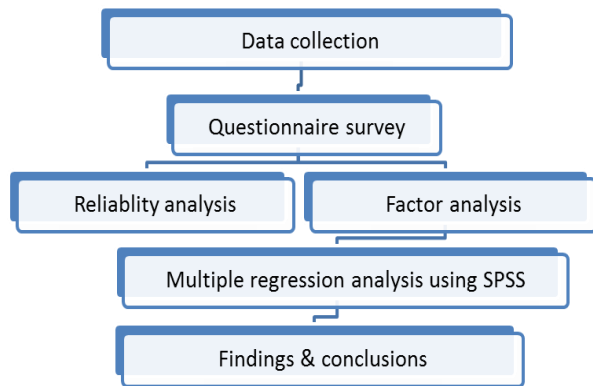


Figure 1 Research method

SPSS is a Windows based program that can be used to perform data entry and analysis and to create tables and graphs. SPSS is capable of handling large amounts of data and can perform all of the analyses covered in the text and much more. SPSS is commonly used in the Social Sciences and in the business world, so familiarity with this program should serve you well in the future. SPSS is updated often.

VI. DATA COLLECTION

The primary data will be collected via direct visit to site or indirect through email or online survey. The secondary data sources are from literature, international business articles, journals, books, professional newspaper and business or expertise website.

VII. QUESTIONNAIRE SURVEY

Questionnaire is at the front line of the research – it is what the general public understanding research, particularly social research. The form of questionnaire contains four sections:

Section 1: A cover letter with the research plan and intention to carry out the research and research title.

Section 2: General information of the project which respondent has involved.

Section 3: Including 43 factors affecting construction productivity with five point Likert rating scale.

Section 4: Respondents information if any.

Finally the completed questionnaire will be shown in the appendices.

Reliability analysis:

The determination of scale reliability is a measurement of the internal consistency of the constructed items in the research in order to evaluate its reliability of each variable in measurement scales. However, the observed variables describes the common construct. The constructs with high reliability are those in which the items are highly inter

correlated. It states that they are all measured with the same construct. Reliability Analysis is used to identify Cronbach's alpha coefficient and item total correlation. The reliability coefficient of Cronbach's alpha also examines how relation of the items in a set which are significantly correlated from one to other.

Factor analysis:

Factors were classified into several components. During this process components classified on the basis of relevant literature review (manpower, project management, drawings & procedures, site management, safety & quality, labour motivation and environment). Those components that were properly classified were examined, and that were not classified were reclassified so that the components could properly represent the factors.

Generally, the value of Cronbach's alpha for acceptable reliability is 0.7 and it could decrease to 0.6 in exploratory research and any variables which have the value of Corrected Item-Total Correlation below 0.4 would be consider to be rejected.

Multiple Regression analysis:

This is the last stage of the statistical analysis in which the factors that significantly influenced labour productivity variation in construction. The significance of the components are analyzed whereas insignificant components were discarded at the final stage. Then the regression model was evaluated and impact of each component was analyzed.

VIII. DATA ANALYSIS & DISCUSSION

A total of 150 questionnaires were distributed to the construction firms in the population. Of these, 100 questionnaires were successfully filled. Once the data was collected the analysis was done as per questionnaires that were used to collect the data.

Questionnaire was collected from various nature of projects such as;

1. Nuclear power plant projects
2. Institutional or commercial projects
3. Metro projects
4. Residential projects
5. Pipeline projects

Summary on data result analysis:

After conducting Reliability Analysis, Factor Analysis, Multi Linear Regression Analysis, on 43 variables affecting to labour productivity, there were 6 variables have been deleted because of its' Corrected – Item Total Correlation value are smaller than 0.3 within Reliability Analysis, including: labour personal problems, increase of labor age, misunderstanding between labor and supervisors, high rate of labour turn over and after conduct Factor Analysis, the variables inspection delay from authorities and low quality raw materials are

deleted, the management team factor also removed because of its' variables: poor supply chain management, Lack of training, Lack of periodic meeting with labor have been moved to supervision and workforce factor. After conducted Multi Linear Regression Analysis, manpower, project management, site management, drawings & procedures, safety& quality factor are supported, but labour motivation and environment factor was not supported by the research.

TABLE: LABOUR EFFICIENCY RATING SCALE

S. No	Activity	Bad	Not bad	Good	Better	Excellent
		1	2	3	4	5
1						
2						
3						
5						
6						
7						
8						
9						
10						

IX. CONCLUSIONS AND RECOMMENDATIONS

The most significant objective of this study is to develop a model in order to determine the factors affecting construction labour productivity across various projects. Initially this chapter summaries the main findings and also outline for future research.

Research finding:

The proposed concept model of this study proposed seven independent factors affect Labour Productivity in construction projects which are man power group, project management, drawings /procedures, site management, safety/quality, labour motivation and environment. After conducting Reliability analysis, Exploratory Analysis, there were 2 independent variables are rejected because of Corrected Item- Total coefficient less than 0.3 and loading score less than 0.5. Furthermore, variable (manpower), (Lack of experience) and (Lack of periodic meeting with labour) in project management Factor have been loaded to another factor. There was no changing in that variables and factors and the number of factor decrease from 7 to 6 factors with environment factor has been deleted.

The Multiple Linear Regression was performed and defined 7 independent factors positively affecting Labor Productivity Fluctuation as final research. Regression analysis indicates

that the model explains 68.7% of the variance in Labor Productivity Fluctuation. Among five extracted factors, labour motivation Factor is the most positively affecting to the Labor Productivity with highest standardized beta of 0.310. It means that the any changing of Motivation factor would be most affect to Labour productivity than others. Therefore the project manager or construction manager who is handling the construction projects needs to pay attention on those factors, especially site management and labour motivation.

The groups of factors which are highly effective are: supervision, material, execution plan, and design. Moreover, for large companies, equipment factors have also highly effective. While in small and medium companies, owner/consultant factors also need special attention because it has high effect too. Research findings also show that health and safety factors has 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.

Practically it is difficult task to all to improve labour productivity upto 100%. But if you have properly control on above factors, productivity can be improved up to large extent.

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