

# Study on Resource Optimization for Improving Construction Productivity

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**Abstract**—In present circumstance, builders are bound to find ways to gain a driven priority and to improve worthy latitude. The realization of any construction project greatly depends on good and effective management of construction resources flow and to enlarge productivity. The intentional establishment presented in the project is to find out the factors that prevails the construction productivity. Data collection was conceded throughout a structured questionnaire survey consisting of factors identified through a broad literature review. Data collection was carried out through a structured questionnaire survey consisting of actors identified through a broad literature review and the factors are analyze by Statistical Package for Social Sciences (SPSS). From these consequences, suggestion was given to the company to improve productivity and make their projects to be more fortunate.

**Key words**—Factors, Management, Resources, Productivity, SPSS

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## I. INTRODUCTION

Projects are shaped to achieve multifarious tasks that cannot be handled by individuals but by multidisciplinary in the construction trade. The main purpose is to bring the project to a successful outcome. Incompetent management of construction resources can effect in low productivity and it creates low appearance that the construction industry has in the society. Therefore, it is important for contractors and construction managers to be familiar with the methods leading to evaluate the productivity. To attain the profits predictable from any construction project in general, it is important to have a fine controlling hand on the productivity factors that throw in the incorporated production composition, like labour, material, equipment, cash flow, etc. Several organization do not realize their magnitude and thus measuring right thing wrong and vice versa. Success of project depends upon how the resources can work satisfactorily to accomplish objectives within scope. More common, the significance of resource management is not measured properly in the intangible and scheduling phases of a construction task which results in construction productivity.

Study findings by social scientists and construction researchers can be controversy, due to the predicament in computing for the many interdependencies. The impact of such factors as attitude and comfort may be uncertain, but that should not keep us from recognize critically about improvements in productivity. To improve productivity, we must be able to measure it. And we must be able to measure the result of changes adopted on methods, efforts, and systems. The need to ensure and enhance employee productivity is a reality no production can disregard. However, it's expected that will meet factors that may decline or turn off employee motivation and reduce productivity. Taking steps to develop your organization's productivity includes all the resources and providing them with the best tools likely to execute their job. The paper is prepared as follows: First, an interpretation is provided on the aspects of the entire resources combine their contribution to overall construction productivity. This then is followed by an analysis of productivity measurement literature towards placing the contribution of the paper in perception. Subsequently, method used in the study is depicting, followed by presentation of the results. The analysis of the findings then follows with the inference, providing a summary of the issues discussed.

## II. RESOURCES IN CONSTRUCTION

A productive factor required to accomplishing an activity to undertake an enterprise and achieve desired outcome. Four resources are: Men, Material, Machinery and Money. Successful management means making optimal and responsible use of men, material, machine and money for the advancement of mankind. So this study is important to identifying and to evaluating the main factors affecting the productivity of construction projects. Improvements will also need to be accepted and supported at all levels.

### A. Men

The right personnel for the right position is a sure bet for organizational effectiveness and efficiency. The lateness and absenteeism, hazardous acts, alcoholism, improper training, incompetence are some of the attributes of man at work. Human resources determine the workings of the other three basic resources. People make sure material; machines and money are utilized in a creative manner to achieve goals and objectives of organizations and enterprises. Poor employment proceeding are harmful to the sustenance of such ventures. With the correct man in the right job, a large portion of effective management will have been achieved. Effective man power management can reduce labour cost and increase profits.

### B. Material

Materials are the essence in the construction industry. Without materials, human resource is made redundant. Thus every right view and right scheduling organization knows that materials needed for any service must be in place. Even if it arrives, in poor quality, the production is certainly doomed for a loss. Poor quality of materials potentially progress risk.

### C. Machine

Machines have made man fulfill almost naturally various dreams of creating things that make our survival more worthwhile. Recently, computers joined in the fray of increasing production and decrease in time tired by man for manufacturing and general making of goods and services. However, without manpower and materials, machines will be ineffective. They need to be operated by man and fed with materials.

### D. Money

Without money, no enterprise can motivate workers, get quality and adequate materials get the correct machines and maintain them or even ensure that time is appropriately managed. Money management, when not correctly organized has been the most identified factor involved in collapse of enterprises. The quantity and quality of money expended in company have a direct bearing on the fruitfulness of same over time. Where there is not enough of money, no good quality workers, materials, or machines can be engaged or purchased. Successful management means making optimal and responsible use of men, material, machine and money for the advancement of mankind.

### E. Resource Optimization

Resource optimization is the processed scheduled and methods to match the available resources (men, material, machinery and money) with the needs of the organization in order to established goals. Optimization consists in attaining desired outcome within a set time and budget with minimum practice of the resources themselves. The need to optimize resource is particularly

noticeable when the organization's demands tend to saturate and exceed the resources currently available.

#### F. Productivity

Productivity is an average measure of the efficiency of production. It can be expressed as the proportion of output to inputs used in the production proceeding, When all outputs and inputs are encompassing in the productivity measure is called total productivity. It is a measure of total efficiency of a production practice and as such the purpose to be maximized in production process. Productivity is a critical determinant of cost efficiency.

#### G. Productivity Measures

A productivity measure is a prerequisite for improving productivity. A good productivity measures need good measures of output and input. Among the best part of output is added value. Without productivity measurement, an organization does not have control. It helps to determine if organization is progressing well.

### III. METHODOLOGY

In construction industry, planning is important to attain its goal. The objectives can be reached by sequencing the course of effort into a typical methodology. Fig.1 represents the methodology adopted for thriving finishing point of the project.

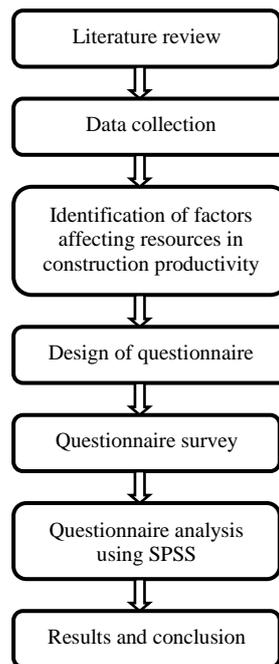


Fig.1. Methodology flow chart

### IV. RESULTS AND DISCUSSIONS

This section presents the factors affecting productivity, and also the tool for analyzing the data.

#### A. Factors Affecting Resources in Construction Productivity

The factors can be identified from the data collection. The most frequent and main factors related to construction resource which affect the construction productivity were determined. Major factors

are grouped in four categories, i.e. material, manpower, machinery and money. Depending upon the factors, the questionnaire will be framed.

**TABLE I FACTORS AFFECTING RESOURCES IN CONSTRUCTION PRODUCTIVITY**

Group	Factors Affecting Resources
Manpower	Lack of skilled labors.
	Lack of job knowledge and fundamental awareness.
	Absence of labors in field.
	Improper coordination between team members.
	Shortage of site workers
Material	Shortage of materials
	Escalation of material prices
	Modification in material specification
	Problem in distribution of materials
	Unavailability of materials
Machinery	Frequent failure of machine
	Delay in supply of equipment
	Inadequate number of equipment
	Increase cost of machinery
	Improper handling of machinery
Money	Waste rate of material due to improper planning
	Delay in payment
	Rework due to errors in construction
	Variation in labour, material and machinery cost
	Project cost overrun due to poor scheduling

*B. Reliability Test*

Cronbach's alpha is the most common measure of internal consistency ("reliability"). It is most frequently used when we have multiple Likert questions in a survey/questionnaire that form a scale and to establish if the scale is reliable. Cronbach's alpha is greater than or equal to 0.9, the internal consistency is considered as highly reliable. If it is less than 0.5, it is considered as unacceptable. Table II shows high reliability of Cronbach's  $\alpha$  in each category of the questionnaire data. The alpha values are in the range of 0.758 to 0.910. This range is considered as high. Thus, the questionnaires are assured and data are valid and highly reliable.

**TABLE II CRONBACH'S ALPHA RELIABILITY TEST RESULTS**

Group of Data	Cronbach's Alpha
Manpower	0.910
Material	0.898
Machinery	0.758
Money	0.833

*C. Kaiser-Meyer-Olkin Test*

KMO is a measure of sampling adequacy that is recommended to check the case to variable ratio for the analysis being conducted. KMO play an important role for accepting the sample adequacy. While the KMO ranges from 0 to 1, the accepted index is over 0.6. In this project, the KMO lies in the range of 0.60 to 0.80.

**TABLE III KAISER-MEYER-OLKIN TEST**

Kaiser-Meyer-Olkin measure of Sampling adequacy	.750
0.750 - Middling	

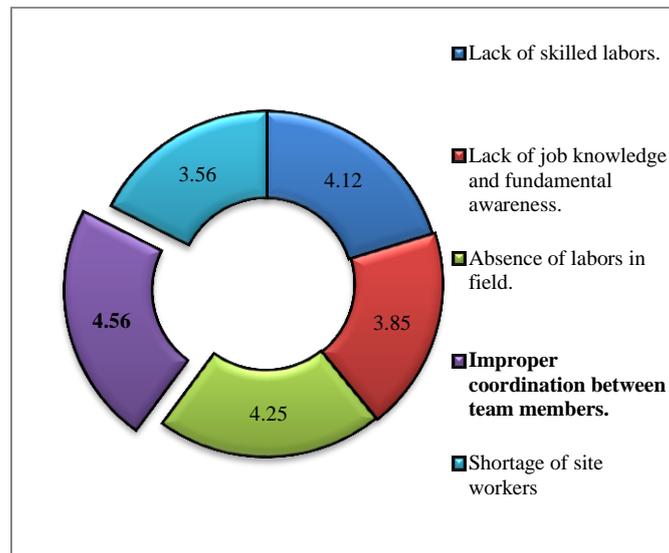
*D. Factor Analysis*

Factor analysis was used to found the unknown interrelations presented among the factors identified in table II. Based on the literatures there are 4 key factors regard as for the questionnaire design. Each of these consists of a number of sub factors. The software would give a proficient result for our work study. The analysis software used in this project is statistical package for social sciences. This required the use of purposive sampling through which questionnaires were sent to 100 respondents. The respondents were to estimate the outcome of the variables determined from the literature using the Likert scale of 1 = Strongly Disagree; 2 = Disagree; 3 = Average; 4 = Agree and 5 = Strongly Agree. 88 of the responses were received, representing 88 % response rate. The collected data was analysed by using SPSS software. From this analysis mean value was founded. Based on the obtained mean value the factors are represented by charts.

**TABLE IV FACTORS AFFECTING MANPOWER**

Factors	Mean
Lack of skilled labors.	4.12
Lack of job knowledge and fundamental awareness.	3.85
Absence of labors in field.	4.25
Improper coordination between team members.	4.56
Shortage of site workers	3.56

It shows that most of the respondent views regarding no cooperation and coordination between the team members.



*Fig.2. Factors Affecting Manpower*

**TABLE V FACTORS AFFECTING MATERIAL**

Factors	Mean
Shortage of materials	3.72
Escalation of material prices	4.04

Modification in material specification	3.42
Problem in distribution of materials	3.80
Unavailability of materials	3.61

The changes in rate according to the material have considerable effect in resource factor.

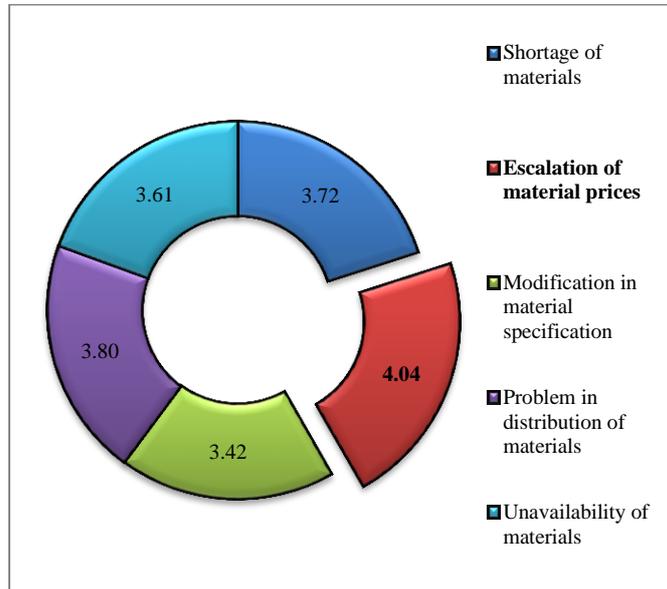


Fig.3. Factors Affecting Material

TABLE VI FACTORS AFFECTING MACHINERY

Factors	Mean
Frequent failure of machine	3.88
Delay in supply of equipment	4.08
Inadequate number of equipment	3.42
Increase cost of machinery	3.64
Improper handling of machinery	3.30

Due to the delay in supply of equipment the productivity will be constantly decreased and it also shows the improper utilization of resources.

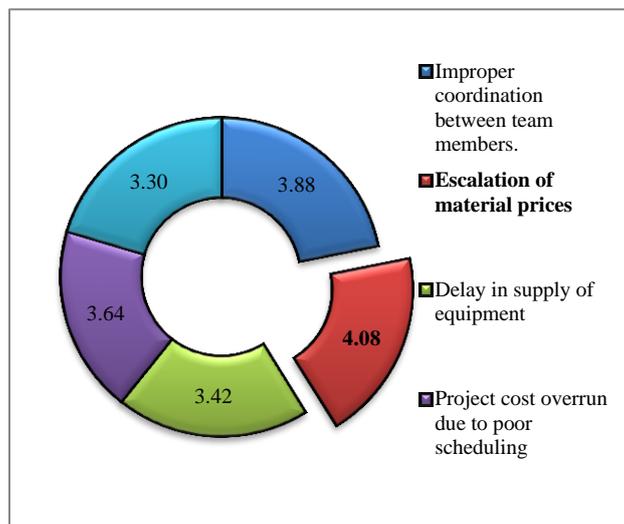
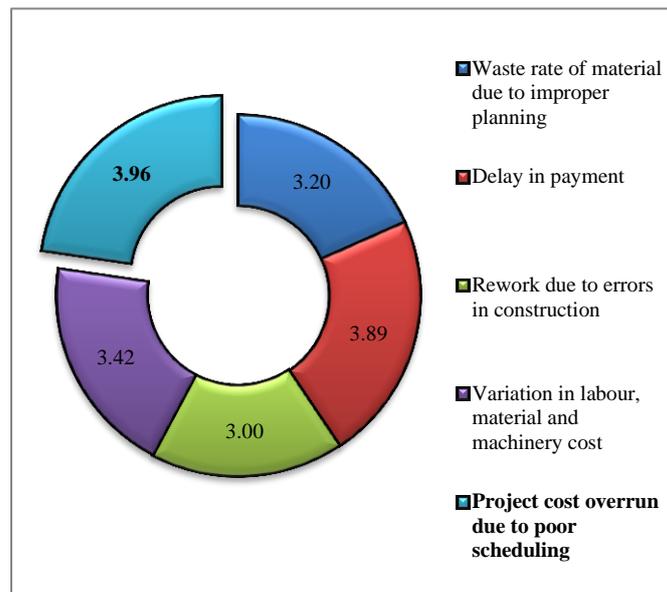


Fig.4. Factors Affecting Machinery

**TABLE VII FACTORS AFFECTING MONEY**

Factors	Mean
Waste rate of material due to improper planning	3.20
Delay in payment	3.89
Rework due to errors in construction	3.00
Variation in labour, material and machinery cost	3.42
Project cost overrun due to poor scheduling	3.96

Improper scheduling makes the project cost overrun is considered as a major cause in factor affecting resource related money.



*Fig.5. Factors Affecting Money*

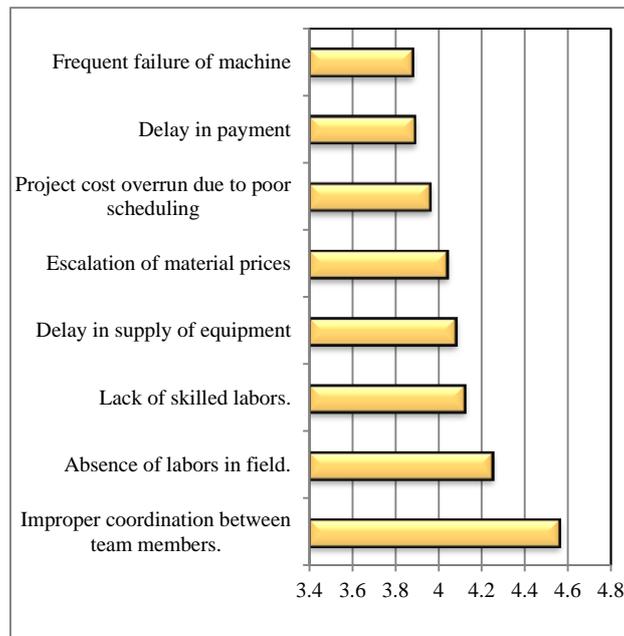
#### F. Ranking of Factors

Factors are ranked based on mean value and suggestions are given in order to rectify and improve the overall project productivity. The inference made from the analysis is discussed in the following table according to the priorities. The results are represented by using BAR charts. Ranking of factors are used to compare, which one is highly significant.

Table 8 shows that there is no coordination between the construction workers or team members are an extremely significant factor affecting construction productivity. Improper coordination may be done by many reasons. Poor communication, behavior of migrant labors could be one of main reason of coordination. Second most significant factor is absence of labor. This factor is found to be the most significant in large construction projects. The third most significant are lack of skilled labors. However, the topmost above three factors are comes under factors affecting manpower. Next, delay in supply of equipment is due to scarce of equipment. The last factor in ranking are frequent failure of machine.

**TABLE VIII TOP SIGNIFICANT FACTORS AFFECTING THE RESOURCES IN CONSTRUCTION PRODUCTIVITY**

FACTORS	MEAN VALUE	RANK
Improper coordination between team members.	4.56	1
Absence of labors in field.	4.25	2
Lack of skilled labors.	4.12	3
Delay in supply of equipment	4.08	4
Escalation of material prices	4.04	5
Project cost overrun due to poor scheduling	3.96	6
Delay in payment	3.89	7
Frequent failure of machine	3.88	8



*Fig.6. Ranking of Factors*

## V. CONCLUSION

Construction industry has complexity in its nature. The levels of success in carrying out construction project development activities will depend heavily on resources are considered in this concern. The factors affecting construction productivity are identified from literature review. Based on literature study a detailed questionnaire was prepared and survey was conducted from owners, site engineer and contractors from various companies through direct survey. From that, 88 responses were collected and analyzed by using SPSS, based on the results the factors are ranked as improper coordination between team members, absence of labors in field, lack of skilled labors, delay in supply of equipment, escalation of material prices, project cost overrun due to poor scheduling, delay in payment, frequent failure of machine are the major factors which affecting the construction project

productivity. In future work, many response are collected from various companies will be analyzed and suitable suggestions will be given to the companies for improving their productivity.

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