ANALYSIS OF FACTORS AFFECTING ON LABOUR PRODUCTIVITY IN CONSTRUCTION INDUSTRY BY USING RII METHOD

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Abstract— Productivity is dominantly aspect in the construction industry. It is important both in developed and under developing countries. Objective of this is to identify and rank. Questionnaire survey was conducted to collect the data. Productivity is the most dominating factor in the construction industry. Productivity is important in both developed and developing countries. The objective of this study is to identify the main factors affecting labour productivity in various construction industries and assessing the impact of the most influenced factors using RII method and lastly, some recommendations are made to minimize the factors affecting labour productivity.

The above objectives have been achieve through the analysis of 25 questionnaires and the result of the analysis shows that there are eight groups which have significant impact on the labour productivity they Manpower, Managerial, Motivation, Environmental, Schedule, Safety, Equipment, Quality group.

Keywords— Labour productivity, RII, Influence factor, construction.

1. INTRODUCTION

GENERAL

Construction projects suffer from various problems and complex factors which affect each phase of the project life cycle. Construction labour productivity has become a big problem in construction industry in most countries, hence it is necessary to see how the human factors will affect the labour productivity in construction projects. Labour productivity is one of the least studied areas within the construction industry. Productivity improvements achieve higher cost savings with minimal investment[1-7]. Due to the fact that profit margins are small on construction projects, cost savings associated with productivity are crucial to becoming a successful contractor. In construction, the output is usually expressed in weight, length, or volume, and the input resource is usually in cost of labour or man-hours.

There are many standards available in the construction industry for contractors as reference values for purposes of construction cost estimation. These standards may vary in values but most are similar in principle. The paper attempts to highlight some of the methods to study Labour productivity, its importance and most factors which affect labour productivity on construction project[13-17].

Productivity has been generally defined as the ratio of outputs to 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 measure 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. Construction labour productivity is influenced by various factors whose impact can be quantified in productivity models play an important role in estimating cost, in scheduling, and in planning.

A number of models have been developed using regression analysis to provide a qualitative evaluation of the impact of different factors on construction labour productivity. The present study intends to quantify these factors and to provide a model for predicting labour productivity. Modernization and industrialization has helped the construction industry grow in leaps and bounds, small towns and cities have become more urbanized and, the construction sector[8-12].

LABOUR PRODUCTIVITY:

Productivity can be defined in many ways. In construction, productivity is usually taken to mean labour productivity, that is, units of works placed or produced per man-hour.

Definition

Productivity is the ratio of output to all or some of the resources used to produce that output. Output can be homogenous or heterogeneous, resource comprise, labour, capital, energy, raw material, etc.
TYPES

(a) Partial Productivity:

It is the ratio of output to one class of input. For example output per man – hour is partial productivity concept. So output per ton of material and interest revenue generated per dollar of capital and so on[18-23].

(b) Total factor productivity:

It is the ratio of net output to the sum of associated labour and capital input. The net output here is sometimes called value – added output. In this, ratio, we explicitly consider only the labour and capital input factors in the denominator.

(c) Total Productivity:

It is the ratio of total outputs to the sum of all input factors. This is a holistic measure that takes into consideration the joint and simultaneous impact of all the input such as labours, materials, machine, capital, energy, etc. This measure has received much attention over the past ten years, as evidence by many paper and case studies.

NEED FOR STUDY

- To analyse the economical and statistical analysis of a country or a particular construction firms in a country.
- To improve occupational educations, training and living standards of constructions labours.
- To ensure safety and healthy environment for construction labours.
- To attain work satisfaction.
- To reach better economical and social development.
- To offer a dynamic measure of economic growth.

IMPORTANCE OF THE STUDY

Productivity has a great importance in construction. Labour productivity constitutes a significant part of production input for construction projects. In the construction industry many external and internal factors are never constant and are difficult to anticipate. This factor leads to a continuous variations in labour productivity. It is necessary to make sure that a reduction in productivity does not affect the plan and schedule of the work and does not cause delays[24-30].

SCOPE OF THE STUDY

The scope of present work is to identify the factors affecting labour productivity in construction. This study will help to identify future work to be carried out to improve productivity in construction. The main scope of study are-

- The identification of factors that affecting the labour productivity is confined to construction projects undertaken based construction companies.
- The data will be collected from residential and commercial construction projects.

OBJECTIVE OF THE STUDY

This study is conducted to achieve the following objectives:

- To identify the factors affecting the variation of labour productivity in the construction projects.
- To assess the impact of influenced factors on the variation of labour productivity.
- To suggest recommendations in order to reduce variation of labour productivity in the construction projects.
- To identify the current scenario followed in human resources management in civil engineering field.

III. METHODOLOGY

Productivity = output / labour cost

LITRETURE REVIEW

IDENTIFICATION OF FACTORS AFFECTING LABOUR PRODUCTIVITY

QUESTIONNARIE SURVEY

DATA COLLECTION

ANALYSIS OF DATA USING RII METHOD
IV. QUESTIONNAIRE METHODOLOGY

METHOD OF SURVEYING

The basic procedure of this study relies on the survey questionnaire which will be gathered from the construction sectors employees of various sizes via mail or by faculty meeting. A thorough literature review was first directed to recognize the labour productivity that influence the performance of construction sector in general.[37-41]. This review has embraced the more broad and expansive meaning of labour productivity in construction sectors and more labour productivity components from other literature.

QUESTIONNAIRE STRUCTURE

The initial segment comprises of general data like kind of organization, experience; cost of their project and so forth and the second part comprises of the project life cycle stage wise productivity elements for assessment. The questionnaire is made outlined upon the accompanying sorts of productivity in construction sectors

FACTORS AFFECTING ON LABOUR PRODUCTIVITY

- Manpower
- Managerial
- Motivation
- Environmental
- Schedule
- Safety

QUESTIONNAIRE DESIGN

The review questionnaire is intended to test the cross-sectional behavioural pattern of labour productivity involved in construction project life cycle. The questionnaire was set up for analyzing information for enhancement of productivity through mathematical approach; review was planned by observing the pertinent literary works in the range of construction sector risk. The primary reason for the study is not to build up another list of productivity but rather to break down the relative criticalness among the productivity distinguished and to highlight the major productivity[31-36].

PRODUCTIVITY RATING

A Likert scale of 1-5 was used in the questionnaire. A Likert scale is a type of psychometric response scale often used in questionnaires, and is the most widely used scale in survey research. When responding to a Likert questionnaire item, respondents specify their level of agreement to a statement. The scale is named after Rensis Likert, who published a report describing its use (Likert 1932). The respondents were required to indicate the relative criticality/ effectiveness of each of the probability of labour productivity factors and their impact to the management.

Table 2 Likert scale index.

<table>
<thead>
<tr>
<th>Likert index</th>
<th>Scale</th>
<th>Level of Productivity Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>One</td>
<td>Very low level</td>
<td></td>
</tr>
<tr>
<td>Two</td>
<td>Low level</td>
<td></td>
</tr>
<tr>
<td>Three</td>
<td>Medium level</td>
<td></td>
</tr>
<tr>
<td>Four</td>
<td>High level</td>
<td></td>
</tr>
<tr>
<td>Five</td>
<td>Very high level</td>
<td></td>
</tr>
</tbody>
</table>
ANALYSIS METHOD USED

RELATIVE IMPORTANCE INDEX:

The questionnaire are collected and analysed using RII Method. Ranking of factors was calculated based on Relative Importance Index.

\[ RII (\%) = \frac{\sum W}{A \times N} \]

Where,

RII = Relative Important Index
W = weighting given to each statement by the respondent and ranges from 1 to 5
A = Higher response integer (5)
N = total no. of respondents.

Table 4 Statistical Data of Questionnaire Sent and Received

<table>
<thead>
<tr>
<th>Number of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Questionnaire sent</td>
</tr>
<tr>
<td>Total Questionnaire received</td>
</tr>
<tr>
<td>Total Questionnaire pending</td>
</tr>
</tbody>
</table>

V. RESULT & DISCUSSION

RANKING OF FACTORS AFFECTING ON LABOUR PRODUCTIVITY

The overall factors are calculated by using RII method. This is one of the management of tools help to analyse by 5-scale likert factors analysis. The mean value is found out for the various factors affecting on labour productivity and determined ranking of the factors affecting on labour productivity[42-45]. Table shows

Table 3 Manpower

<table>
<thead>
<tr>
<th>Manpower</th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>RII</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labour absentation</td>
<td>25</td>
<td>5</td>
<td>3</td>
<td>0.536</td>
<td>4</td>
</tr>
</tbody>
</table>

The above figure shows the ranking of Manpower. It shown that difficulty in recruitment of construction works ranks first and labour personal problems ranks second.

RANKING OF FACTORS AFFECTING ON LABOUR PRODUCTIVITY:

The overall factors affecting on labour productivity are calculated by using RII method. This is one of the management of tools help to analyse by 5-scale likert factors analysis. The mean value is found out for the various factors affecting
on labour productivity and determined ranking of the labour productivity[46-50]. Table 4 shows the

<table>
<thead>
<tr>
<th>Managerial</th>
<th>Factors</th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>RII</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor site management</td>
<td>25</td>
<td>5</td>
<td>1</td>
<td>0.45 6</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Lack of periodic with labours</td>
<td>25</td>
<td>5</td>
<td>1</td>
<td>0.48 8</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Poor communication</td>
<td>35</td>
<td>5</td>
<td>3</td>
<td>0.57 6</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Financial difficulties of the owner</td>
<td>25</td>
<td>5</td>
<td>3</td>
<td>0.60 8</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

5.3. RANKING OF FACTORS AFFECTING ON LABOUR PRODUCTIVITY:

The overall risk factors are calculated by using RII method. This is one of the management of tools help to analyse by 5-scale likert factors analysis. The mean value is found out for the various factors affecting on labour productivity and determined ranking of the labour productivity.

<table>
<thead>
<tr>
<th>Motivation</th>
<th>Factors</th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor site management</td>
<td>25</td>
<td>5</td>
<td>1</td>
<td>0.45 6</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Lack of periodic with labours</td>
<td>25</td>
<td>5</td>
<td>1</td>
<td>0.48 8</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Poor communication</td>
<td>35</td>
<td>5</td>
<td>3</td>
<td>0.57 6</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Financial difficulties of the owner</td>
<td>25</td>
<td>5</td>
<td>3</td>
<td>0.60 8</td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

The above figure 5.2 shows the ranking of Managerial. It shown that the financial difficulties of the owner ranks first and poor communication ranks second.
The above figure 5.3 shows the risk ranking of the Motivation. It has shown the lack of transport facilities ranks first and delay of salaries ranks second.

5.4 RANKING OF FACTORS AFFECTING ON LABOUR PRODUCTIVITY:

The overall risk factors affecting on labour productivity are calculated by using RII method tools. This is one of the management of tools help to analyse by 5-scale likert factors analysis. The mean value is found out for the various factors affecting on labour productivity and determined ranking of the factors affecting on labour productivity. Table 5.4 shows the

Table 6 Environmental

<table>
<thead>
<tr>
<th>Factors</th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>RII Mean</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>working and confined place</td>
<td>25</td>
<td>4</td>
<td>1</td>
<td>0.45</td>
<td>6</td>
</tr>
<tr>
<td>Location</td>
<td>25</td>
<td>5</td>
<td>1</td>
<td>0.49</td>
<td>6</td>
</tr>
<tr>
<td>weather changes (heavy rainfall, flood, etc.)</td>
<td>25</td>
<td>5</td>
<td>8</td>
<td>0.50</td>
<td>4</td>
</tr>
<tr>
<td>project size</td>
<td>25</td>
<td>1</td>
<td>2</td>
<td>0.64</td>
<td>8</td>
</tr>
</tbody>
</table>

The above 5.4 figure shows the ranking of Environmental. It has shown the project size ranks first and Weather changes (heavy rainfall, flood, etc.) ranks second.

RANKING OF FACTORS AFFECTING ON LABOUR PRODUCTIVITY:

The overall factors affecting on labour productivity are calculated by using RII method tools. This is one of the management of tools help to analyse by 5-scale likert factors analysis. The mean value is found out for the various factors affecting on labour productivity and determined ranking of the factors affecting on labour productivity. Table 7 shows Schedule

<table>
<thead>
<tr>
<th>Factors</th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overcrowding</td>
<td>25</td>
<td>5</td>
<td>1</td>
<td>0.464</td>
<td>4</td>
</tr>
<tr>
<td>Delay in project</td>
<td>25</td>
<td>5</td>
<td>1</td>
<td>0.488</td>
<td>3</td>
</tr>
<tr>
<td>Misuse of time schedule</td>
<td>25</td>
<td>5</td>
<td>2</td>
<td>0.520</td>
<td>2</td>
</tr>
<tr>
<td>Improper work planning</td>
<td>25</td>
<td>4</td>
<td>3</td>
<td>0.616</td>
<td>1</td>
</tr>
</tbody>
</table>
5.6 RANKING OF FACTORS AFFECTING ON LABOUR PRODUCTIVITY:

The overall factors affecting on labour productivity are calculated by using RII method. This is one of the management of tools help to analyse by 5-scale likert factors analysis. The mean value is found out for the various factors affecting on labour productivity and determined ranking of the factors affecting on labour productivity. Table 8 shows.

Table 8 Safety

<table>
<thead>
<tr>
<th>Safety</th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire explosion</td>
<td>25</td>
<td>5</td>
<td>1</td>
<td>0.432</td>
<td>4</td>
</tr>
<tr>
<td>improper instruction of safety</td>
<td>25</td>
<td>5</td>
<td>1</td>
<td>0.544</td>
<td>3</td>
</tr>
</tbody>
</table>

Figure 5 Schedule

The above figure shows the risk ranking of Schedule. This shows the Improper workplanning ranks first and Misuse of time table ranks second.

Figure 6 Safety

The above figure shows the ranking of safety. This shows the Insufficient lighting ranks first and Accidents ranks second.

Table 9 Equipment

<table>
<thead>
<tr>
<th>Equipment</th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>RII Mean</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accidents</td>
<td>25</td>
<td>3</td>
<td>1</td>
<td>0.568</td>
<td>2</td>
</tr>
<tr>
<td>Insufficient lighting</td>
<td>25</td>
<td>2</td>
<td>3</td>
<td>0.696</td>
<td>1</td>
</tr>
</tbody>
</table>
The above figure shows the ranking of Equipment. This shows the Old and insufficient equipment ranks first and Machineries and equipment ranks second.

**RANKING OF FACTORS AFFECTING ON LABOUR PRODUCTIVITY:**

The overall factors affecting on labour productivity are calculated by using RII method. This is one of the management of tools help to analyse by 5-scale likert factors analysis. The mean value is found out for the various risk factors and determined ranking of the risk factors. Table 10 shows the Dominant risk factors mean & ranked accordingly.

**Table 10 Quality**

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Factors</th>
<th>Mean</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No proper checking &amp; test of construction materials</td>
<td>0.424</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>low quality of materials</td>
<td>0.48</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>quality inspection delay</td>
<td>0.56</td>
<td>1</td>
</tr>
</tbody>
</table>

The above figure shows the ranking of Quality. This shows the Quality inspection ranks first and Low quality ranks second.

**RANKING OF FACTORS AFFECTING ON LABOUR PRODUCTIVITY:**

The overall factors affecting on labour productivity are calculated by using RII method. This is one of the management of tools help to analyse by 5-scale likert factors analysis. The mean value is found out for the various factors affecting on labour productivity and determined ranking of the factors affecting on labour productivity. Table 11 shows

**Table 11 Dominant factors on labour productivity**

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Factors</th>
<th>Mean</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Old and insufficient equipment/materials</td>
<td>0.6</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Machineries and equipment</td>
<td>0.54</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Delay of arrival of equipment/materials</td>
<td>0.47</td>
<td>3</td>
</tr>
</tbody>
</table>
The theoretical model of this study proposed eight independent groups affecting the variation of Labour Productivity in the construction projects namely Manpower group, Managerial group, Environmental group, Motivation group, Material/Equipment, Schedule group, Safety group and quality group. In construction projects, the contractors used to think that labour productivity is the maximum to complete project in short time. But at the same time due to speed execution of work, occurrence of error is high and if that happens considerable amount of money and time will be wasted to set right error. Decision making such as factors affecting on labour productivity in construction projects is very important in the construction management. The identification and assessment of project labour productivity are the critical procedures for projecting success. This study determines the dominant labour productivity in construction sectors. The results of the questionnaire survey shows that accidents, project size and improper work planning among site management people is the prominent reason for the reduction in productivity. Hence concluded that these factors have to be kept in mind while executing a construction project to achieve the optimal. This approach provides a more effective, accurate and organized decision support tool.

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