Critical Success Factors Affecting Labour Productivity in Building Sector Projects

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Abstract. Labour productivity has been the topic of study since last few decades due to its great contribution in the project success and organization’s growth. Various factors causing poor productivity of labour have been identified by several researchers worldwide. Labour productivity has been one of the least studied areas for the building sector projects within the construction industry of Pakistan. The main aim of this article is to review the previous studies since last one decade and identify the critical factors affecting labour productivity in building sector projects. To achieve the aim, a questionnaire survey based on the identified factors was carried out. The data obtained from 133 successfully returned questionnaires, was analysed by using Average Index (AI) method with the help of Statistical Package for the Social Sciences (SPSS). The findings of this research highlight 15 topmost factors affecting labour productivity including Shortage of materials at first, followed by Shortage of equipment, Lack of supervision, low wages given by employer, old and inefficient equipment, overtime, delays in salary payments, Experience of workers, rewards mechanism, reworks, height of working place, improper work planning, age of the worker, Intensity of lighting and ventilation and weather conditions respectively. The study also gives some suggestions and recommendations to overcome the labour productivity issue. This paper will help the construction stakeholders and researchers as guideline to focus on the key factors that affect the labour productivity in building sector projects, which ultimately have been reducing the project’s success and hindering the organizational growth as well.

1 Introduction

Construction industry plays an essential role in the development of any country’s economic growth, contributing to Gross Domestic Product (GDP) and a major source of employment worldwide. The success of small and medium-sized firms directly depends on labour productivity (LP), which is crucial for the construction industry [1]. It has been a topic of study for many decades because poor productivity is still a main issue in different developing
countries. The management process in any project is supported by human resources. Employee turnover is one of the most significant causes, producing difficulty in the construction sector [2]. Labour is a fundamental input in all the projects to attain the highest level of output in terms of productivity [3] but unfortunately, they are not given the basic facilities which make them happy and satisfied with their job, which ultimately motivate them for producing better productivity. It has been discovered that when employees perform well, the organization is more likely to grow. Someone who is well-trained and eager to work because he is compensated and has a better future out-look would perform well, which ultimately results in successful completion of project [4].

Many researchers have identified the factors related with labour, management, material, tools, and finance which influence LP worldwide. [5] identified 38 different factors and categorized those factors into five main groups. [6] identified most significant factors affecting LP in building construction projects of Australia including award rates, level of skill and experience, inadequate supervision, communication problems with foreign workers and fatigue. A study conducted by [7] on construction labour productivity in Yemen, identified 52 factors and ranked them accordingly. The mapping of the identified factors is shown in Table 1.

Therefore, it is observed from the literature that this topic has been given less attention specially in building construction sector of Pakistan. It is of the great importance to highlight the critical factors which affect the LP in construction industry of Pakistan. Furthermore, the most repeated factors identified from previous studies since the year 2011 were selected for the study.

Since, every stakeholder involved in any construction project expect the successful completion of the projects along with efficient LP but, likewise other industries, this industry also faces many problems and one of the main problems is the poor LP. Hence, for enhancing productivity, it is essential to identify the most influential factors and come up with a solution to improve it [8].

Therefore, keeping in considering the above-mentioned problem, this research aims to identify the most critical factors which affect LP on building sector projects under the contractor category C-6, which has project cost limit Up to 25 million Pakistani Rupees, as per Pakistan Engineering council (PEC). This paper will help the construction industry stakeholders to be proactive and take necessary steps to enhance labour productivity.

Table 1. Mapping of the factors affecting labour productivity.

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<td>Shortage of equipment</td>
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<td>Age of worker</td>
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The above table shows the mapping of the factors which were identified from the literature review. The most occurring factors are mentioned in the table.

2 Methodology

To achieve the aim, the following methodology shown in Figure 1. was adopted.

![Methodology flow chart](https://doi.org/10.1051/e3sconf/202343702004)

Fig. 1. Methodology flow chart.

A detailed literature review was carried out from the studies conducted since 2011 and the factors affecting LP were identified, the mapping of the factors is shown in Table 1. To achieve the aim of the study, a quantitative approach was used. For that, a questionnaire was designed based on the identified factors and that questionnaire was finalized after getting experts opinion with minor corrections. The 5-point Likert’s scale was used where 1 represents “don’t affect”, 2 represents “somehow affect”, 3 represents “moderately affect”, 4 represents “highly affect” and 5 represents “very highly affect”. The questionnaire was distributed among the respondents working in building sector projects, having experience more than 5 years.
The questionnaire was distributed in building sector projects of Sindh including the districts Karachi, Hyderabad, Sukkur, Jamshoro and Khairpur Mir’s. The targeted population was the professionals working under contractors including Project Managers, Deputy Project Managers, Construction Managers, Site Engineers, and Site Supervisors. To obtain the sample size, Equation (1) suggested by [7] was used.

\[
n = \frac{m}{1 + [(m-1)/N]}
\]  

(1)

Where \(n\) is sample size of limited, \(m\) is sample size of unlimited, and \(N\) is available population. The \(m\) in (1) is estimated by (2).

\[
m = \frac{x^2 \times p \times (1-p)}{\varepsilon^2}
\]  

(2)

While the data was collected from the respondents working in the ongoing projects of 202 active firms under C-6 category. Therefore, taking \(N=202\) and \(m=385\), the requires sample size is obtained by Eq. (1)

\[
n = \frac{385}{1 + \left(\frac{385 - 1}{202}\right)} = 132.7 \approx 133
\]

Therefore, the required sample size obtained is 133.

For the data analysis, the average index method is effectively used to discover the components using ranking analysis [21]. This study also used Average Index (AI) method to analyse the collected data by using Statistical Package for the Social Sciences (SPSS). The mean is calculated by (3):

\[
AI = \frac{\Sigma(x1+2x2+3x3+4x4+5x5)}{\Sigma(x1+x2+x3+x4+x5)}
\]  

(3)

Where, \(x1\), \(x2\), \(x3\), \(x4\) and \(x5\) represent number of respondents for scale 1,2,3,4 and 5.

This research has used Cronbach’s alpha to check the stability of the data. This test has been used by previous studies to check the internal consistency of the data [22]. The study conducted by [23] suggests that the Alpha value ranges from 0-1, the value greater than 0.70 is said to be in acceptable limits.

3 Results and Discussions

Due to limitations of the study, the respondents were selected from ongoing projects in the major districts of Province Sindh, Pakistan. 180 questionnaires were distributed among respondents who were working on different building projects of province Sindh under the contractor category C-6. The data was collected from the major districts including Karachi, Hyderabad, Sukkur, Jamshoro and Khairpur Mir’s with 41, 29, 21, 27 and 15 number of respondents respectively. Figure 2 shows the respondent percentage as per the location of the projects. 155 questionnaires were received back and after discarding 12 incomplete questionnaires, 143 questionnaires were filled completely. Out of the 133 considered respondents, 33 respondents were working as Project Manager, 20 were working as Deputy Project Managers, 29 were engaged as Construction Managers, 33 were working as Site Engineers and remaining 18 were Site Supervisors, the result is shown in Figure 3.

The respondents having experience more than five years in building sector projects were targeted for data collection because respondents experience plays a vital role in any research. 18% of the respondents were having experience between 6-10 years, 23% of the respondents with 11-15 years of experience, 26% of the respondents were having experience between 16-
20 years and 33% of the respondents were with experience of more than 20 years of building sector projects.

The Cronbach’s Alpha test was also performed for the above data set as a reliability analysis and the following Table 2 shows the results of Cronbach’s Alpha.

The result shows that the value of the Cronbach’s Alpha is 0.82 which shows that the obtained value is in acceptable limits. The value greater than 0.70 is said to be in acceptable limits [22]. As a result, the data is reliable, and further analysis can be performed.

Table 2. Reliability Statistics.

<table>
<thead>
<tr>
<th>Cronbach's Alpha</th>
<th>N of Items</th>
</tr>
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<tbody>
<tr>
<td>0.82</td>
<td>40</td>
</tr>
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</table>

After that, analysis of data was done on SPSS, the ranking of the top 15 factors with their respective score is shown in Table 3.

Table 3. Ranking of the factors affecting labour productivity.

<table>
<thead>
<tr>
<th>Factors Affecting Labour productivity</th>
<th>Rank</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shortage of Material</td>
<td>1</td>
<td>4.012</td>
<td>1.170</td>
</tr>
<tr>
<td>Shortage of Equipment</td>
<td>2</td>
<td>3.975</td>
<td>1.065</td>
</tr>
<tr>
<td>Lack of supervision</td>
<td>3</td>
<td>3.939</td>
<td>1.220</td>
</tr>
<tr>
<td>Low wages given by employer</td>
<td>4</td>
<td>3.865</td>
<td>1.119</td>
</tr>
<tr>
<td>Old and inefficient equipment</td>
<td>5</td>
<td>3.853</td>
<td>1.031</td>
</tr>
<tr>
<td>Overtime</td>
<td>6</td>
<td>3.841</td>
<td>1.231</td>
</tr>
<tr>
<td>Delays in salary payments</td>
<td>7</td>
<td>3.731</td>
<td>1.186</td>
</tr>
<tr>
<td>Experience of workers</td>
<td>8</td>
<td>3.682</td>
<td>1.174</td>
</tr>
<tr>
<td>Reward mechanism</td>
<td>9</td>
<td>3.609</td>
<td>1.152</td>
</tr>
<tr>
<td>Reworks</td>
<td>10</td>
<td>3.390</td>
<td>1.224</td>
</tr>
<tr>
<td>Height of working place</td>
<td>11</td>
<td>3.365</td>
<td>1.232</td>
</tr>
<tr>
<td>Improper work planning</td>
<td>12</td>
<td>3.292</td>
<td>1.337</td>
</tr>
<tr>
<td>Age of worker</td>
<td>13</td>
<td>3.219</td>
<td>1.154</td>
</tr>
<tr>
<td>Intensity of lighting and ventilation</td>
<td>14</td>
<td>3.122</td>
<td>1.081</td>
</tr>
<tr>
<td>Weather conditions</td>
<td>15</td>
<td>3.073</td>
<td>1.141</td>
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</table>
The findings of this study show that, Shortage of material is ranked as the topmost factor affecting LP with a mean score of 4.01. Material availability plays a major role in the flow of tasks performed in any project. Shortage of material at a certain stage of work affects the productivity of the labour. This is consistent with the findings of [5]. Shortage of Equipment with a mean score of 3.97 was ranked second among all 40 factors. The findings highlight that equipment shortage severely affects the productivity of the labour which ultimately affects the project’s success, hence, negatively affects the productivity of the labour. This is also significant with the findings of [6]. The factors including Lack of supervision, Low wages given by employer and old and inefficient equipment were ranked third, fourth and fifth respectively. Whereas the factors, Intensity of lighting and ventilation and Weather conditions with mean scores 3.12 and 3.07 respectively, were at last rank among those fifteen topmost critical factors affecting labour productivity.

4 Conclusion

It is concluded that there are various issues which need great attention by the construction industry stakeholders. It has been identified that due to lack of attention given by the contractors of C-6 category, labour productivity has been seriously affected by the identified factors. Due to financial instability and lack of management skill of the mentioned category, various problems are being faced by the labours which affect their productivity.

The identified topmost factors need great attention to overcome the labour productivity issues at construction projects. Contractors must make sure the availability of the material within the time limitations so that the work may not be interrupted due to material shortage at site. Sufficient equipment shall be provided at site so that labour shall avoid traditional methods including hand mixing which results in wasting time as well, carrying the material at certain height on their back which lowers the efficiency of the labour to work for whole working day, working without necessary safety equipment at heights which affects their productivity due to fear of falling.

Lack of supervision is also a major problem which has been noticed at the projects handled by the mentioned contractor category. Proper supervision helps to enhance the productivity of the labour. Labour on the other hand, being key resource of project, are given less attention. The factors such as low wages given by employer, delays in salary payments, lack of reward mechanism and overtime, demotivate the labour, makes them dissatisfied from job and affect their productivity to great extent. This is of great importance that contractors should keep these basic needs required by any labour, so that labour shall be motivated and feel satisfied with the job. This will help to enhance the productivity of the labours. The study suggest that contractor should provide basic amenities at site for the labours. It is further suggested that the government should ensure that the minimum wages are given by employers to their employees or not.

Finally, it is expected that the findings of this study will offer the researchers and the stakeholders involved in the construction industry a helpful insight to focus on the key factors affecting labour productivity in the building sector.

5 Future Recommendations

- Due to time limitations, the study was limited to building sector projects of C-6 contractor category only, further studies may conduct the research for other categories as per Pakistan Engineering Council (PEC).
• Further studies can be carried out on each individual factor’s effect on labour productivity including job satisfaction, training and improving skills, motivation, reward mechanism or monitory benefits.
• It is further recommended that more in-depth research may be conducted at the province level covering all the districts.

Acknowledgement

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References


