

## **FACTORS AFFECTING THE CONSTRUCTION PRODUCTIVITY IN THE CONTEX OF KHULNA CITY OF BANGLADESH**

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### **ABSTRACT**

The role of construction in the economy shows the necessity for the progress of construction productivity performance in the construction industry. In the construction industry, the most valuable asset is labor. It is necessary to increase the proficiency of production by increasing the productivity of labor. The key objective of this study is to identify the most affecting factors in construction productivity in the construction industry of Khulna city of Bangladesh. A questionnaire survey has been conducted for collecting the data among various stakeholders and projects in Khulna city. Factors influencing the construction productivity were analyzed by using an RII method. This study has shown that the top five ranked factors affecting construction productivity are Labor Supervision, Skilled Labour, Availability of materials, Availability of Equipment and Scheduling of work in Khulna city. The results obtained from this study fill a gap in knowledge of factors affecting construction productivity in Khulna, which can be used to provide industry stakeholders with guidance for improving the construction productivity in Khulna city.

**Keywords:** *Productivity, Factors, Construction, Labor, Khulna.*

## **1. INTRODUCTION**

The building construction industry is considered as one of the fastest and largest sectors in Bangladesh. Construction productivity is key focus areas for the construction industry for any nation. It has a great contribution to the economy of a country. According to (Hannula, 2002), productivity is the ratio of total output to total input. Low productivity is a key point of anxiety for construction firms due to its bad effects on overall project progress in terms of time and cost performance (Jarkas & Bitar, 2011). The significance of controlling labor value is made into its overall performance to the project cost. It usually extends within 33% to 50% of total project costs (Jergeas, 2009). It is important to set what factors influencing construction productivity act positively or negatively. According to (Mahamid, Al-Ghonamy, & Aichouni, 2013), labor productivity plays a principal role in ensuring the attainment of a project. However, it could be affected by several unexpected variables. These variables may include factors related to labor, materials, equipment, construction methods, and climate. Poor labor productivity is one of the major causes of cost and time overruns in construction projects. So, high consideration should be taken to this factor in the construction industry. This study focuses on identifying and ranking the factors affecting construction productivity in the construction industry in Khulna city with respect to their relative importance so that the outcomes can be provided guidelines to stakeholders for actual planning and efficient utilization of the labors and cost-effective operation. The paper starts with a literature review of studies relevant to this investigation, discusses the research methodology, study area, data analysis, the results obtained, conclusions and finally recommendations.

## **2. LITERATURE REVIEW**

The topic of construction productivity has been done by many researchers. It is important to set what factors influencing construction productivity act positively or negatively (Enshassi, Mohamed, Mustafa, & Mayer, 2007). If factors having a significance on construction productivity are recognized, it will also be feasible to forecast productivity (Lema, 1995). Several studies have been undertaken to identify the factors influencing construction productivity. In a survey carried out in the United States, material availability, tool availability, rework, overcrowded work areas and inspection delays were identified as major factors influencing productivity (Borcherding & Garner, 1981). In the Oman, stakeholders who participated in a survey towards identifying the factors affecting productivity ranked errors and omissions in design drawings, change orders during execution, delay in responding to requests for information, lack of labor supervision, clarity of project specifications, coordination amongst design disciplines, working overtime, rework, inclement weather, labor's physical fatigue (Jarkas, Al Balushi, & Raveendranath, 2015). A survey was done in Yemen, identified labor's experience and skill, availability of materials in site, leadership and efficiency in site management, availability of materials in the market, political and security situation, provides all drawing details during works, interruption of the work, architectural and structural designs, the accuracy and the level of project specifications, building technique, and technology, economic condition in the country, equipment required for work on the project among the most significant factors impacting construction labor productivity (Alaghbari, Al-Sakkaf, & Sultan, 2019). In a survey carried out in Jordan, illustrated that the following dimensions are almost equally important: planning, the worker-management relationship, education and experience, technology and equipment, and motivation (Hiyassat, Hiyari, & Sweis, 2016). In India, Analysis of the factors showed that the top-five ranking factors affecting labor productivity are skilled labor, availability of material, availability of tools, labor supervision and safety conditions on site (Ghate & Minde, 2016).

## **3. METHODOLOGY**

The data of this study were collected using a questionnaire survey. The questionnaire was designed around factors influencing construction productivity collected from various studies and expert

interviews. The survey takes 15 factors propagated based on related research works on construction productivity. The structured questionnaire was built of two parts:

- The first part included general information about the respondents (respondent name, project name, and designation), whose initial aim was to narrate the respondents to effectively ensure reliability.
- The second part included a table, which represents 15 factors influencing construction productivity in Khulna. The questions were designed using a five-point Likert scale comprising ratings from 1 to 5. The respondents were said to give the range to which factor impacted construction productivity in their projects.

Finally, factor analysis was done in order to rank the factors.

### 3.1 Study Area

This study was performed at six selected areas KUET (Khulna University of Engineering & Technology), Fulbarigate, Boira, Sonadangha, Nirala, and Newmarket. These areas are located in Khulna division the southern part of Bangladesh. The areas are busiest places in this Khulna city. Construction of new buildings, infrastructure, the vertical and horizontal extension of the existing structures has become a regular phenomenon.

### 3.2 Data Collection

The study has adopted a questionnaire survey as a method to rank the factors affecting construction productivity in construction projects. Face to face survey was done for collecting the data. The required data for this study was collected from 100 respondents from construction projects in Khulna city of Bangladesh. Engineer, owner, contractor, and sub-contractor were performed as a respondent in this questionnaire survey who had very good experiences for more than 10 years in consultancy works in construction projects.

### 3.3 Data Analysis

To analyze the data received from the questionnaires, SPSS was used to calculate the Mean, Std. deviation. The Relative Important Index (RII) was used to analyses the ratings given by the respondents.

Data from 100 responses were analyzed for reliability. The Cronbach's alpha coefficient, the measure of internal consistency of the survey, was 0.730 indicating good consistency. This study also adopted a Likert scale rating of influence level from 1 to 5 where 1 stands for "Least Important" and 5 for "Extremely Important" influence of the factors collected via the face to face questionnaire survey. This study aimed to rank the identified factors in Khulna according to their importance, using the RII method. For each factor, the RII was calculated using the equation (1):

$$RII = \frac{\sum W}{A \times N} \quad (1)$$

Where,

W = weighting of each factors given by respondents;

A = highest weight, which is 5 for this study;

N = total number of respondents.

Calculated RIIs range in value from 0 to 1 (0 not inclusive), indicating that the higher the RII, the more important was the factor.

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Name: [Redacted]

Project Name: Textile Building

Designation: Engineer

Example:

How much important is 'Labor Supervision' as a key factor for Construction Productivity?

Respondent's response

1.(Least Important)

2.(Somewhat Important)

3.(Moderate)

4.(Very Important)

5.(Extremely Important)

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| Sr. No. | Factors affecting                     | Respondent's response |
|---------|---------------------------------------|-----------------------|
| 1       | Labor Supervision                     | 3                     |
| 2       | Skilled Labor                         | 4                     |
| 3       | Scheduling of Work                    | 5                     |
| 4       | Training of Labor                     | 2                     |
| 5       | Climatic Condition                    | 4                     |
| 6       | Unscheduled Extra Work                | 3                     |
| 7       | Availability of Materials             | 5                     |
| 8       | Availability of Equipment             | 5                     |
| 9       | Numbers of Labor on Site              | 3                     |
| 10      | Site Layout                           | 4                     |
| 11      | Miscommunication between Stakeholders | 4                     |
| 12      | Changes of Work                       | 2                     |
| 13      | Structural Design complexity          | 4                     |
| 14      | Construction method                   | 2                     |
| 15      | Safety conditions on site             | 4                     |

Figure 1: The questionnaire form for the factors influencing in the construction productivity

#### 4. RESULT AND DISCUSSION

The mean value, std. deviation and variance of the survey result have been calculated in SPSS that's are tabulated in table 1. Finally, the Relative Importance Index (RII) was determined according to equation (1).

Table 1: Survey response result with RII

| Factors                      | Mean  | Std. Deviation | RII   | Rank |
|------------------------------|-------|----------------|-------|------|
| Labour Supervision           | 4.340 | 0.878          | 0.868 | 1    |
| Skilled Labor                | 4.070 | 0.819          | 0.814 | 2    |
| Scheduling of Work           | 3.570 | 0.923          | 0.714 | 5    |
| Training of Labor            | 2.970 | 1.086          | 0.594 | 8    |
| Climatic Condition           | 3.310 | 1.001          | 0.662 | 6    |
| Unscheduled Extra Work       | 2.470 | 1.029          | 0.494 | 11   |
| Availability of Materials    | 3.850 | 0.857          | 0.770 | 3    |
| Availability of Equipment    | 3.730 | 0.897          | 0.746 | 4    |
| Numbers of Labor on Site     | 3.050 | 0.891          | 0.610 | 7    |
| Site Layout                  | 1.910 | 1.025          | 0.382 | 13   |
| Poor Communication           | 2.550 | 0.957          | 0.510 | 10   |
| Changes of Work              | 2.780 | 0.882          | 0.562 | 9    |
| Structural Design complexity | 2.200 | 1.100          | 0.434 | 12   |
| Construction method          | 1.890 | 0.983          | 0.378 | 14   |
| Safety conditions on site    | 3.310 | 0.872          | 0.662 | 6    |

#### 4.1 Labor Supervision

With an RII of 0.868, labor supervision was highlighted as the most critical factor influencing productivity. Inadequate supervision of labor's work may be responsible for defective work and inappropriate application of tools and equipment. Labors also played false in the absence of supervisors. Proper monitoring of labor works by supervisors will be improved productivity in the construction industry.

#### 4.2 Skilled Labor

The interviewed respondents identified that skilled labor has a high impact on productivity, it was ranked the second most diametrical factor with an RII 0.814. The project with skilled labor was delivered early in the time. The work with skilled labor can be done in the least time without compromising the quality of work. The consultancy firms, as well as Government, should be taken the necessary steps to make skilled labor.

#### 4.3 Availability of Materials

The availability of materials as a factor was ranked third in respect to its impact on construction productivity, with an RII of 0.77. This is not amazing, as materials are important for the construction process. The owners claimed that this is principally due to the contractor's liquidity problems to procure the materials. For improving better productivity, engineers suggested the clients make progress payments to the contractors.

#### **4.4 Availability of Equipment**

With an RII of 0.746, the availability of equipment was ranked fourth and is caused by inadequate management such as improper maintenance of equipment and use of old equipment. The improper maintenance schedule of equipment can find infrequent breakage. Rapid repair of faulty tools is also important to improve productivity. Construction productivity is disturbed if the equipment is not available on time at the construction sites, which causes long term effects on the cost and schedule performance of the projects. For improving productivity, the event of lack of equipment can be reduced by implementing preventive maintenance.

#### **4.5 Scheduling of work**

Scheduling of work was ranked fifth, as a critical factor influencing the construction productivity, with an RII of 0.714. Improper schedule reduced productivity due to let the work at the right time.

#### **4.6 Climatic Conditions & Safety Conditions**

With an RII of 0.662, Climatic conditions and Safety conditions onsite were ranked sixth jointly. For climatic conditions such as hot and cold weather, rain reduced construction productivity. Using personal protective equipment (PPE), workers can be moved easily in any place without any fear and increased productivity.

#### **4.7 Numbers of Labors on Site**

The number of labors on-site was ranked seventh as a factor influencing construction productivity, with an RII of 0.61. The contractor or owner should be supplied with the number of labors on construction sites according to the work amount to increase productivity.

#### **4.8 Training of Labor**

With an RII of 0.594, training of labor was ranked eighth from the fifteen factors. The consultancy firms, as well as Government, should arrange the training program for labors to improve the skills and performance. The trained labors have a high productivity rate to finish the project earlier without losing quality.

#### **4.9 Changes of Work**

Changes of work were ranked ninth as a factor affecting the construction productivity, with an RII of 0.562. The changes in work were needed more rework and more time & cost for construction. Before starting the work, the design should be checked and completed.

#### **4.10 Poor Communication**

With an RII of 0.51, poor communication ranked tenth as a critical factor, influencing construction productivity. This factor allows defective works to occur due to incompetent communication skills. To overcome this problem, respondents suggest that instead of informal verbal communication, documentation should be used.

### **5. CONCLUSIONS**

Construction productivity is one of the least practiced areas within the construction industry in Khulna. The key objective of this study, identification, and recognition of the factors affecting construction productivity in Khulna city is developed. For this study, fifteen factors were considered for the questionnaire survey and ranked these factors in a consistent way. Analysis of these factors showed that the top-five ranking factors affecting construction productivity are Labor Supervision, Skilled Labour, Availability of materials, Availability of Equipment and Scheduling of work. Labor supervision is a factor that highly affects the construction productivity and skilled labor, work can be done in less time without compromising the quality of work. The Availability of materials as a factor was ranked third with respect to its impact on construction productivity. The owners claimed that this is principally due to the contractor's liquidity problems to purchase the materials. Improvement of

construction productivity in Khulna should be now focused on these factors since this will not only make the construction firms profitable but also increase its chance of progress in the industry.

## 6. RECOMMENDATIONS

Based on the findings, the following are recommended to improve productivity:

- The skilled site staff and experienced builders should be deployed in order to improve the productivity of Khulna city.
- To increase the productivity of Khulna city, Training and safety improvement programs should be taken by the various stakeholders as well as Government.

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