

# Factors Affecting Productivity In Indian Construction Sector

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**Abstract :** *It is significant for the contractors, clients, and consultants to check the productivity levels for construction jobs, as this in turn, will help to estimate the time and cost of the construction projects. The productivity rates vary considerably based on the complexity of the structure, project site constraints, and other technical, managerial, social and cultural factors, etc. Predicting the effect of these factors will improve the ability of the stakeholders for optimum utilisation of resources. This research aims to estimate the most significant factors that affect the productivity of the main construction activities namely: excavation, formwork, reinforcement, concreting, block work, plastering and tiling. The research focuses on the construction industry in India. An extensive literature review was carried out on construction productivity which led to the identification of two factors affecting productivity: External (Environmental) and Internal (Organizational, Group, and Individual) factors. A questionnaire was used as a survey instrument to collect data. The study was conducted to establish the significant factors affecting productivity in Indian construction industry. The results revealed that the critical factors which affect productivity were timing, competency of supervisors, salaries, materials, systems and procedures, and group dynamics.*

**Keywords :** *Productivity; Environmental; Organizational; Group; Individual*

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## INTRODUCTION

The study was conducted to examine the significant factors affecting productivity in the construction industry. Productivity rates of various activities in the construction sector are necessary for a precise assessment of the time and cost of a job. A better productivity rate helps contractors to be more competent, improves project implementation, and also helps them to be more competitive during the bidding stage of the projects. Projects can be better monitored and controlled if the variability in productivity of construction trade is known, and actions are taken to improve the productivity. Doloi et al. (2012) have identified reduced labor productivity as the fundamental reason for delays in Indian construction projects. Despite the significance of productivity in the performance of construction projects, labor productivity is seldom considered at Indian construction sites; hence, losses in productivity

due to labor are never recognized. The current scenario of the Indian construction industry thereby warrants research in construction labor productivity, particularly in identifying opportunities for construction productivity improvement. The first step towards improving construction productivity is to determine the influencing factors (Mojahed and Aghazadeh, 2008; Rivas *et al.*, 2011). After identification of the productivity factors, executives can take action, to mitigate the problems arising due to these factors. The objective of the paper is to determine the factors affecting the productivity in the construction industry.

## RESEARCH PROBLEM

Identifying various factors contributing to productivity in the construction industry in India.

## RESEARCH OBJECTIVE

To determine the significant factors that affects the productivity in Indian construction industry.

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## SCOPE OF RESEARCH

The authors conducted an extensive literature review on construction productivity which led to the identification of two factors, that influence productivity and which were further divided into four broad factors: External (Environmental) and Internal (Organizational, Group, and Individual).

Based on the above four major factors, a survey instrument was developed to determine significant factors affecting productivity. The primary factors identified were regrouped as timings, competence of supervisors, salaries, materials, systems and procedures, and group dynamics.

## REVIEW OF LITERATURE

The construction sector is playing a significant role in the development of major economies. Productivity in construction related activities is therefore necessary. For the developed countries it is a matter of economic growth and social welfare and investigation of further improvements if possible, while for the developing countries, it is an issue of efficient utilization of resources.

According to Lowe (1987) "the importance of productivity growth to an individual enterprise, industry or an economy is something on which most economists would agree"; Chau and Walker (1988) stated, "improvement in productivity leads to economic growth."

Herbsman and Ellis (1990) explored the effects of construction project conditions on the variation of productivity rates and developed a statistical model. Nevertheless, the study was conducted based on past records from the site. They concentrated on the construction influence factors classified into technological and administrative factors. These were project based conditions. Effects of the company-wide environment were not considered.

In previous literature, the factors were quantified using three methods namely direct method, the indirect method by using other indicators (such as labor

turnover for measuring motivation), and quantification using non-parametric ranking. The non-parametric classification involved ranking the elements to a scale of 1 to 10, based on an individual's judgment, experience and knowledge. Also, the influence factors were based on interviews with various participants in the construction sector, established by a group of experts. Finally, a stepwise process was adopted where each of the factors were introduced in the model one at a time, and the model adequacy was established by the resultant R square – the coefficient of determination.

The study conducted by various researchers did not provide validation of regression models, and it was only recommended that the models could predict the productivity, for that activity in future projects.

Sanders and Thomas (1991) in their study of the factors affecting masonry labor productivity, recognized inadequacies in previous similar studies, to accurately determine the factors. The project related factors identified were 'work type, building elements, construction methods, and design requirements.

Proverbs *et al.* (1998) did a comparative assessment of reinforcement fixing productivity rates amongst the French, German, and UK construction contractors. The productivity rates specified by the respective planning engineers, formed the basis of the research. The planning engineers from each of the 31 contractors from the UK, 13 contractors from France, and 10 contractors from Germany were provided a set of project drawings and a survey instrument. The findings of the research work indicated significant differences between the productivity rates used by the three contractors using coefficients of variation and ranks.

Mohamed and Srinavin (2002) in their work on thermal environment effects on the construction employees productivity, argued that in addition to air temperature, relative humidity, and wind velocity, thermal environment factors, should be considered to

enhance the predictive power of forecasting the construction workers productivity. The study was devoted only to the thermal effects on productivity.

Kazaz and Ulubeyli (2006) explored the organizational factors influencing construction workforce productivity in Turkish Construction Industry. Data collection was done with the help of various survey instruments like questionnaire, face to face interview, email, and phone. Data analysis was conducted with the aid of statistical methods by using the Relative Importance Index. The study ends with a detailed discussion of all the factors affecting the productivity.

Aiyetan and Oltouah (2006) examined the impact of motivation on workers' productivity in the Nigerian Construction Industry. Data collection was done with the help of Questionnaires which addressed the relationship between motivation and performance. The research work was confined to the perception survey of the management staff and the labours. There research recommended the following key points-adjusted salary structure, increased welfare, growth in salary, promotion, overtime and holiday with pay which were the financial incentives that increased motivation and therefore the productivity.

An extensive review of the previous research work was accomplished, and a need was therefore felt for a study with the objective of improving the productivity, so that time and cost factors are better monitored and controlled in the project. In other words this meant ensuring that resources are optimally utilized in the project.

### CONCEPTUAL FRAMEWORK

Olomolaiye *et al.* (1998) identified the following factors affecting productivity- nature of the industry, management, climate, nature of the client, job security, workers characteristics, and technology. Herbsman and Ellis (1990) established that the factors affecting construction productivity are management, climate, design, specifications drawings, organization

influence, labor relations, wages, and location. In the study of Alinaitwe *et al.* (2007), the factors recognized were management, climate, skills and political insecurity which affect labor productivity. Enshassi (2007) found that the factors which influence productivity are management, worker characteristics, project factors, safety, material & tools, and motivation. Snow and Alexander (1992) in their research work concluded that the significant factors affecting productivity were- climate, skills, labor relations, materials & tools, communication, and absenteeism. Smithers and Walker (2000) identified the following factors- management, design, planning, and language as the most important factors affecting labor productivity.

From the study of various research work and theories, the authors have identified two broad categories of factors i.e. External and Internal which were further divided into four major factors i.e. Environmental, Organizational, Group, and Individual. These factors fall in line with Mullins (2007), who categorized the interrelated influences affecting the behavior of people into environmental, organizational, group and individual factors.

### RESEARCH METHODOLOGY

#### Sample

In this study, the target population was the employees of a case study company at Indore which consisted of Project Managers, Sr. Engineers, Foreman, and Labours. The participants selected in this study were based on Judgment Sampling. This sampling method was used to ensure that the respondents were the true representative of the population. The number of respondents was 62 out of which Project Managers were 7, Sr. Engineers were 15, Foremen were 17 and Labours were 23.

#### Tool For Data Collection

A 61 item questionnaire was developed with five / three-degree Likert scale type. The questions asked were related to the four-factor groups identified above

which represent:

- Environmental Factors
- Organizational Factors
- Group / Team Dynamics Factors
- Individual Factors

The questionnaire was further verbally rephrased in local language for labours and this helped in collecting the data easily. Following formulas were used to determine the importance index, frequency index, and severity index. (Kadir *et al.*, 2005)

$$\text{Importance Index} = \frac{5n_1 + 4n_2 + 3n_3 + 2n_4 + n_5}{5(n_1 + n_2 + n_3 + n_4 + n_5)}$$

$$\text{Frequency Index} = \frac{3m_1 + 2m_2 + m_3}{3(m_1 + m_2 + m_3)}$$

$$\text{Severity Index} = \text{Importance Index} \times \text{Frequency Index}$$

Where,

- n1 = number of responses for “Strongly not Important” degree of importance
- n2 = number of responses for “Not Important” degree of importance
- n3 = number of responses for “Neutral” degree of importance
- n4 = number of responses for “Important” degree of importance
- n5 = number of responses for “very Important” degree of importance, and n1, n2, n3, n4, and n5 each have a weight of 1, 2, 3, 4, and 5 respectively
- m1 = number of responses for “High” frequency of occurrence
- m2 = number of responses for “Medium” frequency of occurrence
- m3 = number of responses for “Low” frequency of occurrence, and
- m1, m2, m3 each have a weight of 3, 2 and 1 respectively.

## ANALYSIS AND RESULTS

The following is the summary of the results of the survey:

Total Questionnaires sent = 180

Medium = soft copy/field collection

Time taken to respond = 3 ½ weeks

Total Responses Received = 62

% Response = 34.4%

Table 1 gives the results of the survey. The factors have been sorted for ranks within the group for identifying the most significant of the group. As the rank scores differed within each group, it is hard to put a threshold value; so the first six within each cluster have been retained in the table.

The most significant factors affecting productivity listed above are related to the players involved – the supervisors and their leadership skills, the workmen themselves – their competency and attitude, work timings and whether salaries are paid on time and how transparent and accountable the management is. Other factors within the environmental group affecting productivity are related to whether the workmen are paid well, feel a sense of security, feel appreciated, and have effective appraisals.

Organizational factors include whether overtime is paid, whether materials are made available, known management policies, procedures, and method statements, set goals and targets, how competent the supervisors are and whether goals are set. Group factors include the team skills, target oriented work culture and nature of work. The personal factors further include know-how of work, overall appreciation of one's work, attitude, competency, previous experience and overall job satisfaction.

## LIMITATIONS OF THE STUDY

Construction sites are typically subjected to the following constraints related to data collection which were faced during the research work:

- Day to day and hour to hour frequency of work activities based on progress schedule and the priority tasks for the day.
- Less than accurate measurement of whether any delays occurred due to waiting for materials.

**Table 1: Significant Factors Affecting Productivity (First 6 within the Category)**

S No.	Factors Affecting Productivity	Importance Index	Frequency Index	Severity Index (Rank)
<b>ENVIRONMENTAL FACTORS</b>				
1	Proper work timing: Work-life balance	0.9047	0.7354	0.6654
2	Salary on time	0.8476	0.7513	0.6368
3	Reasonable well-paying job	0.8444	0.746	0.6299
4	Safe Secure job	0.8444	0.7354	0.621
5	A job where your experience is valued, and voice is heard	0.8349	0.7248	0.6052
6	Employee welfare oriented scheme health, recreation vacations	0.8349	0.7089	0.5919
<b>ORGANIZATIONAL FACTORS</b>				
1	Leadership skills of supervisor	0.8412	0.7566	0.6365
2	Accountability and transparency at each level of management	0.8539	0.7195	0.6144
3	Overtime Paid for work done beyond normal work hours	0.8349	0.7301	0.6096
4	Materials available on time	0.8574	0.7195	0.6167
5	Defined policies and procedures by management	0.8126	0.7513	0.6105
6	Competency of supervisors	0.8253	0.7407	0.6114
<b>GROUP FACTORS</b>				
1	Individual or Personal Skills	0.8031	0.7566	0.6076
2	Knowledge of Work	0.8253	0.7407	0.6114
3	Overall Work Group / Team Skills	0.8126	0.7354	0.5976
4	Self-Initiative and Competence	0.8063	0.7248	0.5844
5	Target oriented work culture	0.8476	0.6878	0.583
6	Nature of work given	0.7809	0.7195	0.5619
<b>PERSONAL FACTORS</b>				
1	Technical qualified / educated for the work	0.8412	0.7513	0.632
2	Overall appreciation of one's work	0.8253	0.7158	0.5908
3	Attitude of Fellow employees	0.8349	0.7248	0.6052
4	Overall competency of the operator	0.8253	0.7158	0.5908
5	Previous Experience	0.8063	0.7213	0.5816
6	Overall job satisfaction	0.8	0.7248	0.5798

Source: Compiled by authors

**Table 2: Significant Factors Affecting Productivity (Fifteen Factors with Highest Ranks)**

S. No.	Factors Affecting Productivity	Importance Index	Frequency Index	Rank
1	Proper Work Timings : work-life balance.	0.9047	0.7354	0.6654
2	Salary on time	0.8476	0.7513	0.6368

**Table 2: Significant Factors Affecting Productivity (Fifteen Factors with Highest Ranks) (Contd...)**

S. No.	Factors Affecting Productivity	Importance Index	Frequency Index	Rank
3	Leadership skills of supervisor	0.8412	0.7566	0.6365
4	Technical qualified /educated for the work	0.8412	0.7513	0.632
5	Reasonable well- paying job	0.8444	0.746	0.6299
6	Safe Secure job	0.8444	0.7354	0.621
7	Materials available on time	0.8574	0.7195	0.6167
8	Accountability and transparency at each level of management	0.8539	0.7195	0.6144
9	Competency of supervisors	0.8253	0.7407	0.6114
10	Knowledge of Work	0.8253	0.7407	0.6114
11	Defined policies and procedures by management	0.8126	0.7513	0.6105
12	Overtime paid for work done beyond normal work hours	0.8349	0.7301	0.6096
13	Individual or Personal skills	0.8031	0.7566	0.6076
14	A job where your experience is valued, and you are heard	0.8349	0.7248	0.6052
15	Attitude of fellow employee	0.8349	0.7248	0.6052

Source: Compiled by authors

- Variation of productivity levels from site to site, within the site and activity to activity.
- Companies' record regarding labor count was not maintained properly.
- Proper Work Timings: Work-life balance.
- Salary on time.
- Leadership skills of supervisor.
- Technical qualified /educated for the work.
- Reasonably well- paying job.
- Safe Secure job.
- Materials available on time.
- Accountability and transparency at each level of management.
- Competency of supervisors.
- Knowledge of Work.
- Defined policies and procedures by management.
- Overtime paid for work done beyond normal work hours
- Individual or Personal skills.
- A job where your voice is heard, and experience is valued.
- Attitude of fellow employees.

#### **DIRECTIONS FOR THE FUTURE RESEARCH**

The most significant factors affecting productivity were identified from the study. However, the magnitude of the effect of these factors on construction productivity is left unexplored. Such importance of the factors can be determined through a perceptual survey, and then the data may be analyzed using statistical test of significance i.e. Chi Square test. Further, Productivity Evaluation model may be developed using regression analysis which could explain the changes in productivity, when the level of factors was varied.

#### **CONCLUSION**

Labour Productivity in the construction industry is critical for an accurate estimation of the time and cost of a job. Therefore, the authors have recognized the following 15 most significant factors affecting labor productivity-

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