

Analyzing the Various Factors that Affect the Labour Productivity in Construction Industries and Recommending Remedial Measures

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Abstract— Productivity plays a major role in the construction industry in which labour power is the only productive resource and the industry is mainly dependent upon human effort and performance. The resource inputs such as men, material, machinery, money and time produce outputs in the form of work. The success of any project depends upon the performance and availability of these resources and improves higher cost savings with minimal investment. In developing countries like India, proper labour management for productivity is one of the key factor to achieve higher efficiency in development process. Respondents were required for rating the factors that affect labour productivity with respect to importance and severity of the problems. In this research, control process involves accounting the actual productivity of labours and includes comparison and analysis of the causes to find measures to improve productivity.

Keywords--Analysis, Construction industry, Data collection, Factors, Labour Productivity.

I. INTRODUCTION

Several labour productivity related studies were performed from past and most of them were related to the factors affecting productivity. Measureable calculations about the effects of those productivity factors are required for several purposes such as planning, scheduling and estimation of the construction project. From the past studies it has been shown that it is difficult to calculate such an impact, and at present there are no universally accepted standards to measure loss in factors affecting labour productivity. This lack of methods for measuring these effects emphasize the need to enhance measureable assessments for the factors affecting labour productivity in construction industries and is supposed to be the topic of this research.

Achieving better labour productivity requires detailed study of the actual labour cost as well as nature and type of labour. Different labours have different variables which can considerably affect their productivity levels. For every project, productivity, cost, quality, and time are the main factors of concern. Better productivity can be achieved if project management includes the skills of educating and training the labourers on various factors including the work method, personal health, motivational factors, type of tools, materials and machines required, personal skills, workload

to be executed, expected work quality, the type of work to be done etc.

In these days, one of the biggest concerns for any organization is to improve their productivity, which points at the most effective and efficient conversion of resources into marketable products of desired or acceptable quality. Considerable efforts have been taken by various researchers to understand and describe the concept of productivity with different approaches, which have resulted in a wide variety of productivity definitions.

Productivity can be simply defined as the output produced by a unit resource of input. More precisely it can be put into an equation form as follows:

$$\text{Productivity} = \text{Output/Input}$$

Productivity is the main determinant of living standards as it quantifies how an economy uses the available resources, by relating the quantity of inputs to output. Construction industry has several external and internal factors which are never constant and are difficult to anticipate. These factors are responsible for a continuous variation in labour productivity. There lies the importance of monitoring and quantifying the effects of these factors, by which we can analyze how far the productivity is affected and suggest methods to improve productivity.

II. RESEARCH OBJECTIVES

The objectives of this study are stated below:

- To identify the factors which affect the variation of labour productivity in the construction projects.
- To evaluate the impact of influenced factors on the variation of labour productivity.
- To suggest recommendations to improve labour productivity in construction projects.

III. LITERATURE REVIEW

Adnan Enshassi et al (2007) in their research aimed to identify factors affecting labour productivity within building projects, and to rank these factors according to their relative importance from a contractor's viewpoint. The main factors negatively affecting labour productivity are: material shortage, lack of labour experience, lack of labour surveillance, misunderstandings between labour and superintendent, and drawings and specification alteration during execution.

A. Soekiman et al (2011) found that performance of labour is affected by many factors and is linked to the performance of time, cost, and quality. The aim to get the latest information on key factors that affect project performance in terms of project completion time, and this is part of major research to model the interaction relationships between key factors affecting productivity.

Mistry Soham and Bhatt Rajiv (2013) in their study has explained about the productivity and about its improvements, through which higher cost savings with minimal investment can be achieved. The main objective of this study is to identify the main factors associated with loss of productivity in construction projects.

Shashank K. et al (2014) stated that productivity in construction is often broadly defined as output per labour hour. Since labour constitutes a large part of the construction cost and the quantity of labour hours in performing a task in construction is more susceptible to the influence of management than are materials or capital, this productivity measure is often referred to as labour productivity. However, it is important to note that labour productivity is a measure of the overall effectiveness of an operating system in utilizing labour, equipment and capital to convert labour efforts into useful output, and is not a measure of the capabilities of labour alone.

Sunil V. Desale and Sharad V. Deodhar (2013) in their paper elaborates productivity as the ratio of output to input, but it conveys different meaning to different people as productivity and production capability. In the narrow sense of controlling project resources, the productivity concept is used to measure the performance of the resource. The actual quantity of units produced by a team of people compared to the standard amount of time needed to produce those units is generally accepted as the measurement of a factory's productivity.

Thomas (1991) concluded that it is necessary to make sure that a reduction in productivity does not adversely affect the plan and schedule of the work and does not cause delays in completing the project as it could result in serious money losses. Considerable cost can be saved if productivity is improved because the same work can be done with less manpower, thus reducing overall labour cost.

IV. RESEARCH METHODOLOGY

The methodology of the study is described and explained based on the objectives and the aims of the study. In this study the focus is on collecting data from the project construction site.

The research through literature reviews and discussion with some parties involved in the Construction industry identified a total of nine major causes which are mainly effecting in the productivity of construction projects. The methodology adopted in this research is outlined in figure 1.

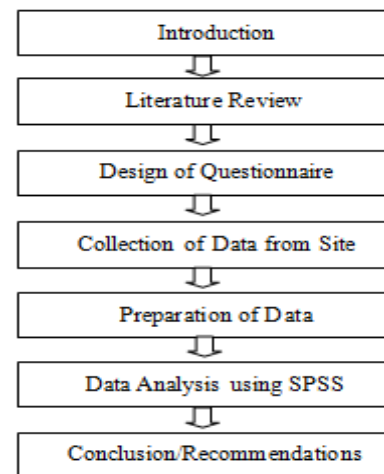


Fig. 1 Methodology showing research structure

A. Data Collection

Data which is obtained from the questionnaire survey will be used to analyze with an appropriate method which may result to the success of the study.

B. Detail Design

A data was designed based on the objectives of the study, to identify the various factors that affects labour productivity in construction industries and methods to rectify the same. For that, a questionnaire survey was administered to get the opinion and understanding from the experienced respondents. The details are all classified into 2 sections:

1) Section A: Company Profile

In this section the respondents' information was obtained. The questionnaire includes:

- The organization name and year of establishment.
- Name of the respondent.
- The position of the respondent in the company.

- The experience of the respondent in construction of projects.

- Number of permanent employees.

- Number of executed projects during last five years.

2) Section B: Factors affecting labour productivity in construction industries

This section is designed to evaluate the factors that contributes to the variation in labour productivity in construction from the previous literature reviews. There are total of nine groups of factors that cause labour productivity variation in construction of project and they are:

- Technical factors.
- Human/ Labour factors.
- Management factors.
- Material management factors.
- Time management factors.
- Project issues.
- Safety issues.
- Quality issues
- External factors

C. Process

This study includes three major steps. The first step involves data collection which were collected from various sites in Kerala and Tamil Nadu. The second step involves the data analysis using Statistical Package for the Social Sciences(SPSS) software. The third step is conclusion of the project with recommendations.

D. Data Analysis Approaches

SPSS software is used to determine the statistical comparison of the various causes and their effects. Mean comparison for each factor is done and rankings are made to compare the importance of the factors relatively as perceived by the three groups of respondents (i.e. contractors, clients and consultants).

In this technique, for each factor the degree of severity were categorized on a five-point scale and are classified as:

affects with little, something, average, large and very large degree.

V. RESULT AND DATA ANALYSIS

In this chapter presents the data analysis and discussions. The collected data were analyzed using the method as mentioned above.

The questions in the questionnaire survey were framed based on the various factors which affects the labour productivity. The data collected from all the 43 questionnaires in Kerala and Tamil Nadu were fed into the SPSS software and their respective mean and rank were obtained.

A. Technical group

By proper technical planning, changes occur in the way productive factors are organized and thereby increasing the efficiency of construction projects. Table I shows 9 factors affecting labour productivity in technical group and the results obtained from SPSS analysis.

TABLE I. FACTORS AFFECTING LABOUR PRODUCTIVITY IN TECHNICAL GROUP

No.	Factors affecting labour productivity	Mean	Rank
1	Clarity of technical specification	4.0714	1
2	The extent of variation/change order during execution	3.3571	6
3	Coordination level among design disciplines	4.0000	2
4	Design complexity level	3.6071	5
5	Rework	3.9643	3
6	Site Layout	3.1429	8
7	Drawings and specifications alteration during execution	3.3214	7
8	Site restricted access	2.4286	9
9	Accuracy of the Estimate	3.6786	4

B. Human/ Labour group

There are many factors that affect the productivity of labour since most of the construction work is still on manual basis. Therefore identifying the major factors to ensure the betterment of productivity of labour with appropriate measures is needed. Table II shows the results obtained from SPSS analysis which shows 15 factors affecting labour productivity in human/ labour group.

TABLE II. FACTORS AFFECTING LABOUR PRODUCTIVITY IN HUMAN/ LABOUR GROUP

No.	Factors affecting labour productivity	Mean	Rank
1	Motivation of labour	3.5000	13
2	Increase of labourer age	3.6786	9
3	Skill of labour	4.0000	2
4	Physical fatigue	3.8214	6
5	Shortage of experienced labour	4.1786	1
6	Labour personal problems	3.1786	15
7	Labour dissatisfaction	3.7857	8
8	Labour disloyalty	3.8214	7
9	Misunderstanding among labour	3.6786	10
10	Lack of competition	3.6429	11
11	Reassignment of staff/ crew	3.5357	12
12	Labour working for more than 10 years	4.0000	3
13	Government regulation	3.3929	14
14	Basic wages	3.8929	5
15	Inspection delay	3.9643	4

C. Management group

The optimum utilization of technical and human resources can be secured by the proper management. Efficient management results in the improved performance of the employees and thereby attaining high productivity. 21 different factors affecting labour productivity in

management group and its results obtained are given in Table III.

TABLE III. FACTORS AFFECTING LABOUR PRODUCTIVITY IN MANAGEMENT GROUP

No.	Factors affecting labour productivity	Mean	Rank
1	Construction managers lack of leadership	3.9643	2
2	Lack of labour supervision	4.2143	1
3	Working overtime	3.7500	4
4	Crew size and composition	3.1071	11
5	Unsuitability of storage location	3.0714	12
6	Use of performance based pay	2.0714	21
7	Supervisors trained in employee relation	3.2500	9
8	Training scheme in place	3.0714	13
9	Accidents as a result of poor site safety program	3.8929	3
10	Regular meet with senior management	2.4286	16
11	Dismissals	2.3214	19
12	Negotiation mentality of employer in the case of strikes	2.1071	20
13	Holidays	2.7500	14
14	Time for relaxing	2.4286	17
15	Rest rooms for labours	2.5000	15
16	Misunderstanding between labour and superintendents	2.4286	18
17	Lack of labour surveillance	3.6429	5
18	Lack of periodic meeting with labour	3.3571	8

19	Timeliness of decision by management in labour issues	3.1786	10
20	Proportion of work subcontracted	3.5714	6
21	Unrealistic scheduling & expectation of labour performance	3.4643	7

D. Material management group

Productivity is greatly affected if required materials, construction equipments, or tools are not available. In order to increase productivity, it is necessary to select equipment with proper size and characteristics most suitable for the job conditions. The 5 various affecting factors in this group and their means and corresponding rankings from the analysis is given in Table IV.

TABLE IV. FACTORS AFFECTING LABOUR PRODUCTIVITY IN MATERIAL MANAGEMENT GROUP

No.	Factors affecting labour productivity	Mean	Rank
1	Shortage of materials	3.7143	2
2	Shortage of tools and equipments	3.6786	3
3	Unsuitability of materials storage location	3.0357	5
4	Construction methods	3.1071	4
5	Payment delay	4.0000	1

E. Time management group

Time affects productivity in various ways. Overtime working may increase productivity in the initial stages but later it decreases due to fatigue, poor workmanship, reduced effective supervision, and also lead to increased costs. On productive activities time used by a labourer is about 30% of the total working time. Table V shows the 4 different factors affecting time management in labour productivity and the results obtained from the analysis.

TABLE V. FACTORS AFFECTING LABOUR PRODUCTIVITY IN TIME MANAGEMENT GROUP

No.	Factors affecting labour productivity	Mean	Rank
1	Work overtime	3.1071	3
2	Working for 7 days of week without holiday	3.8214	1
3	Increasing No. of labours in order to accelerate work	3.0000	4
4	Misuse of time schedule	3.6071	2

F. Project issues group

Improper scheduling of work, methods of construction and other related project issues also affects the productivity to an extent. Table VI shows the 4 factors in the group related to the project issues and these were ranked according to their importance as given below

TABLE VI. FACTORS AFFECTING LABOUR PRODUCTIVITY IN PROJECT ISSUES GROUP

No.	Factors affecting labour productivity	Mean	Rank
1	Type of activities in the project	2.3214	3
2	Construction method	2.7143	1
3	Interference	2.5357	2
4	Working in confined space	2.2857	4

G. Safety issues group

There is a high impact for accidents on labour productivity and hence employing a safety officer is essential for labours to follow the required safety regulations to reduce the number of accidents, thus increasing productivity. Table VII given below shows the 5 various factors affecting labour productivity related to safety issues group and the results obtained from the analysis.

TABLE VII. FACTORS AFFECTING LABOUR PRODUCTIVITY IN SAFETY ISSUES GROUP

No.	Factors affecting labour productivity	Mean	Rank
1	Violation of safety precautions	3.7500	1
2	Working at high place	3.6786	2
3	Bad ventilation	2.8214	4
4	Insufficient Lighting	3.2500	3
5	Noise	2.5000	5

H. Quality issues group

Equipment inefficiency and low quality material used for the work lead to unsatisfactory work and thus reduces productivity. High quality of work cannot be achieved with the poor materials and equipments as it causes breakdowns and leads to longer completion time thereby decreasing productivity. Table VIII shows the 3 various factors affecting labour productivity in quality issues group and the mean and rankings were obtained from SPSS analysis.

TABLE VIII. FACTORS AFFECTING LABOUR PRODUCTIVITY IN QUALITY ISSUES GROUP

No.	Factors affecting labour productivity	Mean	Rank
1	Low quality of raw materials	3.2143	2
2	High quality of required work	2.7500	3
3	Inefficiency of equipments	3.6786	1

I. External factors group

Optimum weather condition is necessary for the proper completion of any construction project. table given below shows the various factors affecting labour productivity in external factors group and the results obtained from SPSS analysis. Table 9 shows the 4 different factors which affects labour productivity in external factor group and the results obtained from the analysis are given below.

TABLE IX. FACTORS AFFECTING LABOUR PRODUCTIVITY IN EXTERNAL FACTORS GROUP

No.	Factors affecting labour productivity	Mean	Rank
1	High/low temperature	2.5357	4
2	High humidity	2.6071	3
3	High wind	2.7500	2
4	Rain	2.8571	1

V. CONCLUSION WITH RECOMMENDATIONS

From the present study, a total of 70 factors which affects labour productivity were identified. Contractors should focus on these factors to improve labour productivity, which ultimately leads to higher profits from the construction projects.

Construction tasks are often expensive and arguments and claims are frequent, which generally affect progress of projects. The environment of a construction firm should be made suitable to implement projects with successful completion. In any industry, it is necessary to find the factors which hinder the smooth completion of a particular task in order to solve and overcome them. Mentioned below are the recommendations, made based on the study, which were found to be important factors of consideration for improving labour productivity in construction industry.

1) A detail note on material supply schedule for each project should be provided by the concerned contractors. It should contain the time required to supply construction materials and the availability of the local market to obtain the required materials on construction site without any delay. Extra attention should be provided to ensure the quality of construction materials and tools used in the projects because using materials and tools of required standards reduces both the time taken to finish the work and wastage of materials, thereby achieving better productivity.

2) Construction materials purchased should be stored at appropriate location so that it is easy to access and close to construction site to avoid wastage of labour and time for multiple-handling materials.

3) It should be made sure that there is enough lighting present at the construction sites, which can also help to reduce the number of accidents. Frequent safety training and meetings should be arranged among labourers to achieve better performance and productivity.

4) To avoid delays in completion of work, time required for implementing change orders and to make corrections in drawings as well as specifications should be estimated and scheduled so that it does not affect the time required for project completion. Moreover, regular

meetings should be arranged with the project authorities and reports should be submitted from time to time.

5) Possible external and natural risk factors should be considered in the budget estimation to reduce delays due to closures, material shortages etc. Provision for suitable emergency budget should be made to cover cost of increased material requirement.

6) Designs and drawings should be checked for simplicity and completeness and care should be taken to avoid confusion among the various construction agencies involved in a single project.

7) Change orders and design changes should be avoided wherever possible. These factors can demand for more cost and time if the work has already been done. Further work schedules can also be affected by rework.

8) Absenteeism at work site can be reduced by including appropriate paid time off and vacations to all employees and thus, unexpected shortage of labourer can be avoided.

Construction industry is rated as one of the key industries in the ever-growing world. Study and knowledge of productivity are very important because low productivity cause losses to the governing agencies and also influence the economy of the construction industry, which can finally affect the economy of the country. Prior knowledge of labour productivity can save money and time during construction. Investments made for construction projects are very high and because of the high complexity in construction, various factors can highly affect overall productivity which leads to the requirement of more time and money for a project to be completed. This research is intended to identify the probable factors affecting labour productivity in building construction.

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