



# CRITICAL STUDY ANALYSIS AND SUGGESTION FOR LABOR IMPROVEMENT IN CONSTRUCTION INDUSTRY

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**Abstract:** A key factor in the building sector is productivity. It supports value propositions, target achievement, competitiveness, stakeholder satisfaction, and stakeholder satisfaction in the construction industry. Pre-existing research studies have suggested different methods for measuring labor productivity at different levels, but none of them has been proven universally satisfying. It is very important to measure Labor Productivity qualitatively and quantitatively, as it affects the overall productivity of a construction project. As a Construction project undergoes several problems and complex factors, such as cost and time. This research reflects the Critical study analysis on factors affecting labor productivity using a Preliminary Questionnaire Survey and the impact of each factor influencing the project was generated through the Relative Important Index. In addition to that, one Industrial Building is taken for a case study, and all the data of that Building is analyzed using MSP Software. After analyzing 15 various factors, Suggestions and recommendations were provided to improve labor Productivity. This research helps the project managers to consider the Labor affecting factors during the planning phase of the project and in the execution stage to measure productivity.

**Index Term - Labor Productivity, Construction Industry, Relative Important Index, Microsoft Project Management.**

## I. INTRODUCTION

The construction Industry is the world's largest industry. After agriculture, the 2nd largest employment is provided by the construction industry. The construction industry mainly depends on 3M Resources. 3M resources include Manpower, Machine, and Materials. These are the basic needs of the industry. The most important and precious resource in the construction industry is Manpower. If we consider only Manpower as an input in the construction productivity, then it will be called Construction Labor Productivity.

This is the most used topic for research because 30 to 50% of the total cost of the project is Labor cost. Labor Productivity is an important parameter that provides feedback to determine trends and the improvement level of the Construction Industry. In this industry, the main problem is the uneducated and unskilled labor. Because of them, we have to face productivity loss, which directly affects the cost and time overrun of the project and affects the quality of the work. As a Construction project undergoes several problems and complex factors such as cost and time, an effective framework has to be designed so that the overall productivity of the project is improved. To improve productivity, laborers should be familiar with the machinery, materials, and tools they use.

### 1.1 Significance of Labor Productivity

The construction industry depends on various internal and external factors that affect the overall cost and time of the project. Thus, productivity has to be evenly poised to save money and time for the project. This can be achieved by continuously working on planning, scheduling, and monitoring the project. In addition, major affecting factors of the productivity have to be considered at the project initiation stage to get the expected response of project planning and monitoring for the execution. These factors lead to continuous Changes in productivity. It is very important to ensure that a decrease in productivity does not affect the plan as well as the schedule of the project.

The term "Productivity" in construction is defined as the ratio of output and input. Output is the product that we construct any type of structure, and input is the resources that we used for construction, i.e., workers, material, or any type of machine we can use for construction.

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$$\text{Productivity} = \text{Output} / \text{Labor Cost}$$

## II. NEED OF THE STUDY.

In any industry, productivity loss is one of the serious and greatest problems. Different project costs, for example, labor, materials, and equipment, are considered more risky in terms of labor components. Whereas other equipment and materials are controlled by market cost and are beyond the control of project management. About 30% 50% cost of the entire project is considered as Labor cost. Because they are more unpredictable than other project cost components, it is very important to study the effect of various factors on the L.P. labor Productivity is directly proportional to the labor cost.

Previous research indicates that Productivity decreases result from various factors which is beyond bad weather conditions, changes in Drawings, and poor management. Due to above above-listed factors, disturbance is produced which affects labor productivity, and it is not in the hands of the contractor to produce productivity loss.

## III. GENERAL SCENARIO OF THE INDIAN CONSTRUCTION INDUSTRY

The construction industry is the second largest employer after the agriculture sector, employing more than 35 million people. It is categorized as follows.

The Indian construction industry is an important sector of the national economy, contributing a major part of the Gross Domestic Product (GDP). The share of the construction sector as part of Indian GDP has reached up to 9% in the financial year 2017-2018. The Indian construction industry is expected to register a growth of 13% in the real term in 2021 following a decline of 12.4% in 2020. It is expected to be 1 trillion US\$, by the year 2030 India would be the third-largest construction market globally, as India's urban GDP is expected to reach 7.5 trillion US\$.

As per CEIC, labor productivity growth data is updated yearly from December 1992 to December 2019, averaging at 5.23%. In December 2019 labor productivity dropped by 2.63%. It is high in December 2010 the value is 7.89% and low in December 2002 value is 1.29%. They calculate labor Productivity from GDP per person employed

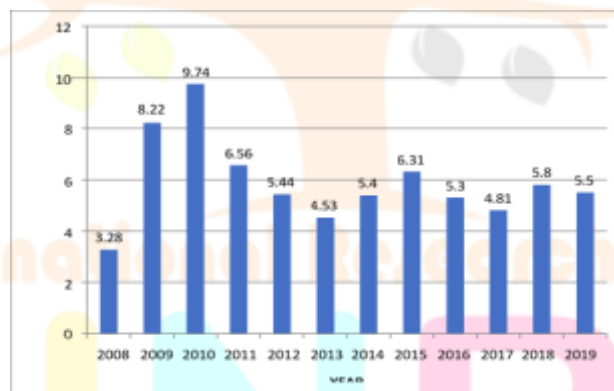


Fig 2 India's labor productivity growth from 2008 to 2019

## IV. RESEARCH METHODOLOGY

To achieve the objectives of this study, a systematic approach will be adopted, incorporating both qualitative and quantitative research methods. The steps followed in the methodology are as outlined below:

### 1. Collection of Preliminary Information through Literature Survey

A comprehensive literature review will be conducted to gather background information on labor issues in the construction industry. This will include reviewing previous studies, academic journals, government reports, industry publications, and international case studies. The purpose of this review is to understand the existing knowledge base, key productivity factors, labor management practices, and challenges in the construction sector.

### 2. Assessing the Current Situation of Construction Labor through Questionnaire Survey

A structured questionnaire will be designed to collect primary data from construction workers, site supervisors, contractors, and project managers in the Sangli and Kolhapur regions. The questionnaire will cover aspects such as working conditions, wage structure, skill levels, availability of safety measures, training, motivation, and job satisfaction. Both closed-ended and open-ended questions will be included to ensure in-depth responses.

### 3. Identification of Factors Affecting Labor Productivity

Based on the responses received and supporting literature, critical factors impacting labor productivity will be identified. These may include physical working conditions, workforce skill level, labor management practices, material delays, equipment availability, motivation, and wage issues.

#### 4. Problem Definition

The data collected will be analyzed to define the key problem areas that most adversely affect labor productivity. This step involves prioritizing the issues based on their frequency and severity as observed from the survey data.

#### 5. Analysis of Questionnaire Survey

Quantitative and qualitative analysis methods will be applied to interpret the survey results. Statistical tools such as percentage analysis, mean score ranking, and graphical representation will be used to analyze responses. This step will help in deriving meaningful insights and identifying productivity trends specific to the study area.

#### 6. Recommendation and Suggestion

Based on the findings of the analysis, practical and actionable recommendations will be proposed to improve labor conditions and productivity in the construction industry of Sangli and Kolhapur. Suggestions may include policy changes, training programs, improvements in safety and welfare measures, better management practices, and the use of modern tools and technologies..

### V. RESULTS AND DISCUSSION

The total 64 responses are classified into 4 building types, see table. () These responses from industry experts were further used for analysis using the RII method. But we calculated the RII only for 3 groups which are 1. Industrial, 2. Commercial, and 3. Residential because as mentioned in the objective we have to study multi-storeyed buildings and Industrial buildings. In other buildings, it includes roads, bridges, irrigation, etc.

Table 1 No. of Respondents for Building/Infrastructures

Sr. No.	Building/Infrastructures Type	No. of Respondents
1	Industrial	14
2	Commercial	19
3	Residential	31
	Total	64

#### 5.1 Factors Affecting Labor Productivity for Residential Building

Table 1 Rank wise Factors Affecting Labor productivity for Residential Building

Sr. No.	Factors	RII	Rank
1	Improper Construction Method	90.21	1
2	Misunderstanding Between Owner and Contractors	90.21	1
3	Unclear Instructions	89.13	2
4	Poor Management	88.04	3
5	Lack of Skills (Unskilled Labor)	85.86	4
6	Accidents During Constructions	83.69	5
7	Variations In Drawing	83.69	5
8	Shortage of Water & Power Supply	82.60	6
9	Material Storage Locations	82.60	6
10	Lack of Construction Materials	79.34	7
11	Health And Safety	78.26	8
12	Violations of Safety Law	76.08	9
13	Weather Conditions	73.91	10
14	Poor Access Within Construction Site	70.65	11
15	Working Overtime	69.56	12

It is seen that when surveyed the residential building site, the building sites are smaller as compared to Commercial Buildings, and Industrial Buildings. Therefore, the factors that affect the productivity of labor are different than the big site factors. The topmost factors are improper construction methods, Misunderstanding between Owner and Contractors, Unclear Instructions, poor management, lack of skills, Accidents during Construction, variation in drawing, shortage of water and power supply, and material storage location. All the factors have the RII above the 80.00%.

#### 5.2 Factors Affecting Labor Productivity for Commercial Building

Table 2 Factors Affecting Labor Productivity for Commercial Building

Sr. No.	Factors	RII	Rank
1	Poor Management	100	1
2	Violations of Safety Law	91.67	2
3	Variations In Drawing	83.33	3
4	Misunderstanding Between Owner and Contractors	83.33	3
5	Health And Safety	83.33	3
6	Lack of Skills (Unskilled Labor)	79.16	4
7	Improper Construction Method	79.16	4
8	Lack of Construction Materials	75	5
9	Poor Access Within Construction Site	70.83	6
10	Accidents During Constructions	70.83	6
11	Material Storage Locations	66.67	7

12	Unclear Instructions	62.5	8
13	Shortage of Water & Power Supply	58.33	9
14	Working Overtime	54.16	10
15	Weather Conditions	54.16	10

It is seen that when surveyed the Commercial building site, the building sites are bigger as compared to the Residential site. Therefore, the factors that affect the productivity of labor are different than the small site factors. The topmost factors are poor management, violation of safety law, variation in Drawing, Misunderstanding between Owner and Contractors, and health and safety. All the factors have the RII above the 80.00%. As the sites and projects are bigger required labors are more in numbers, therefore we have to look for their health, safety, proper management of all the activities for better productivity of the labor.

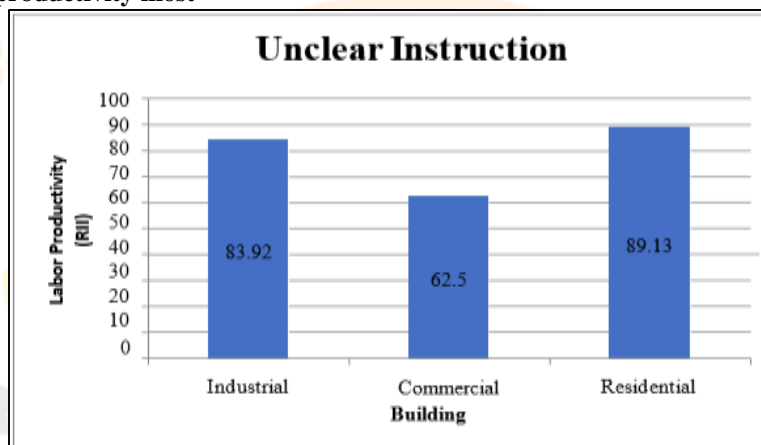
### 5.3 Factors Affecting Labor Productivity For Industrial Building

Table 3 Factors Affecting Labor Productivity For Industrial Building

Sr. No.	Factors	RII	Rank
1	Poor Management	89.28	1
2	Unclear Instructions	83.92	2
3	Improper Construction Method	83.92	2
4	Misunderstanding between owner and contractors	83.92	2
5	Variations in Drawing	82.14	3
6	Lack of Skills (Unskilled labor)	80.35	4
7	Accidents during constructions	80.35	4
8	Violations of safety law	80.35	4
9	Lack of Construction Materials	78.57	5
10	Shortage of water or power supply	76.78	6
11	Health and Safety	76.78	6
12	Material storage locations	73.21	7
13	Weather conditions	67.85	8
14	Working overtime	64.28	9
15	Poor Access within construction site	57.14	10

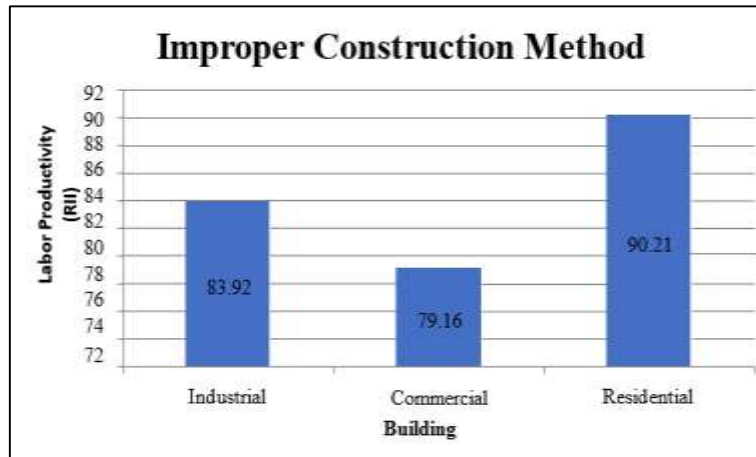
It is seen that when surveyed the Industrial building site, the building sites are bigger as compared to the Residential site also commercial building site. Therefore, the factors that affect the productivity of labor are different than the small site factors. The topmost factors are poor management, Unclear Instruction, Improper construction method, Misunderstanding Between Owner and Contractors, variation in Drawing, Unskilled labor, Accidents during construction, and violation of safety law. All the factors have the RII above the 80.00%. As the sites and projects are bigger required laborers are more in numbers and skilled labor is required.

### 5.4 Factors that affect the productivity most



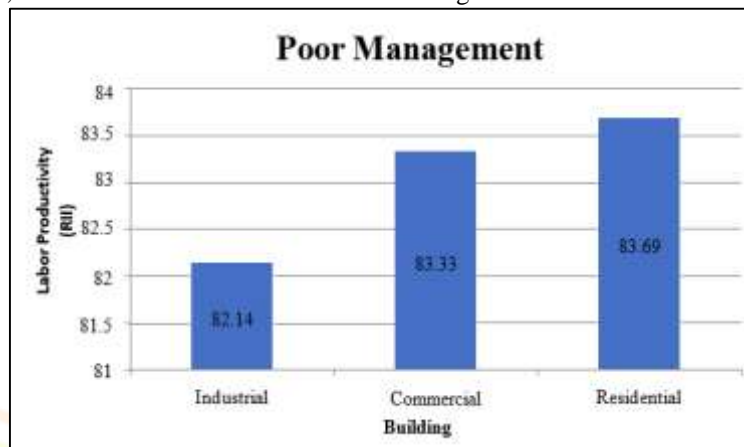
Graph 1 - Unclear Instruction

The above graph shows the RII for factor unclear Instruction. Industrial and residential buildings have respectively 83.92 and 89.13 RII which is a very high effect, and commercial buildings have RII 62.5 high effect.



Graph 2 – Improper Construction Method

For the Residential Building, the most affected factor is improper construction method with RII 90.21 which is very high, RII of an industrial building is 83.92, and commercial have 79.16 which is a high effect.



Graph 3 - Poor Management

The RII of factor poor management for all the types of the building is under the very high effect. The RII of industrial, commercial, and Residential buildings is respectively 82.14, 83.33, and 83.69.

### 5.5 Analysis Using Microsoft Project

#### 5.5.1 Details of the work

- Project: Expansion Work “Deccan Electro Works Pvt. Ltd. Plot No. 76, Vita
- Consultant: Mr Y. S. Shelke, Architect and Engineer, A/p – Islampur Tal- Walwa Dist- Sangli.

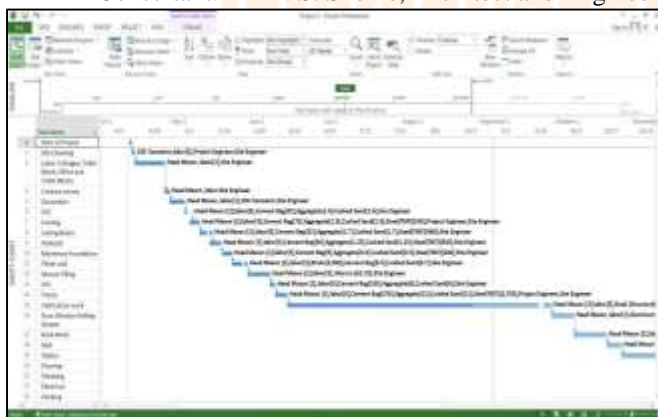


Fig 1 The Gantt chart of the Project- Graphical

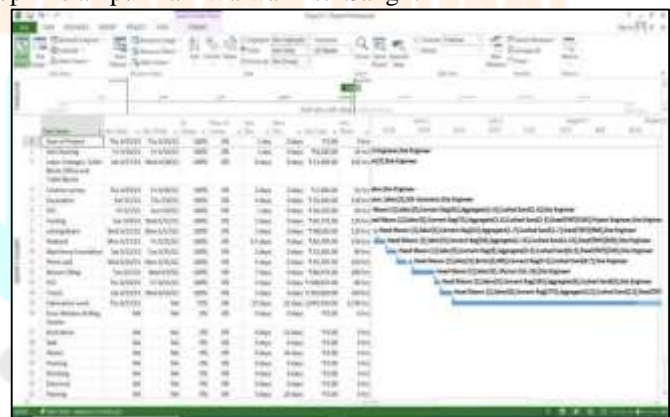
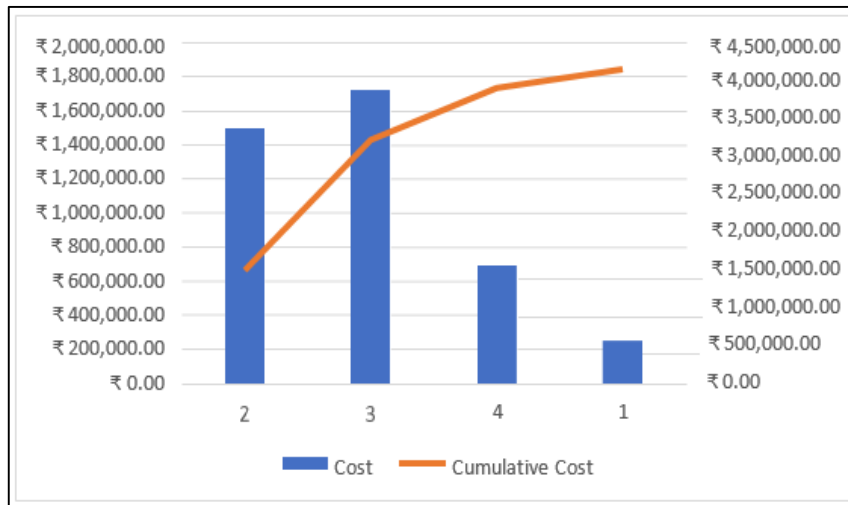


Fig 2 The Gantt chart of the Project- Activities

### 5.5.2 Cash Flow Report of Project

- Actual Cost – 3,057,987.50
- Remaining Cost - 1,095,872.00
- Cost Variance - 4,153,859.50



Graph 4 Cash flow of Project

### 5.5.3 Earned Value over Time

Earned value management helps you quantify the performance of a project. It compares costs and schedules to a baseline to determine if the project is on track. The project’s earned value based on the status date. If actual cost (ACWP) is higher than earned value (BCWP), then the project is over budget. If planned value (BCWS) is higher than earned value, then the project is behind schedule.



Graph 5 Earned Value over Time

## VI. CONCLUSION

This research is to find out the cause of probable factors affecting labor productivity in construction Industry in Kolhapur and Sangli region. The research results are meant to analysis and the ranking of various selected factors in above methodology chapter, is calculated using RII.

In this chapter most affected factors whose RII is above 80% is mentioned below as their intensity of affecting is very high. The research concluded that among several factors that affect productivity in different construction sites are as follow

### Residential Building

The following factors affect most residential buildings because their range of RII is very high, it is between 80 to 100.

- Improper Construction method (90.21)
- Misunderstanding between owner and contractor (90.21)
- Unclear Instructions (89.13)
- Poor Management (88.04)
- Lack of Skills (Unskilled Labor) (85.86)
- Accidents During Constructions (83.69)
- Variations In Drawing (83.69)
- Shortage of Water & Power Supply (82.60)
- Material Storage Locations (82.60)

### Commercial Building

The following factors affect most Commercial buildings because their range of RII is very high, it is between 80 to 100.

- Poor Management (100)
- Violation of safety law (91.67)
- Variation in Drawing (83.33)
- Misunderstanding between owner and contractor (83.33)
- Health and safety (83.33)

### **Industrial Building**

The following factors affect most Industrial buildings because their range of RII is very high, it is between 80 to 100.

- Poor Management (89.28)
- Unclear Instructions (83.92)
- Improper Construction Method (83.92)
- Misunderstanding between owner and contractor (83.92)
- Variation in Drawing (82.14)
- Lack of skills (unskilled labor) (80.35)
- Accidents during Construction (80.35)
- Violation of safety law (80.35)

## **VII. ACKNOWLEDGMENT**

I would like to express my heartfelt gratitude to Prof. Adnya S. Manjarekar, Assistant Professor, Department of Civil Engineering, Sanjay Ghodawat University, for his invaluable guidance, encouragement, and continuous support throughout the course of this project. His insights and expertise greatly contributed to the successful completion of this work. I am also thankful to the Department of Civil Engineering, Sanjay Ghodawat University, Kolhapur, for providing the necessary resources and support.

## **REFERENCES**

- [1] Ameh Oko John, Osegbo Emeka Emmanuel, (2011) "Study of Relationship Between Time Overrun and Productivity on Construction Sites" International Journal of Construction Supply Chain Management Volume 1
- [2] Gupta Vaishant, R. Kansal (Oct 2014) "Improvement of Construction Labor Productivity in Chambal Region" International Journal of Research in Engineering and Technology,
- [3] Ibbs, W., & Nguyen, L. D. (2012). Using the Classical Measured Mile Approach and Variants to Quantify Cumulative Impact Claims. *Constr.Law.*, 32, 18.
- [4] Jamadagni Sneha, Birajdar B. V. (2015) "Productivity Improvement in Construction Industry" International Research Journal of Engineering and Technology Volume: 02 Issue: 08
- [5] Mohammed Salleh Hammad, Abdelnaser Omran, Abdul Hamid Kadir pakir (2011) "Identifying Ways to Improve Productivity at the Construction Industry"
- [6] Nazarkoa Joanicjusz, Chodakowska Ewa, (2015) "Measuring productivity of construction industry in Europe with Data Envelopment Analysis" *Procedia Engineering* 122 204 – 212
- [7] Paul Riya, Prof. Mrs. Adavi P. R. (Aug. 2013) "Affect of Labor Productivity on Project Performance" International Journal of Engineering Research & Technology (IJERT) Vol. 2 Issue 8,
- [8] Shashank K, Dr. Sutapa Hazra, Kabindra Nath Pal (May 2014) "Analysis of Key Factors Affecting the Variation of Labor Productivity in Construction Projects" International Journal of Emerging Technology and Advanced Engineering, Volume 4, Issue 5
- [9] Shehata M. E., El-Gohary K. M. (3 March 2012) "Towards improving construction labor productivity and projects' performance", *Alexandria Engineering Journal* 50 321-330.
- [10] Shinde V. J. and Dr. Hedao M. N. (November 2017) "A Review On Productivity Improvement In Construction Industry" International Research Journal of Engineering and Technology (IRJET) Volume: 04 Issue:11
- [11] Soekiman, A., K. S. Pribadi, B. W. Soemardi, and R. D. Wirahadikusumah. "Factors relating to labor productivity affecting the project schedule performance in Indonesia." *Procedia engineering* 14 (2011): 865-873.
- [12] Subramani T., P. T. Lishitha, M. Kavitha (June 2014) "Time Overrun and Cost-Affectiveness in the Construction Industry" *Int. Journal of Engineering Research and Applications* Vol. 4, Issue 6 (Version 5),
- [13] Thomas, H. R., & Sakarcian, A. S. (1994). "Forecasting labor productivity using factor model". *Journal of Construction Engineering and Management*, 120(1), 228-239.
- [14] Venkatesh M.P and Saravana Natarajan P.S (November 2019) "Improvement of Manpower and Equipment Productivity in Indian Construction Projects" International Journal of Applied Engineering Research Volume 14).