

Research On Critical Study and Strategic Recommendations for Labor Productivity in Construction: Latur

Mr. Siddharth Sanjay Shinde¹, Dr. Pratibha M Alandkar², Dr. Sushma R. Awad³

¹*Student, ME Construction and Management, Dept. of Civil Engineering, RMD Sinhgad School of Engineering, Warje*

^{2,3}*Professor, Department. of Civil Engineering, RMD Sinhgad School of Engineering, Warje*

Abstract—Labor productivity plays a vital role in the successful execution of construction projects, significantly influencing project time, cost, and quality. However, the construction industry continues to face challenges related to low labor productivity, leading to time overruns and increased project costs. This study focuses on the critical assessment of labor productivity in the construction industry and provides strategic recommendations for its improvement, with special reference to the Latur region. The primary objective of this research is to evaluate the current status of labor productivity, identify key factors affecting it, and analyse its impact on project performance. The study adopts a systematic methodology, including literature review and a structured questionnaire survey conducted among construction professionals and workers. The collected data is analysed to determine the major factors responsible for productivity loss, such as poor project planning, inadequate supervision, and shortage of skilled labor, communication gaps, and delays in decision-making. The study examines the relationship between these factors and project delays and cost overruns. Based on the analysis, the most critical issues affecting labor productivity are identified. The research then proposes practical and effective recommendations, including improved planning and scheduling, proper site management, skill enhancement programs, and better communication practices.

Index Terms—Labor Productivity, Construction Industry, Project Performance, Questionnaire Survey

I. INTRODUCTION

The construction Industry is words largest industry. After agriculture, the 2nd largest employment is provided by the construction industry. The

construction industry is mainly depending on 3M Resources. 3M resources include Manpower, Machine, and Materials. These are the basic need 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 improvement-level of the Construction Industry.

In this industry, the main problem is that 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 Construction project undergoes several problems and complex factors such as cost and time, an effective framework has to be designed, so that overall productivity of project is improved. To improve productivity labor should be familiar with machinery, material, and tools they use. Pre-existing research studies have suggested different methods for measuring labor productivity at different levels, but none of them has been proved universally satisfying. It is very important to measure Labor Productivity qualitatively and quantitatively, as it affects the overall productivity of construction projects.

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.

$$Productivity = Output / Labor Cost$$

A. Problem Statement For Labor Productivity

In any industry productivity loss is one of the serious as well as greatest problems. Different project costs, for example labor, material, and equipment, labor components are considered as of more risk. 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 consider as Labor cost. Because they are most 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 decrease results from various factors which is beyond bad weather condition, changes in Drawings, and poor management. Due to above listed factors disturbance is produced which affects labor productivity, and it is not in the hand of contractor produces productivity loss

II. METHODOLOGY

The methodology adopted for this study is designed to systematically analyze the factors influencing labor performance in the construction industry and to suggest effective measures for improvement. A structured approach has been followed, beginning with an extensive literature survey to gain insights from previous research and to identify the critical factors affecting labor productivity. Based on the findings, questionnaires were prepared to collect both qualitative and quantitative data through online surveys and actual site surveys.

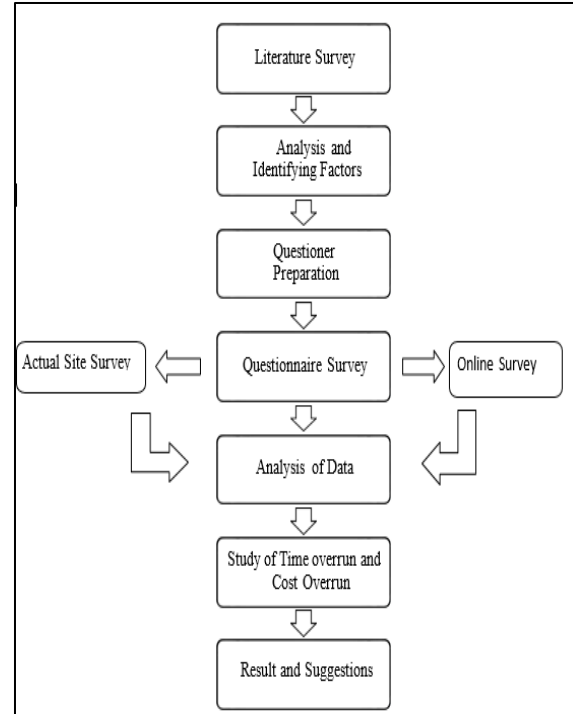


Fig 1 Flow Chart describing various Stages in the research thesis

Our target was Industrial buildings and multi- storied buildings. Therefore, we started from the Industrial buildings from Latur region to collect the data. We have visited ongoing construction sites of Industrial buildings. As per the questionnaire survey prepared, we have collected data for industrial building construction based upon selected factors.

While designing the Questionnaire survey form, special measures were considered that are listed below

- The preliminary text was introduced for explaining the survey project to the respondent.
- Easy way of Communication for the respondents, to give their review and suggestions about the conduct.
- Logical questions were avoided to procure responses and reduced drop- rate time.
- Care was taken that initial questions do not influence negative impact on subsequent questions.

RII is widely used in construction management research for analyzing structured questionnaire data, especially when dealing with subjective assessments of respondents.

Where,

$RII = (\epsilon W)/(A \times N)$
 W = weighting that is assigned to each variable by the respondent,
 A = highest weight and
 N = total number of respondents.

III. ANALYSIS OF QUESTIONNAIRE

A questionnaire survey was conducted, and 80 responses were collected from construction professionals and workers. The collected data was analyzed to determine the critical issues influencing labor productivity and project performance.

i) Your position

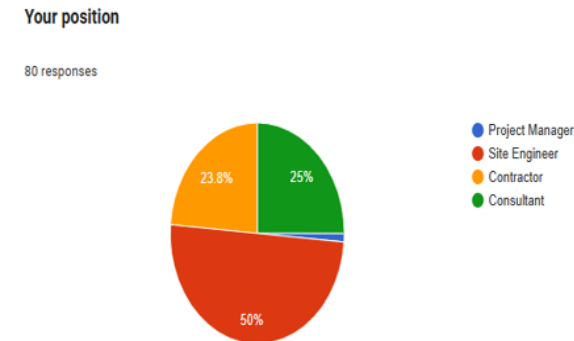


Fig 2 Your Position

Out of 80 respondents, the majority (50%) are Site Engineers, followed by consultants (25%) and Contractors (23.8%), while Project Managers contribute only about 1.2%. This indicates that the survey mainly reflects on-site practical insights into labor productivity

ii) Do you have a clear understanding of labor productivity?

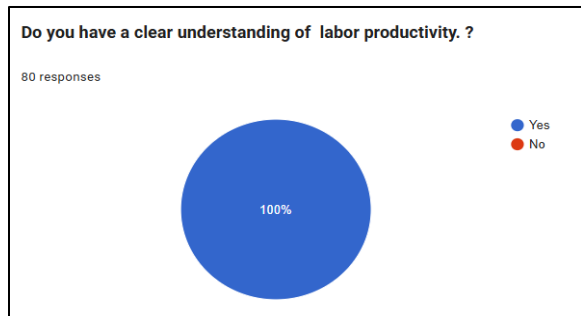


Fig 3 understanding of labor productivity

All respondents (100%) reported that they have a clear understanding of labor productivity

iii) Does organization emphasize the importance of labor productivity

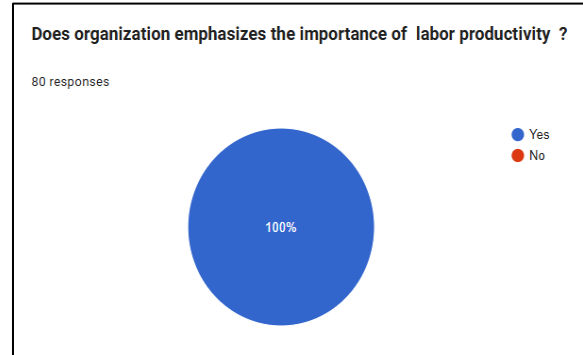


Fig 4 Importance of labor productivity

All respondents (100%) stated that their organization emphasizes the importance of labor productivity

iv) Management Factors- RII Table 1 Management Factors- RII

According to your opinion what are the possibilities of Management Factors							(RII)
Sr No	Answer	1	2	3	4	5	RII
1	Lack of proper project planning	51	29	4	5	1	0.365
2	Poor site supervision	46	26	0	3	5	0.338
3	Delay in management decision making	4	51	17	1	7	0.490
4	Poor communication between management and workers	4	5	50	18	3	0.628
5	Lack of leadership from project managers	2	8	4	49	17	0.778

The analysis indicates that lack of leadership from project managers (RII = 0.778) is the most significant factor affecting labor productivity

v) Labor Factors – RII Table 2 Labor Factors – RII

According to your opinion what are the possibilities of Labor Factors							(RII)
Sr No	Answer	1	2	3	4	5	RII
1	Shortage of skilled labor	6	8	2	9	55	0.848
2	Lack of training programs for workers	2	12	5	46	15	0.750
3	Low worker motivation	5	7	16	18	34	0.773
4	High labor absenteeism	6	8	46	19	1	0.603
5	Worker fatigue due to long working hours	14	53	9	3	1	0.410

The results show that shortage of skilled labor (RII = 0.848) is the most critical factor affecting productivity

vi) Material Factors – RII Table 3 Material Factors - RII

According to your opinion what are the possibilities of Material Factors							(RII)
Sr No	Answer	1	2	3	4	5	RII
1	Delay in material delivery	4	6	49	19	2	0.623
2	Shortage of construction materials	3	53	22	2	0	0.458
3	Poor quality materials	47	24	6	1	2	0.318
4	Improper material storage	2	40	21	16	1	0.535
5	Material wastage on site	4	41	18	15	2	0.525

The analysis shows that delay in material delivery (RII = 0.623) is the most significant material-related factor affecting productivity

vii) Equipment Factors – RII Table 4 Equipment Factors - RII

According to your opinion what are the possibilities of Equipment Factors							(RII)
Sr No	Answer	1	2	3	4	5	RII
1	Lack of modern equipment	4	7	48	19	2	0.620
2	Frequent equipment breakdown	5	9	42	20	4	0.623
3	Insufficient tools for workers	4	47	25	2	2	0.478
4	Poor maintenance of equipment	5	49	22	2	2	0.468
5	Delay in equipment availability	10	8	39	20	3	0.595

The results indicate that frequent equipment breakdown (RII = 0.623) is the most significant factor, closely followed by lack of modern equipment (0.620)

viii) Financial Factors – RII Table 5 Financial Factors - RII

According to your opinion what are the possibilities of Financial Factors							(RII)
Sr No	Answer	1	2	3	4	5	RII
1	Delay in wage payment	43	29	6	1	1	0.320
2	Budget constraints	2	9	44	25	0	0.630
3	Increase in material costs	3	9	42	24	2	0.633
4	Poor financial planning	2	9	44	24	1	0.633
5	Cash flow problems	6	40	28	6	0	0.485

The analysis shows that increase in material costs (RII = 0.633) and poor financial planning (0.633) are the most significant financial factors affecting productivity

ix) Site Condition Factors – RII Table 6 Site Condition Factors - RII

According to your opinion what are the possibilities of Site Condition Factors							(RII)
Sr No	Answer	1	2	3	4	5	RII
1	Site congestion	10	14	26	20	10	0.615
2	Limited working space	3	52	23	1	1	0.463
3	Poor site layout planning	51	23	4	1	1	0.295
4	Unsafe working environment	49	25	3	1	2	0.305
5	Difficult site accessibility	48	28	2	1	1	0.298

The analysis indicates that site congestion (RII = 0.615) is the most significant site-related factor affecting labor productivity

x) Safety Factors – RII Table 7 Safety Factors - RII

According to your opinion what are the possibilities of Safety Factors							(RII)
Sr No	Answer	1	2	3	4	5	RII
1	Lack of safety training	7	10	44	18	1	0.590
2	Inadequate safety equipment	5	9	46	19	1	0.605
3	Poor safety awareness	5	7	9	42	17	0.748
4	High risk of accidents	4	50	24	1	1	0.463
5	Unsafe work practices	37	21	17	3	2	0.380

The results show that poor safety awareness (RII = 0.748) is the most significant safety factor affecting labor productivity

xi) Environmental Factors – RII Table 8 Environmental Factors - RII

According to your opinion what are the possibilities of Environmental Factors							(RII)
Sr No	Answer	1	2	3	4	5	RII
1	Adverse weather conditions	39	23	17	0	1	0.353
2	Extreme heat or rainfall	5	53	20	1	1	0.450
3	Poor lighting conditions	49	24	4	0	3	0.310
4	Noise and dust at construction site	49	29	1	0	1	0.288
5	Environmental restrictions	46	29	4	0	1	0.303

The analysis shows that extreme heat or rainfall (RII = 0.450) is the most significant environmental factor affecting labor productivity.

xii) External Factors – RII Table 9 External Factors - RII

According to your opinion what are the possibilities of External Factors							(RII)
Sr No	Answer	1	2	3	4	5	RII
1	Government approval delays	9	3	9	3	56	0.835
2	Transportation problems	5	9	46	20	0	0.603
3	Local labor disputes	9	49	17	4	1	0.448
4	Shortage of utilities (water/electricity)	7	6	13	49	5	0.66

							9
							8
5	Unexpected site conditions	14	42	20	2	2	0
							4
							4
							0

xiii) Technology Factors – RII Table 10 Technology Factors - RII

According to your opinion what are the possibilities of Technology Factors							(RII)
Sr No	Answer	1	2	3	4	5	RII
1	Lack of use of modern construction technology	6	9	2	50	13	0.738
2	Poor use of construction software	4	7	5	15	49	0.845
3	Lack of automation in construction processes	5	6	2	17	50	0.853
4	Inadequate technical support	5	6	57	3	9	0.613
5	Lack of innovation in construction methods	5	6	4	61	4	0.733

xiv) Indexing and Ranking of Factors Table 11 Indexing and Ranking of Factors

Group	Factor	RII	Ranking
Management Factors	Lack of proper project planning	0.365	40
	Poor site supervision	0.338	42
	Delay in management decision making	0.49	28
	Poor communication between management and workers	0.628	15

	Lack of leadership from project managers	0.778	5
Labor Factors	Shortage of skilled labor	0.848	2
	Lack of training programs for workers	0.75	7
	Low worker motivation	0.773	6
	High labor absenteeism	0.603	22
	Worker fatigue due to long working hours	0.41	38
Material Factors	Delay in material delivery	0.623	16
	Shortage of construction materials	0.458	34
	Poor quality materials	0.318	44
	Improper material storage	0.535	26
	Material wastage on site	0.525	27
Equipment Factors	Lack of modern equipment	0.62	18
	Frequent equipment breakdown	0.623	17
	Insufficient tools for workers	0.478	30
	Poor maintenance of equipment	0.468	31
	Delay in equipment availability	0.595	24
Financial Factors	Delay in wage payment	0.32	43
	Budget constraints	0.63	14
	Increase in material costs	0.633	12
	Poor financial planning	0.633	13
	Cash flow problems	0.485	29

Site Condition Factors	Site congestion	0.6 15	19
	Limited working space	0.4 63	32
	Poor site layout planning	0.2 95	49
	Unsafe working environment	0.3 05	46
	Difficult site accessibility	0.2 98	48
Safety Factors	Lack of safety training	0.5 9	25
	Inadequate safety equipment	0.6 05	21
	Poor safety awareness	0.7 48	8
	High risk of accidents	0.4 63	33
	Unsafe work practices	0.3 8	39
Environmental Factors	Adverse weather conditions	0.3 53	41
	Extreme heat or rainfall	0.4 5	35
	Poor lighting conditions	0.3 1	45
	Noise and dust at construction site	0.2 88	50
	Environmental restrictions	0.3 03	47
External Factors	Government approval delays	0.8 35	4
	Transportation problems	0.6 03	23
	Local labor disputes	0.4 48	36
	Shortage of utilities (water/electricity)	0.6 98	11
	Unexpected site conditions	0.4 4	37
Technology Factors	Lack of use of modern construction technology	0.7 38	9
	Poor use of construction	0.8 45	3

software	Lack of automation in construction processes	0.8 53	1
	Inadequate technical support	0.6 13	20
	Lack of innovation in construction methods	0.7 33	10

Top 10 Factors Affecting Labor Productivity (Based on RII Ranking)

- Lack of automation in construction processes (RII = 0.853)
- Shortage of skilled labor (0.848)
- Poor use of construction software (0.845)
- Government approval delays (0.835)
- Lack of leadership from project managers (0.778)
- Low worker motivation (0.773)
- Lack of training programs for workers (0.750)
- Poor safety awareness (0.748)
- Lack of use of modern construction technology (0.738)
- Lack of innovation in construction methods (0.733)

The study identified major factors affecting labor productivity such as lack of automation, shortage of skilled labor, poor use of construction software, delays in approvals, and weak project management practices. To tackle these issues and improve project planning, scheduling, monitoring, and resource management, Microsoft Project (MSP) was implemented on a small-scale construction project.

IV. RESULTS FOR MICROSOFT PROJECT MANAGEMENT

The study was carried out on a rural infrastructure development project undertaken under the Financial Year 2024–25, Head 2515 – Rural Development Program. The selected project is the construction of a Sabha Grah at Chincholi Jogan, Taluka Ausa, District Latur. The project was executed under the supervision of the Public Works Sub Division, Ausa, as a part of the scheme for providing basic amenities within villages in rural areas. The project was selected to study labor productivity and project

scheduling practices in small-scale construction works.

- Project: Rural Infrastructure Development Work under Financial Year 2024–25 (Head 2515 – Rural Development Program), Ausa Taluka, District Latur.
- Department: Public Works Sub Division, Ausa (under Zilla Parishad Scheme).

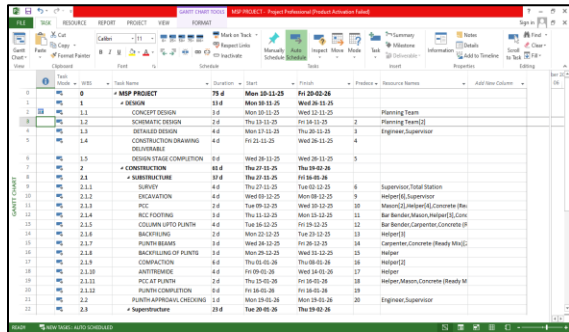


Fig 5 The Gantt Chart of the Project

i) Resource sheet

Resource sheet gives you information about the resources assigned to your project, including standard and overtime rates, availability for overtime work, and fixed cost. The resources are defined in the resource sheet. The resource sheet contains more than 12 fields. The data are entered in this field and assign to the task in the project

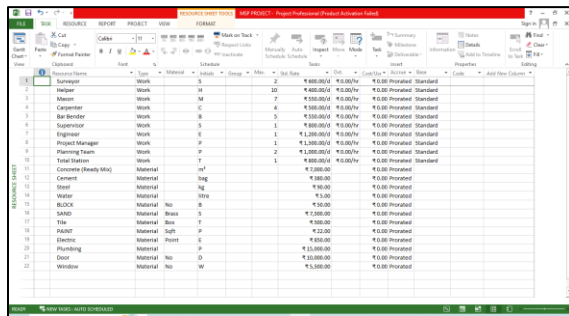


Fig 6 Resource Sheet

ii) Cash Flow Report of Project

Actual Cost – 8, 37,200
 Baseline Cost – 9, 51,250
 Cost Variance – 1, 14,050

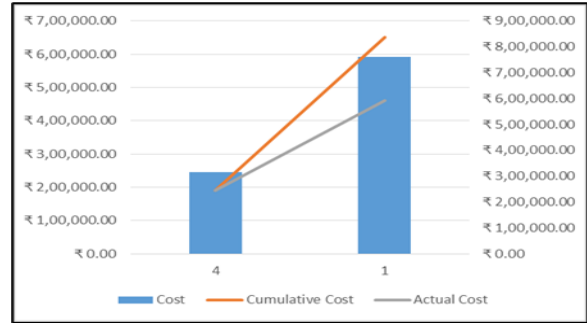


Fig 7 Cash Flow of Project

The Graph shows the project's cumulative cost and cost per quarter. After scheduling in MSP, the actual cost (Rs. 8,37,200) is lower than the baseline cost (Rs. 9,51,250), resulting in a positive cost variance of Rs. 1,14,050. This indicates that the project is performing efficiently in terms of cost and is under budget

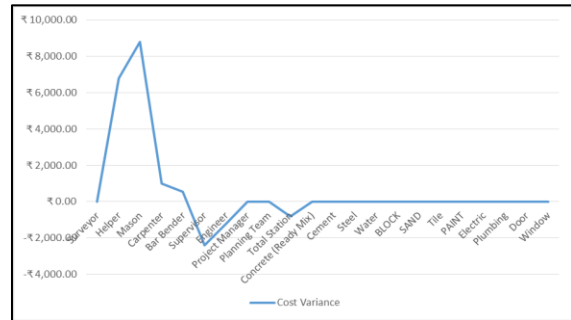


Fig 8 Resource Cost Variance

iv) Resource Usage Table 12 Resource Usage

Name	Start	Finish	Remaining Work
Surveyor	NA	NA	0 hrs
Helper	Wed 03-12-25	Thu 19-02-26	1,072 hrs
Mason	Tue 09-12-25	Mon 02-02-26	200 hrs
Carpenter	Tue 16-12-25	Mon 02-02-26	136 hrs
Bar Bender	Thu 11-12-25	Wed 21-1-26	72 hrs
Supervisor	Mon 17-11-25	Mon 19-01-26	104 hrs
Engineer	Mon 17-11-25	Mon 19-01-26	40 hrs
Project Manager	NA	NA	0 hrs
Planning Team	Mon 10-11-25	Fri 14-11-25	56 hrs
Total Station	Thu 27-11-25	Tue 02-12-25	32 hrs

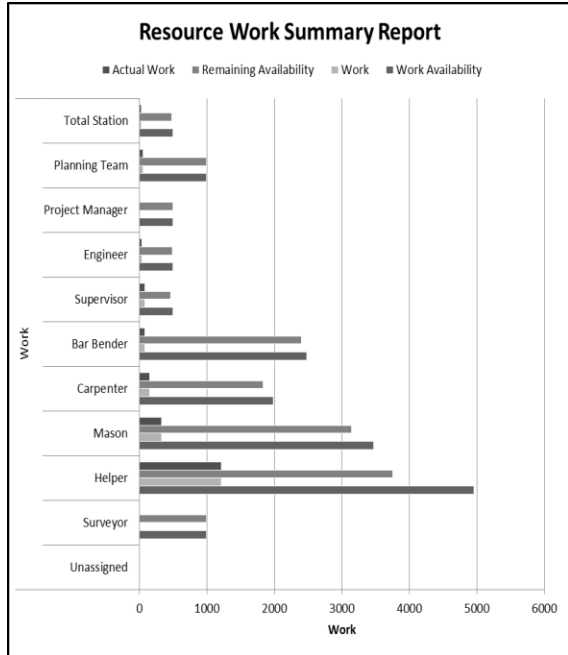


Fig 9 Resource Work Summary Report

The image shows a Resource Work Summary Report, which compares workload distribution and availability across different roles in a construction project. The horizontal bar chart represents the amount of work (on the X-axis) assigned to each resource category listed on the Y-axis.

The chart highlights four key parameters: Actual Work, Remaining Availability, Total Work, and Work Availability, allowing a clear comparison between planned and utilized resources.

At the top level, management roles such as Planning Team, Project Manager, Engineer, and Supervisor have relatively low work values. This suggests that these roles are not heavily burdened in terms of measurable work hours or quantities, which is typical since their contribution is more supervisory and decision-based rather than labor-intensive.

Table 13 Activity Wise Cost

Task Name	Total Cost	Baseline	Variance
Msp Project- At	₹ 837,200.00	₹ 951,250.00	-₹ 114,050.00
Design	₹ 12,000.00	₹ 15,000.00	-₹ 3,000.00
Concept Design	₹ 2,500.00	₹ 3,000.00	-₹ 500.00
Schematic Design	₹ 3,500.00	₹ 4,000.00	-₹ 500.00
Detailed Design	₹ 6,000.00	₹ 8,000.00	-₹ 2,000.00

			2,000.00
Construction Drawing Deliverable	₹ 0.00	₹ 0.00	₹ 0.00
Design Stage Completion	₹ 0.00	₹ 0.00	₹ 0.00
Construction	₹ 825,200.00	₹ 936,250.00	-₹ 111,050.00
Substructure	₹ 244,100.00	₹ 256,900.00	-₹ 12,800.00
Survey	₹ 5,000.00	₹ 6,400.00	-₹ 1,400.00
Excavation	₹ 5,500.00	₹ 4,800.00	₹ 700.00
Pcc	₹ 11,600.00	₹ 8,900.00	₹ 2,700.00
Rcc Footing	₹ 50,600.00	₹ 55,900.00	-₹ 5,300.00
Column Upto Plinth	₹ 75,600.00	₹ 82,200.00	-₹ 6,600.00
Backfilling	₹ 4,000.00	₹ 2,400.00	₹ 1,600.00
Plinth Beams	₹ 80,100.00	₹ 83,300.00	-₹ 3,200.00
Backfilling Of Plintg	₹ 1,200.00	₹ 1,200.00	₹ 0.00
Compaction	₹ 3,000.00	₹ 4,800.00	-₹ 1,800.00
Antitremitide	₹ 1,500.00	₹ 1,600.00	-₹ 100.00
Pcc At Plinth	₹ 6,000.00	₹ 5,400.00	₹ 600.00
Plinth Completion	₹ 0.00	₹ 0.00	₹ 0.00
Plinth Approavl Checking	₹ 2,000.00	₹ 2,000.00	₹ 0.00
Superstructure	₹ 579,100.00	₹ 677,350.00	-₹ 98,250.00
Column Casting	₹ 85,500.00	₹ 104,700.00	-₹ 19,200.00
Slab And Beam Casting	₹ 84,500.00	₹ 96,000.00	-₹ 11,500.00
Block Work Of Ground	₹ 5,600.00	₹ 5,700.00	-₹ 100.00
Plastering Internal	₹ 20,900.00	₹ 22,200.00	-₹ 1,300.00
Plastering Exrternal	₹ 40,000.00	₹ 37,600.00	₹ 2,400.00
Water Proofing	₹ 3,500.00	₹ 4,900.00	-₹ 1,400.00

Painting	₹ 86,600.00	₹ 121,000.00	-₹ 34,400.00
Electrical Work Conceled	₹ 10,500.00	₹ 17,850.00	-₹ 7,350.00
Electrical Fitting	₹ 10,500.00	₹ 17,000.00	-₹ 6,500.00
Plumbing Conceled	₹ 24,100.00	₹ 30,000.00	-₹ 5,900.00
Plumbing Fitting	₹ 58,000.00	₹ 60,000.00	-₹ 2,000.00
Door Panel Fixing	₹ 38,000.00	₹ 40,000.00	-₹ 2,000.00
Window Panel Fixing	₹ 38,000.00	₹ 44,000.00	-₹ 6,000.00
Flooring	₹ 23,200.00	₹ 24,600.00	-₹ 1,400.00
Tiling	₹ 50,200.00	₹ 51,800.00	-₹ 1,600.00
Handover	₹ 0.00	₹ 0.00	₹ 0.00
Haning Over Keys	₹ 0.00	₹ 0.00	₹ 0.00

V. CONCLUSION

- The study was carried out to identify and evaluate the factors affecting labor productivity in construction projects in the Latur region. A total of 80 responses were collected from professionals, and the data was analyzed using the Relative Importance Index (RII) method to rank the influencing factors.
- The analysis revealed that the most critical factors are lack of automation in construction processes (Rank 1, RII = 0.853), shortage of skilled labor (Rank 2, 0.848), poor use of construction software (Rank 3, 0.845), government approval delays (Rank 4, 0.835), and lack of leadership from project managers (Rank 5, 0.778). Other significant factors include low worker motivation (Rank 6), lack of training programs (Rank 7), poor safety awareness (Rank 8), lack of modern construction technology (Rank 9), and lack of innovation in methods (Rank 10).
- Project planning and scheduling were carried out using Microsoft Project (MSP). By applying proper scheduling, resource allocation, and

continuous tracking of labor and material usage, it was observed that the actual cost (Rs. 8,37,200) was lower than the baseline cost (Rs. 9,51,250), resulting in a cost saving of Rs. 1,14,050. This demonstrates that effective labor management, material planning, and monitoring can significantly reduce project cost and duration.

- Labor productivity can be improved through technology adoption, skilled workforce development, effective management practices, and proper planning and tracking using tools like MSP, leading to enhanced project performance and cost efficiency

VI. RECOMMENDATIONS

Based on the findings of the study, the following recommendations are suggested to improve labor productivity in the construction industry:

1. Adoption of Modern Technology:
Implement advanced construction technologies, automation, and software tools such as MSP, BIM, and project management systems to enhance efficiency and accuracy.
2. Skill Development and Training:
Conduct regular training programs and workshops to improve the skills and efficiency of construction workers.
3. Effective Project Planning:
Ensure proper planning and scheduling of activities to avoid delays and improve coordination among different teams.
4. Strengthening Leadership and Management:
Improve leadership qualities of project managers and enhance communication between management and workers.

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) "Effect 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),