

Study of On-Site Labour Productivity to Assess Various Factors Influencing Construction

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ABSTRACT: Productivity is an important aspect of construction industry that may be used as an index for efficiency of production. Efficient management of construction resources can lead to higher productivity which can help to achieve cost and time saving. The labour is the most valuable assets. It is important to improve efficiency of production by improving productivity of labour. Decreasing productivity of project has always been major concern for construction Industry. Aim of this project is to study the importance of measurement of labour productivity. For a company in the building industry to remain competitive, it must try to improve the productivity of its labour. This paper reviews the literature on labour productivity in the building industry. It looks at the definitions, measurement, use, factors affecting and theories on improvement of labour productivity in the building industry. It is noted in the industry lacks generally agreed strategies for improvement of labour productivity. The paper further reviews the paradigms of innovation, benchmarking, and industrialization among the theories aimed at improving the productivity of labour in the building industry construction industry around Mumbai sector after finding the factors affecting labour productivity.

KEYWORDS: Construction, Productivity, Labour, Factors affecting productivity

I. INTRODUCTION

Construction industry is world's most largest and challenging industry. Human resource has a strategic role in increasing productivity in construction industry. With the effective and optimum use of human resources can help in productivity growth. The construction projects are mostly labour based with basic use of hand tools and equipment's in which labour cost consists of about 30% to 50% of total project cost (Vekaria, S.G.). Indian construction industry is one of fastest growing sector globally. The construction sector gives second largest employment after agriculture. India shares about 8% of total GDP and also provides employment to around 35 million peoples directly or indirectly (Yogendra kumar et al, 2013). In construction industry one of the biggest problems faced is of unskilled labour which implies in productivity loss and impacts on cost overrun and schedule daily. Labour productivity is one of important factor which affects physical progress of construction project. Many researchers have shown that poor construction management practices leads to poor performance, wastage of efforts in different phases of construction projects. Researchers tried to over-come some of challenges by adding their efforts in construction project, however many problems are yet to be solved in terms of construction productivity. Identifying and analyzing the critical factor that influence construction productivity will lead to develop most effective method and strategies to improve the construction productivity in upcoming time.

II. LITERATURE REVIEW

We need a basic knowledge about the past researches and advancements in this field, before starting the work in it. A Literature Review is a text written on the study of the past work and our understandings from them. In other words, it is a form of work acquired to get the knowledge about the past works and inventions in that field, and to get a clear idea about the methods and ways for going ahead with our work. Literature review isn't any form of new works, it is only the content taken from secondary sources for reference.

- **Ameh et al. (2011)** established the relationship between time overrun and labor productivity on construction sites in Lagos, Nigeria. He concluded that factors causes time overrun are inadequate fund for the project, inadequate planning of project before take-off, inadequate tools and equipment, delay in delivery of materials, subcontractors' incompetency and design changes during project execution. And factors that affect productivity in the construction sites are use of wrong construction method, inadequate construction materials and inaccurate drawings/specification were the most significant.
- **Attar et al. (2012)** carried survey of building projects in Sangli, Kolhapur and Pune districts, where an increase in productivity is being sought. He identified ten most significant factors affecting labor productivity for small, medium and large companies. The groups of factors which are highly effective are: supervision, material, execution plan, and design.
- **Dayakar et al. (2012)** concluded important factors affecting labor productivity are quality of site management, material shortage, timely payment of wages, labor experience, misunderstanding between labor and superintendent. Work concentrated on labor productivity ratios that reduced day by day, which in turn harm organization's profitability. MS excel methods and SPSS software used for analysis.
- **Vekaria (2012)** concluded that project management skills were acceptable as the most important factor that influenced the productivity among the labor a part of the other factors such as technology exploration, skill and training, labor organization, project uniqueness and wage trends.
- **Khaled et al. (2013)** comprised 30 productivity factors and classified them under three primary categories: Human/labor, Industrial and Management. Their study represented five factors which are most significant in construction labor productivity in Egypt: (1) Labor experience and skills, (2) Incentive programs, (3) Availability of the material and ease of handling, (4) Leadership and competency of construction management and (5) Competency of labor supervision.
- **Shah Meet et al. (2014)** stated that productivity can be an influential factor in minimizing the project losses or increased profits. Productivity can help a company gain competitive advantage and slim profit margins. He suggest the top factors which affects productivity based on the survey conducted in the central Gujarat region were low payment, poor construction methods, use of technology/level of mechanization, delays in material delivery etc.
- **Shashank et al. (2014)** grouped factors affecting labor productivity in six different group which are Motivation group, Manpower group, Material/Equipment group, Safety group, Managerial group, Quality group. They said Motivation factor has the highest impact on labor productivity. So they suggested that, the construction company should increase labour satisfaction by paying a reasonable salary, developing financial reward or recognition program and improving the living condition on site.
- **Thiyagu et al. (2015)** proposed fifteen independent groups affecting the labor productivity in the construction projects. The topmost factors affected the labour productivity are given Sanitation and hygiene of the construction site and the temporary shed; Labour injuries on site; Alcoholism; Working overtime; Shortage of construction materials; Payment delays; Change orders from the designers; Improper equipment; Poor quality of construction materials; Misunderstanding among laborers.
- **Saravanan et al. (2016)** concluded eleven different factors influencing labor productivity which are time, quality, safety and managerial factors, experience of labor, type of project, misunderstanding, external factors, motivation, material/tools and natural factors.
- **Mahesh et al. (2017)** found prior knowledge of labor productivity during construction can save money and time. Investments for projects are very high and because of the complexity in construction, various factors can highly affect overall productivity, thus the project can end up adding even more time and money in order to be completed. First method used for analysis was the person product moment correlation coefficient.

III. METHODOLOGY

This section discuss the methodology of the research. The process involved in conducting the study is shown in Table 1 The preliminary insight of the subject data has been collected through a literature review followed by the use of questionnaire survey targeted at contractors, sub-contractors and labours. On the basis of literature studies definition productivity and different factors which contributes in lowering the productivity was derived. After deriving the productivity and related problems of labour the questionnaire for employer and labour's is prepared. The details about the facilities, wages, working condition, expenses were included in the questionnaire.

Table 1 The various questionnaires include the following factors

1 Not Applicable 2-Does not affect. 3-Somewhat affects 4-Directly affects it.-



Table 1 Questionaries

NO	Factor's affecting labour productivity in building construction	Data measurement	Data measurement	Data measurement	Data measurement
		1	2	3	4
1	Manpower				
	A. Lack of experience				
	b. Disloyalty				
	c. Misunderstanding among labors				
	d. Lack of competition among labour				
	e. Age (More than 50 years)				
	f. Personal problem				
	g. alcoholic				
	h. Absenteeism				
	i. Team work				
	j. Job satisfaction				
2	External				
	a. Implementation of government laws				
	b. Rework				
	c. Supervision delay				
	d. Inspection delay from authority				
	e. Variation in the drawing				
	f. Complex design provided				
	g. Incomplete drawing				
	h. Payment delays to worker				
	i. Training sessions				
	j. Design changes.				
	k. Political effects				
3	Communication				
	a. Change order from designer				



	b. Change order from owners				
	c. Dispute with owners				
	d. Dispute with designer				
	e. Misunderstanding with owners and contractors				
	f. Disrespectful treatment				
	g. consulting with other while making decision				
4	Resources				
	a. Lack of required construction material				
	b. Increase in the price of material				
	c. Lack of required tool and other equipment				
	d. Poor site condition				
	e. Differencing site condition from the plans				
	f. Violation of safety laws				
	g. Insufficient lightning				
	h. Inadequate construction method				
	i. Inadequate transportation facilities for workers				
	j. Material storage location				
	k. Quality of required material.				
5	Miscellaneous				
	a. Shortage of water and power supply				
	b. Working overtime				
	c. Accident during construction				
	d. Project objective is not well defined.				
	e. Festival				
	f. Weather condition (excluding monsoon)				
	g. Labour accommodation				

Interview with officers and labors

Interview will be conducted from construction sites of Mumbai and Navi Mumbai. Different types of sites like residential, Highways, etc. will be visited to get variety of data. Data analysis will do to arrive at different factors which



lower the productivity. The survey will carried out using interviews with labors and officers. The data from survey will analyses by using following method.

Analysis methods

To obtain the data required for the study, a questionnaire was prepared. Different factors which were found from earlier works in book and journals were listed in the questionnaire (Table 1). To analyses the data obtained by survey, Relative importance index (RII) were used.

Relative importance index (RII) method -

The contribution of each of the factor to overall delays was examined and the ranking of the attributes in term of their critically as perceived by the respondent was down by use of relative importance index (RII) which was computed using equation and the result of the analysis are presented in the table. For this purpose, a rating scale of 1 to 4 was adopted with 1 representing the lowest level of effect and 4 representing the highest level. The RII was evaluated by the following expression:

$$RII = \frac{\sum W}{A} \times N$$

W is the weight given to each factor by the respondents and ranges from 1 to 4.

$$W \text{ ranges } \left\{ \begin{array}{l} 1. \text{ Not applicable} \quad 2. \text{ Does not affect it.} \\ 3. \text{ Somewhat affects it.} \quad 4. \text{ Directly affects it} \end{array} \right\} \times \text{Number of respondent for each degree}$$

A is the highest weight = 4

N is the total number of response collected for the ordinal scale.

The numerical value obtained from above formula indicates the RII value of each of the factor mentioned in table 3.1.

IV. RESULT

Data collected from various sites

Collection of accurate data is one of the important phase in order to achieve main objective of study. Data collection is a procedure of collecting crucial data record for a certain sample or population of observation. A total number of 150 questionnaires were used to collect the data from sites in early 2020. Research was performed considering, 46 factors affecting labor productivity for building construction were identified, and their RII was calculated. These factors were classified into five groups: manpower factors, external factors, communication factors, resources factors, and groups: manpower factors, external factors, communication factors, resources factors, and miscellaneous factors. After calculating the RII values of the factors affecting labor productivity, factors has been arranged according to their rank i.e. Higher the RII value = Higher Rank

Overall Factors Affecting Labour Productivity According to RII Value

Table 2 Overall factors affecting labour productivity

Factors	RII	Rank
Lack of Required Construction material	0.990	1
Lack of required tools and other equipment	0.981	2
Age (More than 50 years)	0.942	3

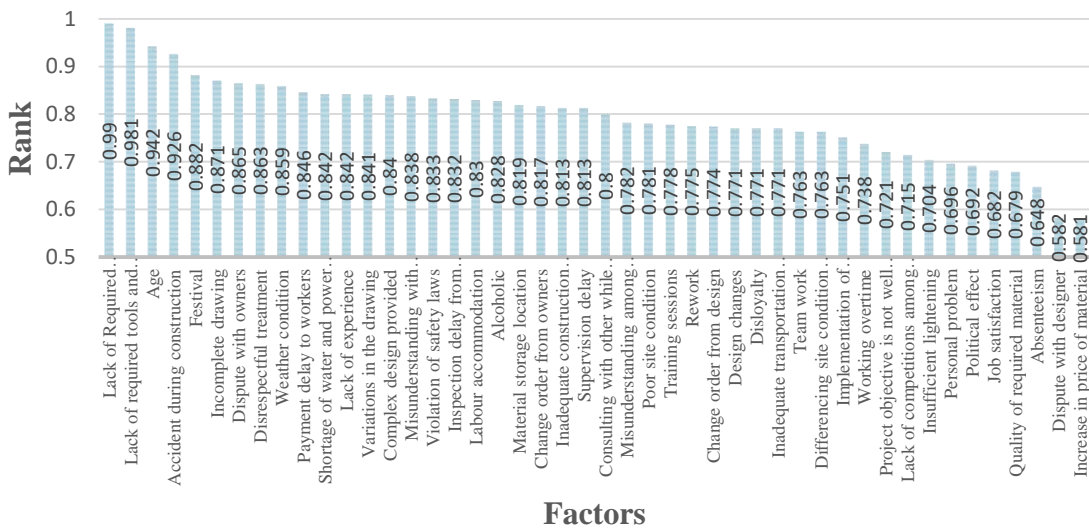


Factors	RII	Rank
Accident during construction	0.926	4
Festival	0.882	5
Incomplete drawing	0.871	6
Dispute with owners	0.865	7
Disrespectful treatment	0.863	8
Weather condition (excluding monsoon)	0.859	9
Payment delay to workers	0.846	10
Shortage of water and power supply	0.842	11
Lack of experience	0.842	12
Variations in the drawing	0.841	13
Complex design provided	0.840	14
Misunderstanding with owner and contractors	0.838	15
Violation of safety laws	0.833	16
Inspection delay from authority	0.832	17
Labour accommodation	0.830	18
Alcoholic	0.828	19
Material storage location	0.819	20
Change order from owners	0.817	21
Inadequate construction method	0.813	22
Supervision delay	0.813	23
Consulting with other while making decisions	0.800	24
Misunderstanding among labour	0.782	25
Poor site condition	0.781	26
Training sessions	0.778	27
Rework	0.775	28
Change order from designer	0.774	29
Design changes	0.771	30
Disloyalty	0.771	31
Inadequate transportation facilities	0.771	32
Team work	0.763	33
Differencing site condition from plans	0.763	34
Implementation of government laws	0.751	35
Working overtime	0.738	36
Project objective is not well defined	0.721	37
Lack of competitions among labour	0.715	38
Insufficient lightening	0.704	39
Personal problem	0.696	40



Factors	RII	Rank
Political effect	0.692	41
Job satisfaction	0.682	42
Quality of required material	0.679	43
Absenteeism	0.648	44
Dispute with designer	0.582	45
Increase in price of material	0.581	46

GRAPH OF OVERALL FACTORS AFFECTING PRODUCTIVITY



Comparison of factors affecting labour productivity for different type of construction site.

Low labor productivity is assumed as one of the challenges of Construction. The overall objective of the research is to assess the labor productivity in selected construction Projects. In the above sections we have seen the overall factors affecting to the labour productivity. But this factors may vary depending upon the type of construction sites. Various types of construction sites may be commercial, residential, Highways etc. for our study we have conducted the survey on residential and highways sites. From the study we can see that the factors affecting productivity varies depending upon the types of sites.

Following are the details of construction site on which we have study the factors affecting labour productivity.

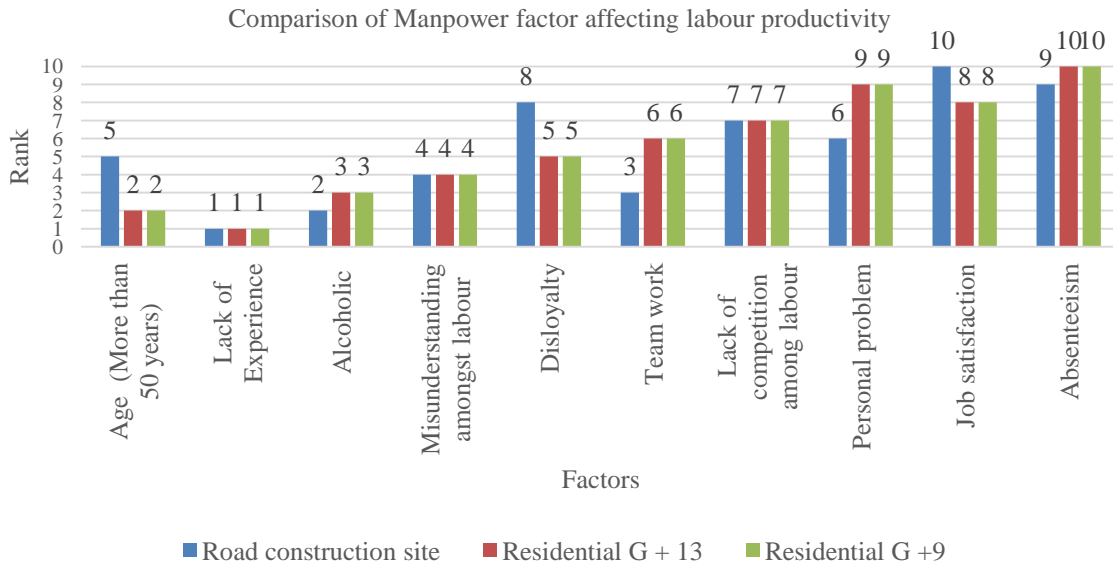
Table 3 Details of Construction site

Sr No	Name of work	Name of Contractor	Type of Construction	Total cost	No of labours
1	Construction of Road	C4 infra Pvt limited	Government	16cr	35
2	Construction of G+13 residential building	w/s Bharati construction company	Residential	50cr	40
3	Construction of G+9 Residential building	LK Infrastructure pvt.ltd	Residential	42cr	35

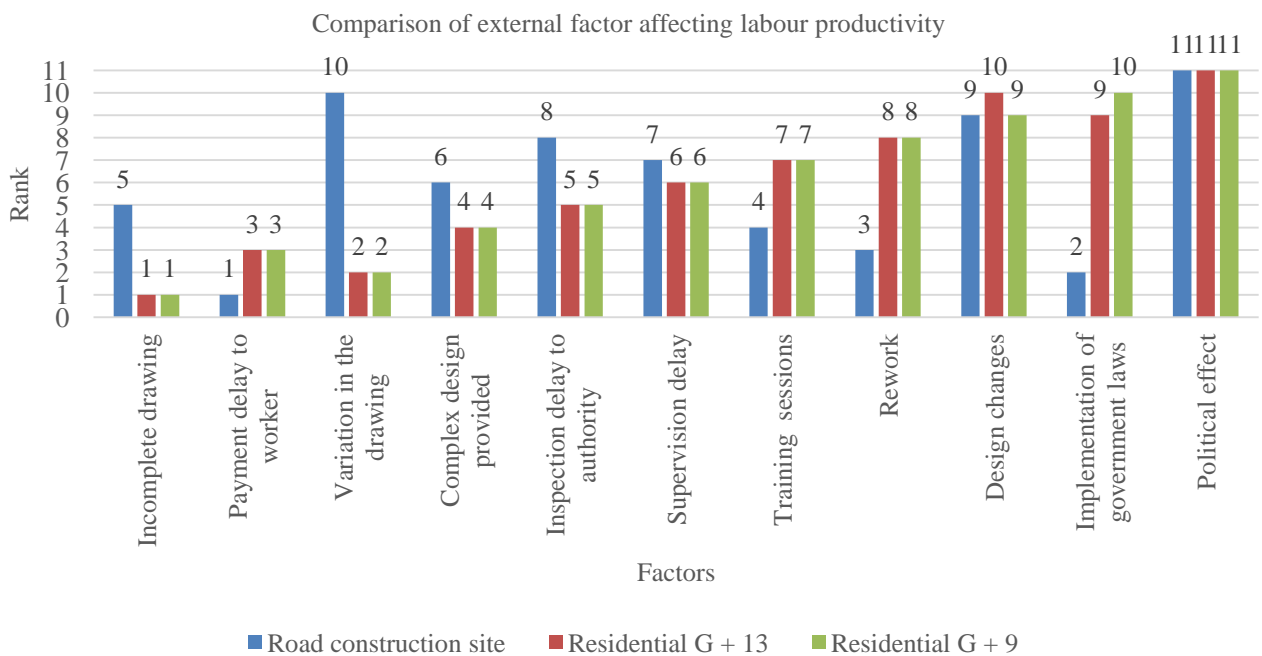


Comparison of Different Factors affecting labour productivity with Road construction and Residential Building construction site according to their Rank obtain from analysis

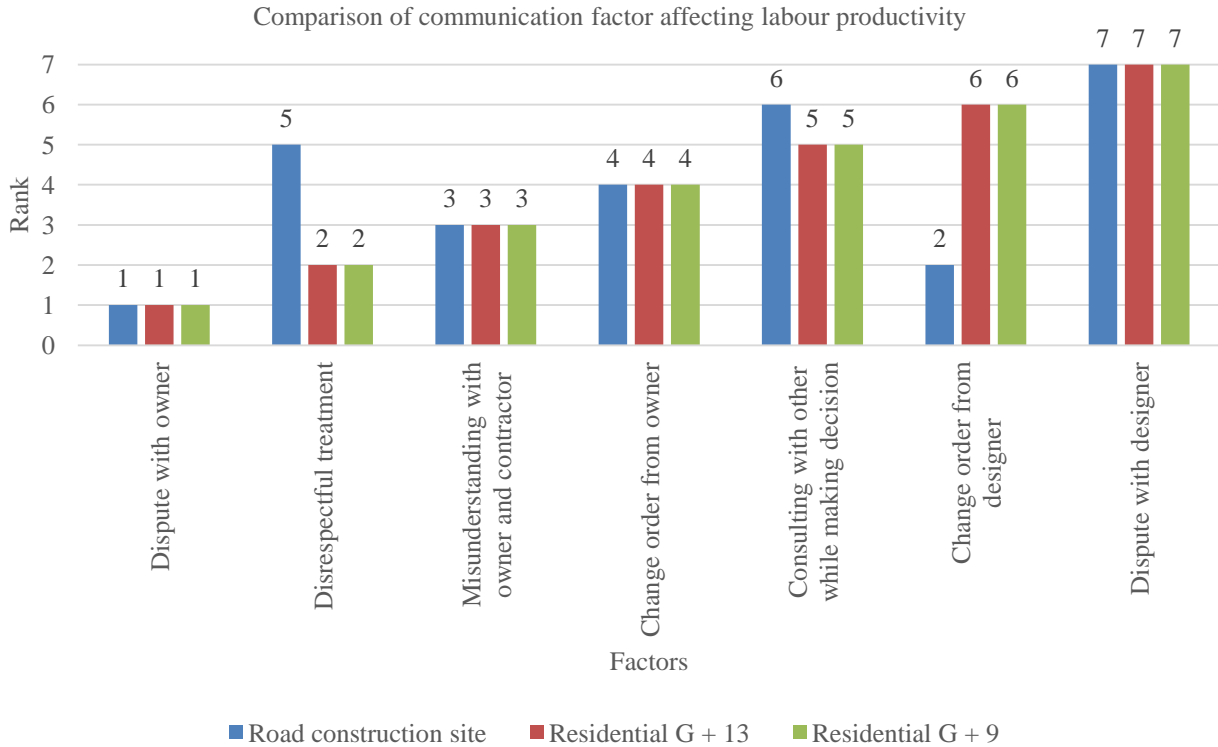
Manpower Factors affecting labour productivity



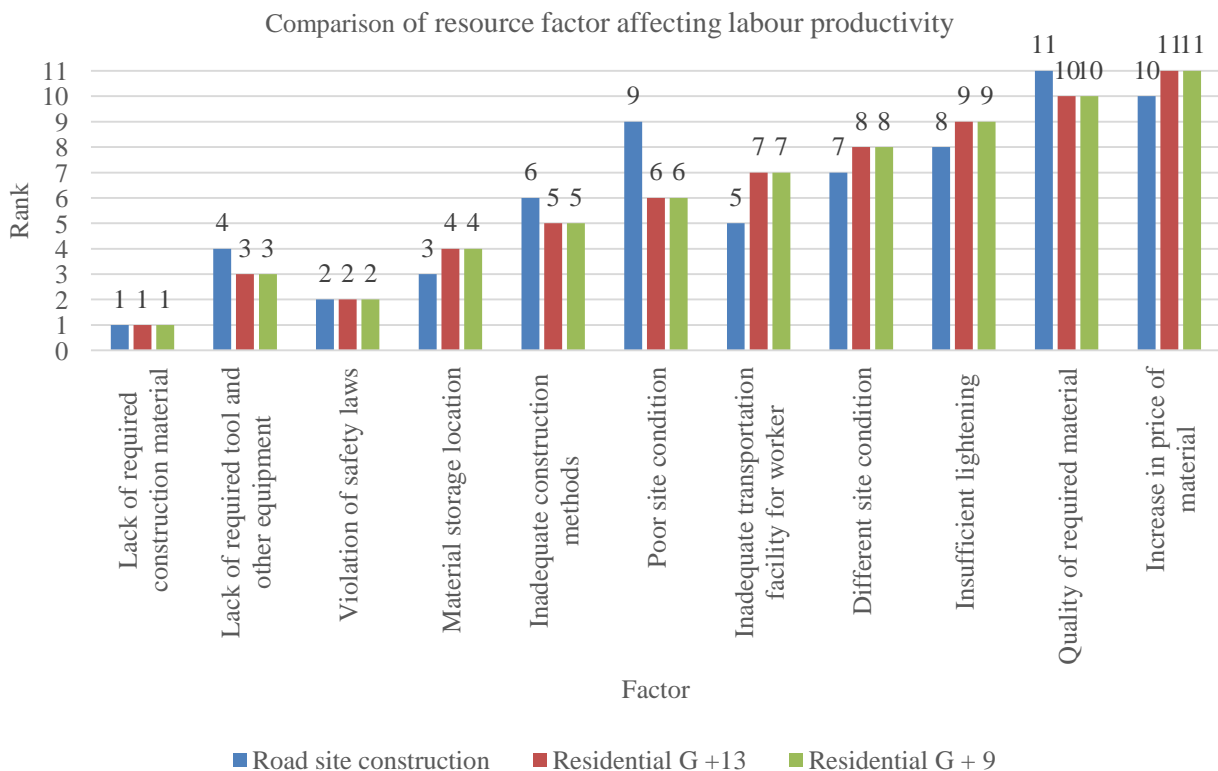
External Factors affecting labour productivity



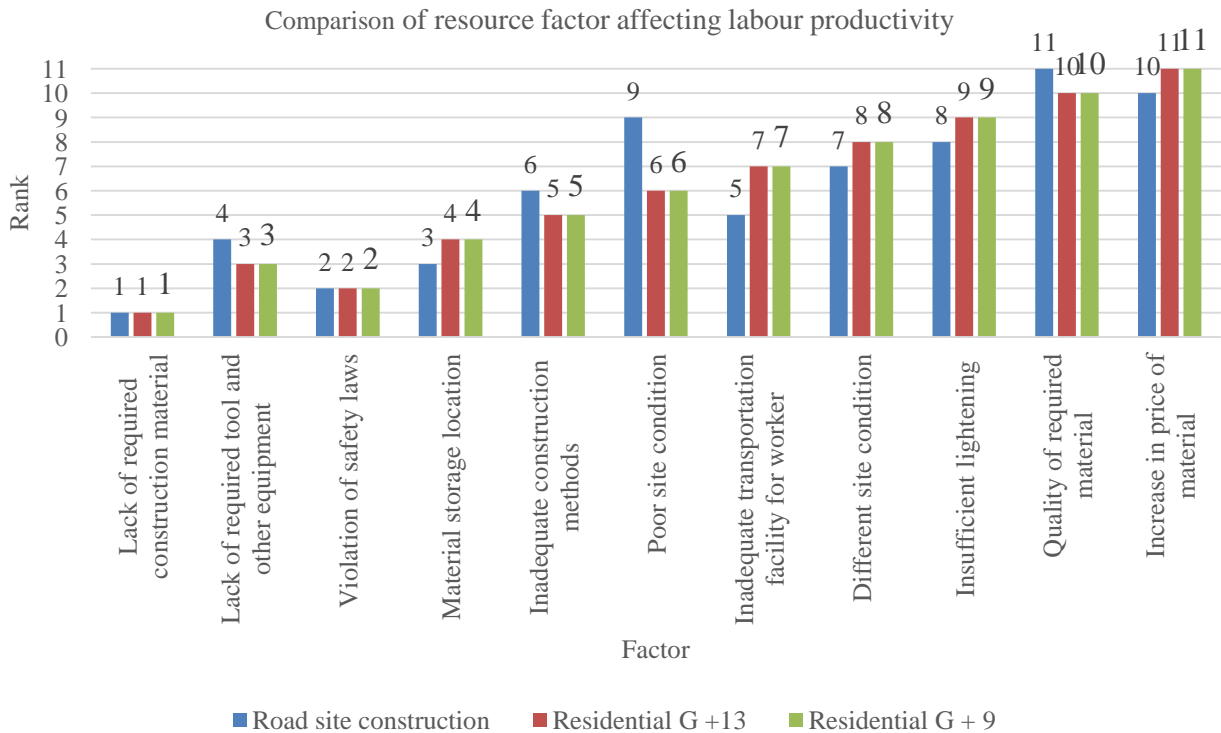
Communication Factors affecting labour productivity



Resource Factors affecting labour productivity



Miscellaneous Factors affecting labour productivity



V. CONCLUSION

In India, the construction industry is considered as one of the key industry. It helps in developing the nation and achieving the goal of society. The economics of construction industry can be influenced by the various factors of the proper study and knowledge of construction industry are not considered in appropriate manner this can also cause the loss of the governing agency. Prior knowledge of labour productivity during construction can save and time. The investment for this project is very high and because of the complexity various factors can highly affect the construction productivity. Thus project can be end up adding even more time and money in order to completed. This research is intended to identify the cause of probable factors affecting labour productivity in road and building construction. This research also point out various factors influencing between two construction site. This study also investigate the all possible factors through a structured questionnaire. The survey result are subjected to analysis and the ranking of factors is calculated using relative importance index. The basic ideas of the resource is to study various factors affecting labour productivity in construction.

Forty six factors were considered for the study which were categorized in five different groups such as manpower, external, communication, resources and miscellaneous group. Total 141 questionnaire were surveyed and out of which 130 were considered. The targeted groups in the study were construction professional. Because project engineer, project managers have vast experience in construction. There adequate experience were a proper suggestion to study about the various construction factors affecting labour productivity.

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