STUDY OF FACTORS AFFECTING LABOUR PRODUCTIVITY IN CONSTRUCTION INDUSTRY

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Abstract: Labour productivity in a construction industry has become most challenging issue in developing as well as developed country. Labours are the main, unique and precious resources in construction industry due to high migration towards construction. Productivity depends on some factors related to construction which improves or negatively affects the labour productivity. This paper attempts to identify the factors that negatively affects the productivity of labours in construction industries in Gwalior region(India) by conducting a questionnaire survey that relates for these problems encountered at construction sites. Eighty Three (83) questionnaire sets are distributed to the construction sites out of which fourty seven(47) were returned (56%). Thirty three (33) factors have taken from the various literature review and categorized into five main group namely- Manpower Group, Financial Group, Material and Equipment Group, Management Group, and External Group in questionnaire survey. The data has been analyzed using AHP and Garrett's Ranking Technique. At the last, most critical factors that are affecting labour productivity are identified. The policy makers, researchers and construction management should focus on these identified factors in order to improve labour productivity.

Keywords: Labour Productivity, construction industry, AHP, Garrett's Ranking Technique.

I. INTRODUCTION

Construction industries even now a days needs huge amount of manpower despite of this growing technical and globalized India. Technology and machinery can substitute some manual work but not all, since labours are basic requirement of any construction industry. Construction industry requires many types of resources and these are classified as money, materials, machine, men and manpower but among all these resources, Human resources is the determinant of the efficiency of construction since human resources play the role of seeing to the effective utilization of the other resources in the construction project. In order to low technology tools and blindly use of large number of uneducated and unskilled workers, construction industries perceived as a low productivity sector and this low productivity affects the overall performance (cost, time, and quality) of any organization.In India there are many challenges for the construction industry but the labour productivity is one of the most important challenge in construction. Every construction project has some difficulties like material, money, tools and construction cost of local contractor. On seeing to the current scenario(situation) of regular downfall of construction labour productivity, it is highly necessary to identify the factors which affect the labour productivity and then work out on the critical ones out of the available factors.

II. OBJECTIVE OF THE STUDY

This study includes the following main objectives:

- To identify the factors affecting labour productivity in construction industries in Gwalior region of India.
- To give the ranking of all these factors by using AHP (analytic hierarchy process) and Garrett's Ranking Technique.
- To give recommendations and conclusion.

III. RESEARCH METHODOLOGY

This research study is totally based on a survey designed for gathering all necessary information in an effective way. This survey presenting 33 productivity factors taken from the previous literature review related to work on construction productivity. These factors were categorized into (5) five main groups based on previous literature and as advised by experts: Manpower, Financial, Material and Equipment, Management, and External factors. All the factors then tabulated in two types of questionnaire based on two different approaches used.

1. For Analytical Hierarchy Process(AHP), the questionnaire include comparison of factors from 1(Equal importance) to 9(Absolute importance) scale.
2. For Garrett's Ranking Technique, respondent have been asked to assign the rank of factors from 1(Not significant) to 5(Very significant).

The questionnaire is divided into two main parts.

First part is about general information regarding the company, and detail about the experts of that company who were requested to answer the question pertaining to their experience in construction industries.

Second part includes the list of 33 identified factors that affects labour productivity in construction.

TABLE 1: List of factors affecting labour productivity in construction

NO.	FACTORS	SUB FACTORS	ABBR.
1.	MAN POWER		
A.		Lack of labour experience	LLE
B.		Labour disloyalty	LD

C.		Misunderstanding among labour	MAL
D.		Increase of labour age	ILA
E.		Labour fatigue	LF
F.		Labour personal problem	LPP
G.		Labour dissatisfaction	LDF
2.	FINANCIAL		
A.		Payment delay by contractor to labour	PDCL
B.		Low wages	LW
C.		Lack of financial motivational system	LFMS
D.		Lack of place for eating and relaxation	LPER
E.		Lack of first aid	LFA
F.		Financial condition of contractor	FCC
G.		Lack of incentive scheme	LIS
3.	MATERIAL AND EQUIPMENT		
A.		Material shortage	MS
B.		Delay in delivery of material tools or equipment	DDMTE
C.		Tools and equipment shortage	TES
D.		Unsuitability of materials storage location	UMSL
E.		Low quality of raw materials	LQRM
F.		Old and inefficient equipment	OIE
G.		Disruption of power and water supply	DPWS
4.	MANAGEMENT		
A.		Lack of labour supervision	LLS
B.		Misunderstanding between labour and superintendent	MBLS
C.		Inspection delay	ID
D.		Frequent change in orders	FCO
E.		Poor site management	PSM
F.		Rework	_
G.		Accidents as a result of poor site safety programme	ARPSP
5.	EXTERNAL		
A.		Weather changes	WC
B.		High wind	HW
C.		Worker education	WE
D.		Natural disaster	ND
E.		Order variation	OV

IV. DATA ANALYSIS APPROACHES

Following are the data analysis approaches:

Analytic Hierarchy Process(AHP): The Analytic Hierarchy Process (AHP) is introduced by **Satty**(1980) and quite often is reffered to, as the **Satty method**.It is popular and widely used, in decision making and in a wide range of applications.

Analytic Hierarchy Process is a multiple criteria decision making tool. This is an eigenvalue approach to the pairwise comparisons. This method also provides a methodology to caliberate the numeric scale for the measurement of qualitative as well as quantitative performance. Analytic hierarchy process requires a pairwise n(n-1)/2 comparison between the correspndent factors, where n indicates the number of factors. These comparisons are used to make the matrices to obtain the

priorities ranking of factors for making decision. In matrices all the diagonal elements are equal to 1 and the other elements would simply be the reciprocals of the earlier comparison. If the comparisons are not consistent, then the result and comparison will be revised. After making consistent comparison it is necessary to perform the calculation to find the maximum Eigenvalue, Consistency index CI, Consistency ratio CR and normalized values for each criteria/alternative. If the max Eigenvalue, consistency index and consistency ratio are become satisfied then decision would be take on the basis of normalized values, otherwise the procedure would be repeat till these values lie in a desired range.

Garrett's Ranking Technique: Garrett's Ranking Technique is used to find out very significant factors which influences the respondent. According to this method, respondents have been asked to assign the rank for all factors and the outcome of such ranking have been converted into score value with the help of the following formula:

Percent Position=100(Rij-0.5)/Nj

Where,

Rij=Rank given for the i^{th} variable by j^{th} respondents.

Nj=Number of variable ranked by J^{th} respondents.

With the help of Garrett's Table, the percent position estimated is converted into score value. then for each factor, the score of each individual are added and then total value of scores and mean value of score is calculated. The factors having highest mean value is considered to be the very important factor.

V. RESULTS AND DISCUSSION

The data have been collected with the help of questionnaires which were sent to the construction projects in Gwalior region (India). Total 83 questionnaires set were sent to get the respondents' opinion. The data were collected in about one and half month in the calendar year 2017. A total number of 47 questionnaire sets were successfully received. Table 2 shows the statistical data of questionnaires sent and received and Table 3 shows the job title of respondents.

Table 2: Questionnaires sent and received

	No.	Percentage of total(%)
Total questionnaires sent	**83**	**100**
Total questionnaires returned	**47**	**56.6**

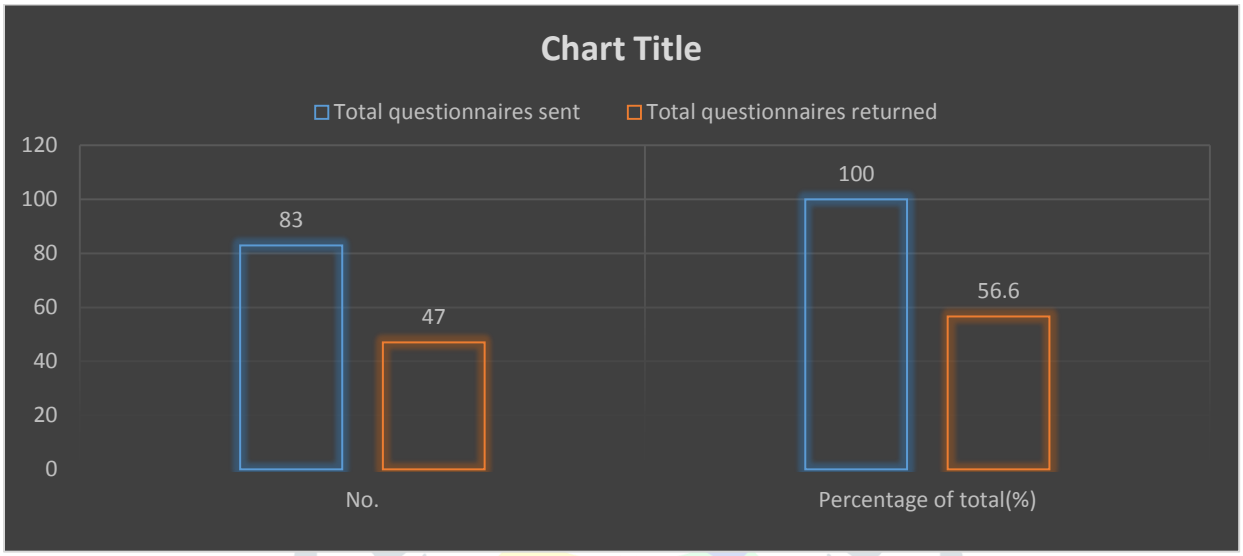

Table 3: The job title of 47 respondents

JOB TITLE OF RESPONDENT	NUMBER OF RESPONDENT
PROJECT MANAGER	06
CONTRACTOR	09
SITE ENGINEER	22
JUNIOR ENGINEER	03
OTHERS(SUPERVISOR, ARCHITECT,EIC,GOV, PROJECT ENGG.)	07

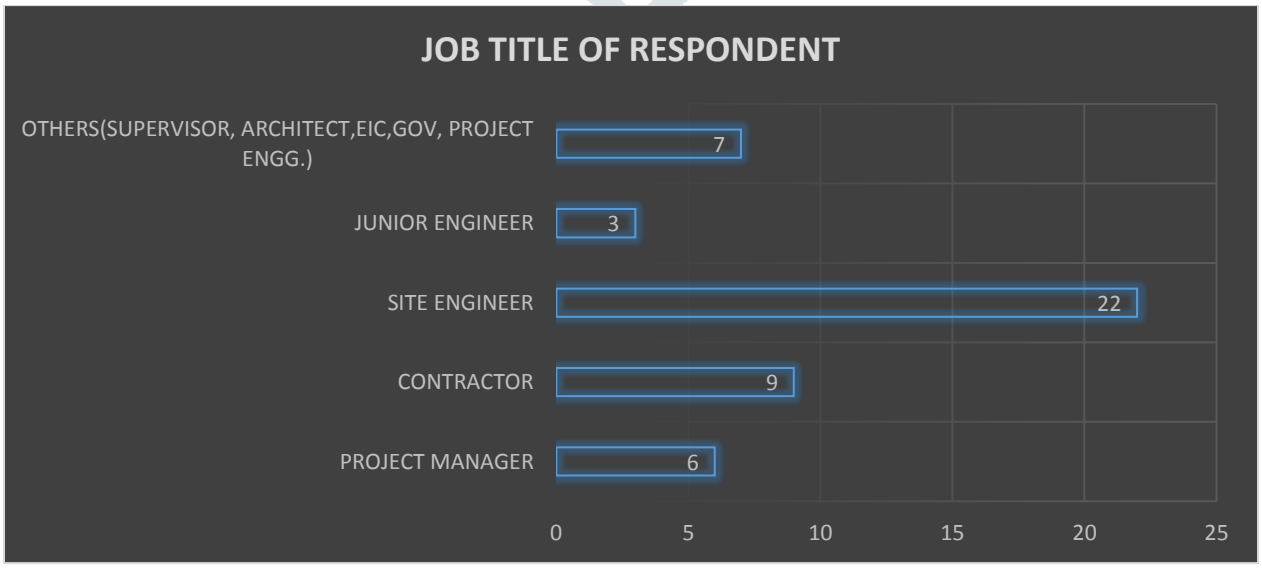

TABLE 4: MAN POWER FACTORS

SR.NO	FACTORS	AHP RANK	GARRETT'S RANK
1	MISUNDERSTANDING AMONG LABOUR	I	I
2	LABOUR FATIGUE	IV	II
3	LABOUR PERSONAL PROBLEM	V	III
4	LABOUR DISSATISFACTION	II	IV
5	LABOUR DISLOYALTY	III	V

According to AHP and Garrett's Ranking Technique all the five main groups' sub factors which negatively affecting labour productivity are same but at different ranking position .Some factors are showing contradiction in ranking position and some are not like misunderstanding among labour has high weightage and shows the first ranking position by both technique. According to AHP, labour dissatisfaction and labour disloyalty and according to Garrett's, labour fatigue and labour personal problem shows the moderate impact on labour productivity and shows the second and third ranking in their particular technique in manpower group (table 4). Labour fatigue and labour personal problem shows fourth and fifth rank in AHP whereas labour dissatisfaction and labour disloyalty shows the fourth and fifth rank in Garrett.

TABLE 5: FINANCIAL FACTORS

SR.NO	FACTORS	AHP RANK	GARRETT'S RANK
1	LACK OF FINANCIAL MOTIVATIONAL SYSTEM	IV	I
2	LACK OF FIRST AID	II	II
3	LACK OF INCENTIVE SCHEMES	III	III
4	PAYMENT DELAY BY CONTRACTOR TO LABOUR	V	IV
5	FINANCIAL CONDITION OF CONTRACTOR	I	V

In the financial group (table 5) two factors lack of first aid and lack of incentive schemes are at same ranking position and showing moderate impact on labour productivity and got second and third ranking position by both technique.

According to AHP-financial condition of contractor shows the high impact on labour productivity and having first ranking position, whereas lack of financial motivational system and payment delay by contractor to labour show the low impact and having at fourth and fifth rank.

According to Garrett's Ranking-lack of financial motivational system has high impact for reducing labour productivity and got first rank, other two factors payment delay by contractor to labour and financial condition of contractor showing low impact on labour productivity and got fourth and fifth rank.

TABLE 6: MATERIAL AND EQUIPMENT FACTORS

SR.NO	FACTORS	AHP RANK	GARRETT'S RANK
1	LOW QUALITY OF RAW MATERIALS	I	I
2	OLD AND INEFFICIENT EQUIPMENT	III	II
3	MATERIAL SHORTAGE	V	III
4	DISRUPTION OF POWER AND WATER SUPPLY	II	IV
5	TOOLS AND EQUIPMENT SHORTAGE	IV	V

Low quality of raw materials has high weightage in material and equipment group and having the first ranking position in both the technique in material and equipment group (table 6).

According to AHP Ranking-disruption of power and water supply and old and inefficient equipment shows moderate impact on labour productivity with the ranking position second and third. Tools and equipment shortage and material shortage shows low impact with ranking position of fourth and fifth.

According to Garrett's Ranking-old and inefficient equipment and material shortage showing moderate impact with ranking position second and third as well as disruption of power and water supply and tools and equipment shortage shows low impact with ranking position of fourth and fifth.

TABLE 7: MANAGEMENT FACTORS

SR.NO	FACTORS	AHP RANK	GARRETT'S RANK
1	POOR SITE MANAGEMENT	II	I
2	INSPECTION DELAY	IV	II
3	LACK OF LABOUR SUPERVISION	III	III
4	MISUNDERSTANDING BETWEEN LABOUR AND SUPERINTENDENT	V	IV
5	ACCIDENTS AS A RESULT OF POOR SITE SAFETY PROGRAM	I	V

Management group (table 7) showing lack of labour supervision at the same third ranking position with moderate impact towards reducing labour productivity.

According to AHP Ranking-accidents as a result of poor site safety program shows first ranking position with high impact for affecting labour productivity, poor site management has also high impact with ranking position of second rank. Inspection delay and misunderstanding between labour and superintendent shows low impact with position of fourth and fifth rank.

According to Garrett's ranking-poor site management and inspection delay shows first and second ranking with high impact and misunderstanding between labour and superintendent and accidents as a result of poor site safety program shows the fourth and fifth ranking position with low impact.

TABLE 8: EXTERNAL FACTORS

SR.NO	FACTORS	AHP RANK	GARRETT'S RANK
1	WORKER EDUCATION	III	I
2	HIGH WIND	V	II
3	WEATHER CHANGES	IV	III
4	ORDER VARIATION	II	IV
5	NATURAL DISASTER	I	V

According to AHP and Garrett's ranking all the five factors in external group(table 8) are analyzed and ranked, all the factors shows different ranking position to each other after applying both technique. AHP shows natural disaster and order variation has high impact on labour productivity with ranking position of first and second rank whereas Garrett's ranking shows worker education and high wind have high impact with ranking position first and second rank.

According to AHP Ranking –worker education, weather changes and high wind have moderate and low effect with their ranking position of third, fourth and fifth rank toward reducing labour productivity.

According to Garrett's ranking –weather changes, order variation and natural disaster have moderate and low impact on labour productivity with ranking position third, fourth and fifth rank.

VI. CONCLUSION AND RECOMMENDATION

In this study data are analyzed through AHP and Garrett's Ranking Technique. Finding from this, study reveals that there is a contradiction in critical factors ranking by two techniques. On the seeing of result and based on discussion it is concluded that the identified critical factors significantly affects the labour productivity in the construction projects. The labour working in this sector feels discomfort because of payment delay, financial motivation, lack of incentive schemes, accidents. Therefore they put less effort towards the assigned activity. The main stakeholder of the industry are of the opinion that their companies do not support labours in their problems. The constructors should think on this critical issue. They should introduce different labour motivation policies to enhance and improve the motivation level of the workers. The due attention should be given to labour by supervisor to understand and solve their problems according to company policies. Training and workshop programs should be introduced to train the workers to enhance their skills related to construction methods, tools and health safety practices. Timely payment of salaries, bonuses, rewards and due appreciation is necessary to enhance labour productivity in construction projects of Gwalior region (India).

Changes in orders and order variation during the project causes low productivity. These should be discussed properly before the starting of project. Materials and tools shortage lead to low productivity. The materials and tools should be supplied on time and a permanent arrangement should be made for material supply. Continuous work without proper break causes stress and fatigue and overwork consequently affecting productivity. The project managers should make the plan in such a way as the worker should not face work stress and overwork.

In absence of proper health and safety practices like first aid, place for eating and relaxation, water and light supply lead to loss of labour productivity, these practices should be adopted and proper human resources should be deployed to monitor it. Poor site management, lack of labour supervision, and inspection delay causes low productivity. Worker on construction sector faces difficulty working on height because of improper work management, insecure scaffold which causes more and more accidents at the site. Hence all of these issue should be addressed properly. Proper work conditions at site with due consideration of health and safety are necessary to enhance labour productivity.

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