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IMPROVEMENT OF CONSTRUCTION LABOR PRODUCTIVITY IN CHAMBAL REGION

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ABSTRACT: *In construction industry labor cost 30 to 50% of total cost of project. In Chambal Region (M.P.) construction industry is facing the problems of low productivity. The aim of this study, therefore, is to identify and rank the relative importance of factors perceived to affect labor productivity on construction sites. To achieve this objective, professional such as Project Manager, Project Engineer, Site Engineer, Architect, Assistant Project Manager, Assistance Project Engineer and others who work on the project from management to execution level, were invited to participate in a questionnaire survey. In the questionnaire, factors were divided in four primary groups such as (1) management; (2) technological; (3) human/labor; and (4) external. After the analysis of the questionnaire, we find top ten following factors which effect on construction labor productivity in Chambal Region such as: (1) Clarification in Technical Specifications; (2) Labor Supervisions; (3) Method of construction; (4) Delay in Payment; (5) Labor Fatigue; (6) lack of construction managers, leadership; (7) extents of variations/change order during executions; (8) late arrival, early quit, and frequent unscheduled breaks; (9) Labor Skill; and (10) Availability of Experienced Labor. The results obtained can be used by the construction professional to take care of labor productivity in construction projects.*

INTRODUCTION

Several studies have been conducted on construction labor productivity in past time. Some studies related to find the factors affected on labor productivity in the construction industry. The basic aim of the study was calculated and measured affected by these factors in planning and scheduling of the construction project.
But we could not get any standardized method for calculated and measured loss of labor productivity in the construction industry from past studies.
Detailed studies of actual labor cost are required for achieving better labor productivity. All the labor do not affect same level on productivity. Different type's labor has different affecting level of productivity. The basic and main concern of the project for any organization are high productivity, low cost, better quality, and last time. We cannot imagine about to get better productivity without high technology machine and tools, skilled manpower and easy availability of materials and another important point is better management of the construction site.
In today's era, good labor productivity is the biggest point of perturbing of any organizations. There are a number of ways defined productivity. Several researchers defined productivity in his own ways. In general productivity is the ratio of output and input. Resources are input in the construction industry and ready to use a structure is output.
Construction industry depends on 3-M resources. There are means of 3-M is manpower, machine and materials. 3-M are the basic input in the construction industry. Manpower is a main and precious resource for the construction industry. If we consider only manpower as an input in productivity, then productivity will be called construction labor productivity. Construction labor productivity is most frequently research topic for construction field researchers. A reason behind it because of labor cost are around 30-50% of the total cost of the project.
In Chambal Region, the construction industry facing many challenges, but one of the most important is low productivity. Mostly project in Chambal Region is running over budget. Despite all the new technological advancements, easy availability of construction materials, tools and financially strong local contractors.
Pick out and rank the relative importance factors affected construction labor productivity in Chambal region is the objective of this study, so that the result can be used for those people who want to start a mega project and have not a sufficient knowledge about the construction industry of Chambal Region. This study will also be helpful for the experience construction professional for executing the project with good labor productivity.

In the general definition of productivity is the ratio of output and input. There are a few definitions of productivity

(1) According to Borcherding and Liou 1986, "productivity" express the relationship between outputs and inputs.
(2) According to Drewin 1982, the definition of labor productivity is the amount of good and services produced by a productive factor (manpower) in the unit of time.

(3) According to Sumnath 1984, the definition of productivity as a quotient obtained by dividing the output by one of the productivity factors.
(4) According to Adrian 1987, the productivity as "dollars of output per person-hour of labor productivity."
(5) According to Jarkas 2005, the productivity as the "faculty to produce," that is, the desire to produce.

Productivity further classified into two types:-

A. TOTAL FACTOR PRODUCTIVITY (TFP)
B. PARTIAL FACTOR PRODUCTIVITY (PFP)

Firstly Total Factor Productivity is defined as the ratio of outputs to the summation of inputs, and is expressed as:-

TFP=TOTAL OUTPUT/SUM OF TOTAL INPUT

Partial Factor Productivity establishes a relationship between outputs and a single or selected inputs. Equation 1a, 1b and 1c expressed example of partial factor productivity.

LABOR PRODUCTIVITY=
OUTPUT QUANTITY /LABOR HOURS… 1a

CAPITAL PRODUCTIVITY=
OUTPUT QUANTITY /CAPITAL INPUT… 1b

EQUIPMENT PRODUCTIVITY=
OUTPUTQUANTITY/EQUIPMENTS HOURS… 1c

FACTOR AFFECTING ON LABOR PRODUCTIVITY

Forty Five factors identify by literature survey, which affected labor productivity are classified under the four primary groups (1) Management Group (2) Technological Group (3) Human/Labor Group (4) External Group.

A. MANAGEMENT GROUP

Management group have 24 following factors:-

1. Labor Supervision
2. Method of Construction
3. Delay in Payment
4. Lack of Construction Manager Leadership
5. Late Arrival, Early Quit and Frequent Unscheduled Breaks.
6. Sequence of Work
7. Communications Between Site Management and Labor
8. Storage Locations
9. Labor Interference and Congestion
10. Incentive Scheme
11. Unrealistic Scheduling and Expectation of Labor Performance
12. Lack of Recognition Program
13. Unavailability of Suitable Tools
14. Proportions of Work Subcontracted
15. Delay in Inspection by Site Management
16. Material Shortage
17. Lack of Training Offered to Operatives
18. Lack of Periodical Meeting with Crew Leader
19. Lack of Suitable Rest Area Offered to labor on the site
20. Crew Size and Composition
21. Working Overtime
22. Lack of Providing Labor With Transportations
23. Owner's Representative Intervention with Site Management and Operatives
24. Accidents as a Result of Poor Site Safety Program

B. TECHNOLOGICAL GROUP

Technological group have 12 following factors:-

1. Clarification in Technical Specifications
2. Extents of Variations/Change Order During Executions
3. Team Spirits
4. Delay in Responding to Requests for Information's
5. Rework
6. Stringent Inspection by The Engineer
7. Delay in Inspection by The Engineer
8. Site Restricted Access
9. Design, Complexity Level
10. Compatibility and Consistency Among Contract Documents
11. Confinement of Working Space
12. Layout of Site

C. HUMAN/LABOR GROUP

The human / Labor group have 4 following factors:-

1. Labor Fatigue
2. Labor Skill
3. Availability of Experienced Labor
4. Labor Motivation

D. EXTERNAL GROUP

External group have 4 following factors:-

1. High/Low Temperature
2. Sandstorms
3. Rain
4. High Humidity
5. High Winds

METHODOLOGY

A questionnaire survey was carried out among the various construction professionals. The Questionnaire consists of two parts. The first part consists with general information of respondents. Second's part consists with a set of questions targeting the factors affecting labor productivity in the four different groups that is management group, technological group, human/labor group and external group. The responses were to be based on the understanding, knowledge and experience of the respondents and not related to any particular project.

DATA ANALYSIS

During the questionnaire survey, 37 professionals from the construction industry have responded. Table 1 represents the scale used for representation of the effect different factors on labor productivity used in the questionnaire survey.

Table 1 Scale Used for Representation of effect

EFFECT OF FACTOR ON LABOR PRODUCTIVITY					
TYPES OF EFFECT	NO EFFECT	LITTLE EFFECT	MODERATE EFFECT	STRONG EFFECT	VERY STRONG EFFECT
SCALE	1	2	3	4	5
FACTORS	n1	n2	n3	n4	n5

In order to facilitate the study, after the literature review and personal interviews, a plan was formulated for collecting field information and creating an evaluation process and numerical values. R.I.I. method used for analysis the survey results.

$$\textbf{R.I.I.} = \frac{\mathbf{5(n5) +4(n4) +3(n3) +2(n2) +1(n1)}}{\mathbf{5\ (n1+n2+n3+n4+n5)}} \mathbf{X\ 100}$$

Where

n1= number of respondents who selected factor for no effect
n2= number of respondents who selected factor for little effect
n3= number of respondents who selected factor for moderate effect
n4= number of respondents who selected factor for strong effect
n5= number of respondents who selected factor for very strong effect

RESULTS AND DISCUSSION

Based on R.I.I. top ten factors affecting labor productivity in the Chambal Region are presented in table 2.

Table 2 Top Ten Factors Affecting Labor Productivity

RANK	FACTOR	R.I.I.	RELATED GROUP
1	CLARIFICATION IN TECHNICAL SPECIFICATIONS	76.21	TECHNOLOGICAL
2	LABOR SUPERVISION	74.59	MANAGEMENT
3	METHOD OF CONSTRUCTION	74.05	MANAGEMENT
4	DELAY IN PAYMENTS	72.97	MANAGEMENT
5	LABOR FATIGUE	72.43	HUMAN/LABOR
6	LACK OF CONSTRUCTION MANAGERS LEADERSHIP	71.89	MANAGEMENT
7	EXTENTS OF VARITIONS/CHANGE ORDER DURING EXECUTIONS	71.35	TECHNOLOGICAL
8	LATE ARRIVAL, EARLY QUIT AND FREQUENT UNSCHEDULE BREAKS	70.81	MANAGEMENT
9	LABOR SKILLS	69.72	HUMAN/LABOR
10	AVAILABILTY OF EXPERIENCED LABOR	69.18	HUMAN/LABOR

The Clarification in Technical Specifications factor ranked 1st among the 45 factors have R.I.I. 76.21%. So it is the most important factor affecting construction labor productivity in Chambal Region. Lack of clarity in technical specification become a cause disturbance in the work progress. Continuous request for clarification is required in case of unclear and incomplete technical specifications.

Labor Supervision factor ranked 2nd among all 45 factors with R.I.I. 74.59%. The supervisor is a link between managements and workforce. The supervisor is directly responsible for productivity and activity of labors. The supervisor has responsibility to manage the workforce. He is responsible for the work to be complete with time and as per specifications.

The 3rd rank factor is Method of Construction with a R.I.I. 74.05%. Effect of Construction method is related to way of working. It depends on intelligence of people those who work on the project. The wrong method of work is very harmful. It may result in cost and time overrun.

Delay in Payment factor ranked 4th. Without smooth financial flow we cannot imagine good productivity of the project. A time to time payment will motivate labor.

Labor Fatigue factor ranked 5th. Fatigue is created due to long working hours. Fatigue decreases the concentration on work, which reduce the productivity. Fatigue can be reduced by periods of rest.

Lack of Construction Manager's Leadership, with a R.I.I. 71.89% is ranked 6th. It indicates the importance of construction manager's leadership to improve the labor productivity.

Extents of Variation/Change Orders during Execution rank 7th among all45 factors, with R.I.I. 71.35%. Suppose that construction of the wall is completed and after that architect come and say to fix a window on this wall. Obviously the work is to be done again. And it will be effective on labor productivity.
The 8th ranked factor is late arrival, early quit and frequent unscheduled breaks, have R.I.I. 70.81%. There is fixed time to work at the site, if labor comes late, so obviously work will be starting late, if labor quit early from the time so workable time will be short.
Skilled and Availability of Experienced Labor Factor rank 9th and 10th with R.I.I. 69.72% and 69.18% respectively. Specialization and expert in work define a worker to be skilled. Increasing demand of skilled labor due to the use of technology at construction sites such as computerized high tech machine and plant will increase labor productivity.

CONCLUSION AND RECOMMENDATIONS

Basic knowledge of construction labor productivity during execution of a project can save money and time. Investment and risks in the construction industry are very high because of complexity and long lasting duration of projects. Two basic drawbacks of the construction industry are "time overrun and Cost overrun" of the project. Low labor productivity is the basic reason behind these. In the present study all possible factors which may effect on construction labor productivity are identified. Ranking of factors is done using the Relative Important Index method. The basic objective of this study is to study various factors affecting labor productivity in the construction industry in Chambal Region.
Following are the recommendations for improving labor productivity in the construction industry.

I. Detail of every work should be present on site. Every work should be well specified.
II. Effective Labor supervision increases labor productivity. The supervisor should be made responsible for the productivity
III. Construction method should be in such a way so that labor can complete work with more productivity.
IV. Payment should be made timely without delay.
V. Uses of worker should not be more than 8 hours/day and 40 hours/week. Because after the 8 hours efficiency of the worker has been less than 90%, and maybe he will present at site physically but not mentally due to physical fatigue. If we want to use overtime at a site we should use another batch of labor after each 8 hour slots.
VI. Make a group of each task and each group should have a leader. Leader of the group will be responsible for the productivity of his group. Behaviors of leader should be friendly with team members.
VII. To achieve desired results, the time required in implementing change orders should be estimated and scheduled without affecting the project time completion. Regular meetings should be arranged with the project authorities.
VIII. Timetable of workers at the site should be strictly maintained. Engagement of worker in nonproductive task should be less during work time. Special focus should be on late arrival, early quit and frequents break during working time. It can save loss of productivity.
IX. Labor at the site should be skilled and experienced. Good productivity cannot be imagined without skilled and experienced labor.

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