



Labour Productivity Measurement for Industrial Construction Project

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Abstract

The Productivity is that the key subject for any development. In construction area, the reanumber of resources involved such as labour, machinery, material are used for performing the regular activity. The productivity of the any construction company is primary depend upon the effectiveness of manpower, but now days the labour productivity rate is reducing due to allocating the unqualified or inexpert labour, old equipment on work site, affect on complete time & earnings of the construction. The mainof aim of the study is to find out the main factor those are affect on labour productivity by using the surveys & these factor are checked on site observation by using workstudymethod. The activity of productivity is finished by applying a time-and-motion study procedure & identify thatthe issuethataffectingonperiodoftheprojectandvalue

Keywords—Productivity, RII method, labourscheduling,controlling

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Introduction

Construction industry is the biggest industry valued after theagriculture industry .In India the major infrastructure worksuchasroads,bridges,airport,railwaysetcmoreinvestment are used for construction of this activity .Suchwork involves scheduling, oragansing ,planning, monitoringof the resources are in better way to achieve the companygoals. But the current condition the value of the developmentprojectandlengthoftheprojectisrisetonumberof ~~fits~~ Between these issues labour resources is the mostfactor affecting on the performance of the company. Now a daysThe performance of labour are decline due to environmentalcondition,remunerationspolicies,managementsystemetchaveimpact on the productivity .The human resources are show asignificantroleingrowthofthedevelopmentfirm.Onconstruction site the contractor are allocating the inexpertlabour for performing the daily construction activity withouthired the skilled labour from outside the zone, which mayresult in lower the labourproductivity.

Upgrading in theproductivity will result in contractor or company takenmore construction project for development. This result thecontractorororganizationmakefamousamongtheparticipant .So measuring the labour productivity onsite is essential for increasing the growth of the firm. The aimof the study is to identify the top most factors affect on labourproductivity by survey & rank the top mostfactors by Relative importance index. The Work &Time studymethod are used to measure the onsite productivity by takingthetimeforcompletionoftheconstructionactionby stopwatchmethod&setnewprocedureforcompletionofa ctivity by changing the labour as per their skills, knowledge,recent technology for performing the activity .After acceptingthenewstandardsithasbeenseenthatthetotalcost stand Periodoftheconstructionactivityisreduced.Theorganiza tionshouldbetakenstudyononsitelabourproductivityan dnewstandardsforimprovingtheproductivityisneededto day.

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I. OBJECTIVE

To study the labour productivity measurement the following are the objectives are taken

1. To study the various factors affecting on labour productivity in industry construction project.
2. To measure the productivity on industrial construction project.
3. To analyse the factors affecting on labour productivity.
4. To provide best solution for enhancement of productivity.

I. PROPOSED METHODOLOGY

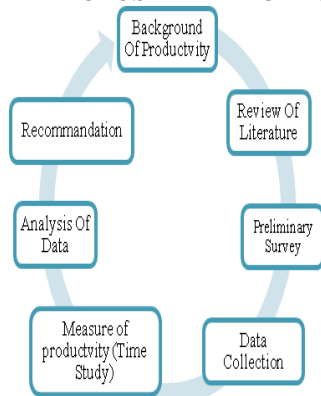


Fig.1 flowchart of proposed methodology

II. RESEARCH METHODOLOGY

A. Research Methodology:

A initial survey consists of fieldwork & collection of data from the various sources to identify the current issue in the construction sector. Survey is nothing but collection of data by asking question to respondents. The data collection processes consist of two steps i.e. by questionnaire survey and by personal interview. Out of these questionnaire survey is quite popular, self-analysis tool with web-design questions with appropriate response.

B. Types of Research :

Qualitative research is benefit in gaining the knowledge about problem under study. These types of research aim at discovering the fundamental motives and desires, using depth of interview for the purposes. Qualitative research is especially important in the behavioral science where the aim is to discover the underlying motives of human behavior. Quantitative research is based on quantitative measurement.

C. Sample Design:

A sample design is defined as the plan is control before any data is actually collected for obtaining a sample from given population. Model design is the number of item that involved in sample. The sample

design is determined before the data is taken. Sampling is important part in sample design. Sampling is describes as taken certain item in given population. In sample design, there are two approaches such as Non-Probability sampling and Probability sampling. Out of two procedures we have selected Non-Probability sampling for this research.

D. Convenient sampling :

Non-Probability sampling that involves the sample being taken from that part of the population. For this study we select the suitable sampling for collection of the data from population

F. General assumption:

To study the labour productivity measurement on industrial construction, we have made the some assumption of the factors affecting on labour productivity with respect to cost and work.

1) Performance of labour:

Performance of labour is directly proportional to work and inversely proportional to period.

$$PLaW \dots\dots\dots (1)$$

$$PLa1/T \dots\dots\dots (2)$$

2) Use of recent Equipment:

Use of current Equipment's are directly proportional to work and inversely proportional to time.

$$UEaW \dots\dots\dots (3)$$

$$UE (1/T) \dots\dots\dots (4)$$

3) Location of material:

Location of resources are directly proportional to work and inversely proportional to time.

$$LMaW \dots\dots\dots (5)$$

$$LMa(1/T) \dots\dots\dots (6)$$

III. DATA COLLECTION

The collection of records is to done by work study is a structure which is examine or investigate the performance of the construction company by applying the setup of the standards for all the activities which held in the organization by proper utilizing the manpower, machinery & material. Company want to achieve better result with reducing the cost of

construction material with the minimum time. This work study can give the standards for the enlightening productivity. This work study is divided into two portions i.e. method study & time study (work measurement).

G: On Site Productivity Measurement:

Method study is defined because it examines the manner of doing work or applying the new method to eliminate the waste of raw material or avoid the needless work which has effect on the performance of work. Method study is additionally mentioned to as methods engineering, or work design which is center on improving men and machine by studying the collection of data. Time study is basically work measurement method which collecting the time for a carry out a new job or action under a condition. The work study method contains following steps: 1) Select the work on which techniques are to be apply. 2) Note down the observation on site with respect to time and work. 3) Examine the collection of data in steps no 2 & 4) Revise the existing methodology by adding new methodology & record time & work. 5) Applying the new criteria after check the alternative in various ways.

The following chart shows the various activities with recording time & work.

Table No I Work measurement Chart for method study

Sr No	Observed activity	Total time	Quantity	labour		
				F	H	S
01	Column Erection	3620	1276 kg	01	10	05
02	Column Erection	3320	1301 kg	01	08	04
03	Brickwork	240	267	nil	06	02
04	Brickwork	240	300	nil	05	02

Table No II Work measurement chart for time study

Sr No	Observed Activity	Time (before implementation)			Time (After implementation)		
01	Lifting of PEB Sections	20.10	19.09	19.30	9.55	10.11	11
02	Bar bending	6.0	8.5	9.13	0.4	1.0	1.0
03	Selection of bar	12.17	7.43	9.49	4.70	4.18	3.37

IV. ANALYSIS OF THE DATA

For the identification of the factor affecting on labour productivity survey are prepared. From this survey all the respondents give their opinion through a Google forum technology. The top most factor affecting on productivity is to find after the relative importance index ranking. These top most factors are noted on site observation. To check these factors, the measurement of all action on site are measure with time & work. The factors are recorded below with their analysis by work study approach.

H. Performance Of Labour:

Productivity of any construction company depends upon the skill of the worker, company policy, age, working condition, environment etc. The skilled labours have abilities such as skill, training, experience, education improving the productivity of the construction firm. The skilled labour is unavailable, the contractor has finishing the activity with use of less skilled labour and it will affect the productivity. The performance of the labour is to be observed on site by using work study method. The time required to finish activity is to be measured with stop-watch. The table no. 2 shows that two cases observed on site such as Placing & Erecting the steel bar along with holding the stirrups with binding wire (size of footing 1.7 m * 1.85 m) are done with worker (foreman, helper, skilled labour) & Brick Work. For case 1. The normal time before changes labour quantity 3620 min. For this action work study approach is used. After the same changes in labour quantity & time is logged by stop-watch. The middle time after changes in labour quantity is 3320 min.

• Productivity Calculation for work for footing

To estimate the Productivity the activity oriented model is reused as below

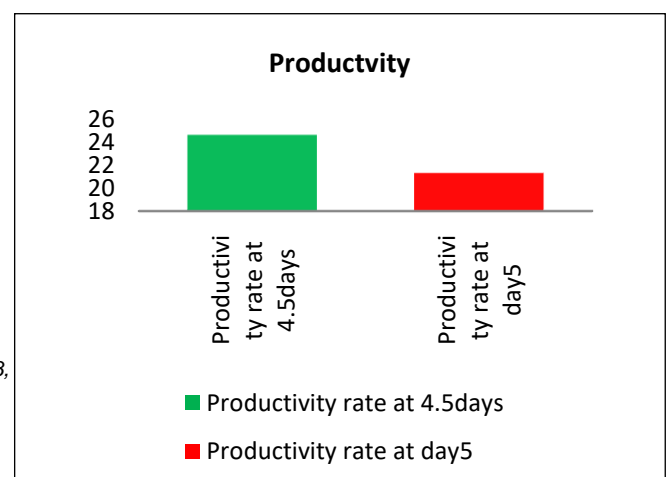
$$\text{Productivity} = \frac{\text{Output}}{\text{Input}}$$

For a Column the overall quantity of steel reinforcement was 1276 KG. The Column erection can complete in 5 days. The operational hour on site 12 hr.

$$\text{Productivity} = 21.26 \text{ kg/hr}$$

For a left over column the total quantity of steel reinforcement was 2016 KG. The footing can complete in 4.5 days. The working hour on site 12 hr

$$\text{Productivity} = 38.3 \text{ kg/hr}$$

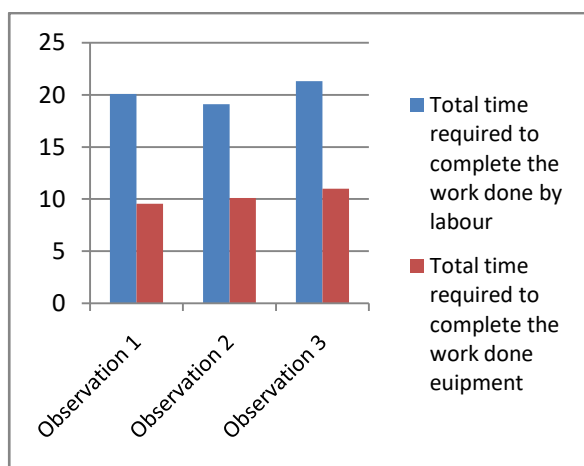


ChartNo: 01 Productivity changes with respect to time

1. USE OF RECENT EQUIPMENT:

The proper finding process for material, tools are playing significant role for performing the productivity. The material, tools or equipment can be used at right place, at right time result in saving the cost and time. For And size can approach to the amount of the equipment, the project manager can be conscious of the major types of equipment utilized in often. The on site productivity can be improved with a proper selection of equipment types, and suitable at the work condition. The table no 3 shows that time required to complete work by labour and recent equipment.

From the below chart it shows that the evaluation between total time taken by labour and equipment at working conditions. From chart no 2 show that lifting and placing of the PEB Sections at height of 5.5m has done with crane and labour. The time taken to lift and place the reinforcement by crane & labour is 10.22 mins. and 20.63 mins. From chart no.3 describe that bending of reinforcement at an angle of 90° , 45° , 60° has done by bending apparatus and labour. The time required to bending of reinforcement at an angle of 90° , 45° , 60° by bending machine and labour is 1.02 mins and 8.22 mins. By appropriate procurement process the productivity can be improved with less time.

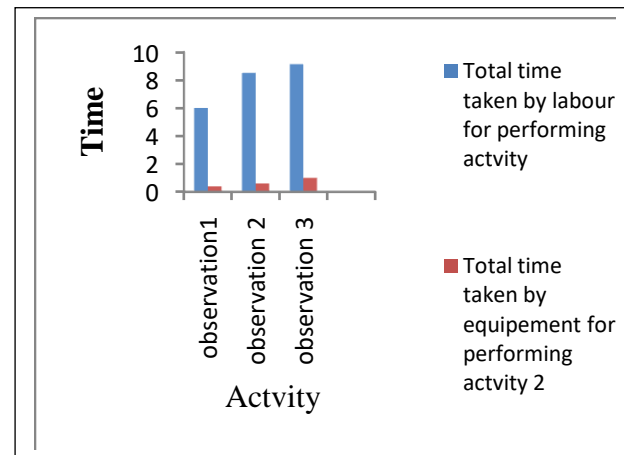


ChartNo2 Time taken by labour and equipments (crane)

J. Location Of Material:

Proper material management is key feature of the construction company. The productivity can go decreasing if the required material, tools & equipment are not

selection
of equipment
types



available at particular occasions of time & location. The material storage location has more important impact on productivity because the labour requires the extra time to find the required material from the appropriate location.

Chartno03 Time taken by labour and equipment (barbending)

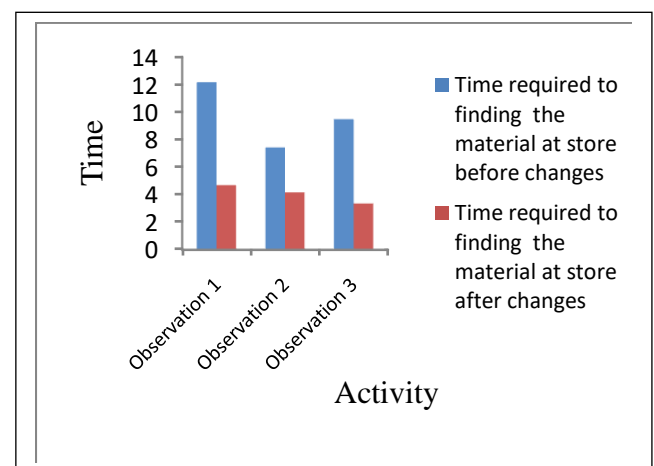


Chart No.04 Time required completing the work done by before & after application

It was observed that all the steel reinforcement are not stored properly and away from work location. The average time required to find the material at store before changes in site layout is 9.83 min. The required steel bar and stirrups are placed distinctly and the average time required to find the material at store after changes in site layout is 8.08 min. The complete time saving is 2.02 mins. From this result the site of material is near by working area as well as the material is stored with proper way. The company & classification of the material are done so that it can be easily assessable to worker. The store in charge should take record of the received material and reporting the transfer material with inspection.

VII.RESULT

The top most factor affecting on labour productivity are identify on site observation. The observation are taken by using work study method .In this method the

Performance Of Labour :

Observation 1:

The performance of labour is measuring on site. First observation, the placing & erection activity of Column was finished within in 5 days with productivity rate was 21.26 kg/hr& price of labour was 41,500/-. Second observation, the placing & erection action was completed within in 4.5 days with productivity rate was 24.54 kg/hr. cost of labour was 30,300/-. Due to changes in labours the efficiency are increased by 3.28% and cost saving around 11,200/-

I Use Of Equipments :

Observation 2 .

Second observation was taken on brickwork of office, toilet blocks and outer wall of factory. Before application quantity of brickwork is 267 Sqm. with two skilled & 6 unskilled labour . The productivity before implementation was 66.75 Sqm./hr. After application the quantity of brickwork is 300 Sqm with two skilled & 5 unskilled labour . The productivity after application was 75 Sqm./hr. So that the productivity rate are changed around 31%. From above observation, it is concluded that the performance of labour is directly proportional to work and inversely proportional to time.

Observation 3.

Usage of the equipment are play significant role for any performing construction site with a time saving. The observation are taken, labour are lifting & placing PEB Sections at height of 5.5 m from ground surface. The average time for this activity is 20.16 min. The same observation is taken instead of lifting & placing of steel bar by crane. The average time for this activity is 10.39 min .By matching this activity the total time saving is 9.77 min.

Location Of Material:

Observation 5:

Before application the average time required for collecting the material on are 10.09 min. After application average time required for collecting the material on site are 4.08 min. The total time saving are 7.22 min. From above observation, it is accomplish that the Location of material is directly proportional to work and inversely proportional to time.

VIII.RECOMMENDATIONS

observation are taken with respect to work & time of such activity before & after implementation .The results of such activity are as below

Usually the progress of any construction company may affect due to argument between owner, contractor and labour. The environment of the construction firm should be managed so that the performance of the construction firm is to be stable. The project can completed within the period, cost of project will lowered also contractor increases more work through a tendering process. It is necessary to study the problem of particular task on site and give the corrective measure on site. Following are the recommendation for those factors effects on productivity.

L.Performance Of Labour :

The company should have check the worker age, wages, worker effort, work environment at the time of supervision. The performance of the labour should amount with changing the semi-skilled labour with skilled labour. While staffing process contractor should have check the skill of the worker .At the time of allotting the work to labour, contractor should decide the categories of labour as per skill, age and work effort. The contractor should have assigned the work time to the workers. If the work environment was not appropriate to the worker those hired from outside the area, contractor should study the the environment and hired the workers form the workplace area.

M.UseOf Recent Equipment:

The use of the current equipment should be introduced at work site. This can help for dipping time and cost and increase the labour productivity .The company should consider the size, cost, efficiency of the equipment at the process of procurement & also study the suitability of the equipment with respect to working situations.

N.Location Of Material :

Buying material should store at the workplace so it can accessible to the worker, so that the time required for collecting material is less hereafter the productivity is increased. The material should be deposited at close to constructed site. The store in charge should take record of the received material and reporting the sending material with inspection also the material are stored according to the company and classification .The Supervisor or Engineer should prepare the required material list for performing the next activity on site to the store manager through the process of request letter. So that while performing the activity on succeeding day ,the material ate located

near to the workplace such that the time required for discovering material is less.

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