PRODUCTIVITY ANALYSIS OF CONSTRUCTION ACTIVITIES

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Abstract : Productivity is a important feature of the construction business that may be used as a measure of production efficiency. Effective construction resource management can lead to increased production, which can help save money and time. Construction is a labor-intensive business. It places a high value on its employees' abilities. Industry's most important asset is its workforce. It is critical to increase labour productivity in order to increase production efficiency. The construction industry has always been concerned about project productivity declining. The goal of this project is to investigate the significance of measuring labour productivity in the construction business in the Mumbai region after identifying the elements that influence labour productivity.

IndexTerms – **Work sampling,Labour produtivity,Work study,Direct Work.**

I. INTRODUCTION

In the construction sector, productivity is crucial. Since low productivity and stable expansion has been a source of major worry in the construction sector in recent years. "The construction business had a productivity decrease," it is stated. Many scholars throughout the world are saying the same thing, thus it is important to pay attention to it. Because so many elements are involved, increasing productivity is a difficult endeavour. These are both subjective and objective considerations. The influence of these parameters varies from location to location, condition to condition, weathering condition to weathering condition, and so on. When it comes to the potential to influence the project, there are aspects that are both little and major. One of the most variable and costly costs is labour.

Constructed items that are less expensive to manufacture and perform better in terms of durability and upkeep throughout time. Greater efficiency in the building process, improved architectural and engineering design, and the utilisation of higher performing components supplied by manufacturers can all help to achieve this aim. The ratio of output to all or portion of the resources utilised to achieve that output is called productivity. There are two types of output: homogeneous and heterogeneous. Labor, capital, energy, raw materials, and so on are examples of resources. The productivity ratio can be used to compare output to all resources consumed or to a specific item like labour units, capital, or energy. Labor productivity is the most prevalent single factor productivity indicator. It can be used if the output is homogeneous (for example, the amount of concrete poured).

Inadequate productivity is caused by a number of factors, one of which is poor organisation. The pace and size of decision-making and procurement procedures are insufficient.

•Insufficient communication. Subcontractors, contractors, and owners do not have a consistent idea of how the project is progressing at any given moment due to reporting inconsistencies.

•Performance management issues. Because of a lack of communication and responsibility, unresolved issues accumulate.

•Misconceptions about facts. The contract is usually negotiated by the procurement team, and it is virtually always complex and convoluted. When an issue arises, project managers may be unsure of what to do.

1.1. Need for Study

This study has been carried out to analyses factor affecting productivity of construction industry. In this study work sampling was carried out on selected construction activities in order to determine proportion of time spend by worker on define categories of activity. Comparative analysis of work sampling data, productivity of activities and personal interviews help in identifying factor affecting productivity. Construction projects are unique. The results are based on study carried out on two sites in particular area.

1.2. Scope of Work

Work sampling is widely accepted tool to measure work time for direct, indirect and no work conditions. Method is easy to perform also economical. It also consume less time. This exercise can be performing on larger scale for more number of projects on more number of activities. It will give more accurate results. Its ease in conduction and ability to produce quick results helps in identifying factors responsible for low productivity which then can be eliminated. It can be used in different location for different

projects for determining factor responsible for no work conditions and eliminating them. It will improve productivity as productivity is inversely proportional to no work condition.

II. OBJECTIVES

- Finding out the factors which can increase productivity of construction activities.
- To do work sampling for various construction activities.
- To improve operational efficiency, productivity, tool time and support time and to decrease the idle time
- To analyze the productivity of construction activities.

III. METHODOLOGY

3.1. Literature Review

Literature review has been done from previously published research papers on this topic from various international journals as well as relevant books and researched thesis to understand previous work done on this kind of project.

3.2. Data Collection

Data collection has been carried out by questionnaire survey from various executives who have worked in similar kind of projects and within similar region.

3.3. Data Analysis

Data analysis has been done from collected data by qualitative analysis and quantitative analysis as well as frequency analysis so that proper importance index to factor can be achieved.

3.1 Literature Review

3.1.1. Analysis of Labour Productivity in Building Construction with Special Reference to Residential Project.Vivek Kumar Chandravanshi, Mr. Mukund P. Chougale (2020).International Journal for Research in Engineering Application & Management (IJREAM) ISSN : 2454-9150 Vol-06, Issue-07.

One of the most vital and important aspects of any construction project is labour productivity. In any construction project, effective use and attention to the factors that affect labour productivity, as well as a positive practise, regulate the cost, quality, and time. The labourer and the management are the most important components in a construction project; it is they who have a direct impact on issues such as strikes, accidents, and disputes between labourers and management, as well as building design changes. This is also the direct cause of budget fluctuations of 60% or more of the project's total budget. As a result, managing the things that affect the labourer, as well as anything that affects him through management, is an important part of any effective project execution. If it is not adequately managed, it will result in a significant cost variance, as well as a delay in the project's schedule and quality. As a result, project management nowadays necessitates a thorough and detailed planning process that is primarily focused on labour productivity.

Following are the major findings -

- This study has been carried out by the researcher on the factors affecting the labour productivity through a closed ended questionnaire survey method and has tried to sort top 15 key factors affecting labour productivity.
- The researcher has tried to contribute to this area of construction industry by bifurcating these factors according to the type of construction site.

3.1.2. A Study on Factors Affecting Labour Productivity by Application of Relative Importance Index Srilakshmi V. Annigeri, Amey A. Kelkar (2018) International Research Journal of Engineering and Technology (IRJET).Volume: 05 Issue: 06 | June-2018

The study's main goals are to identify the factors that influence labour productivity, analyse those factors using the relative importance index (R.I.I.), and provide mitigation methods. Site inspection is shown to be the most significant aspect in documentation work, with an R.I.I. value of 0.71. To avoid delays, the responsible authorities must complete the site visits in a timely manner by planning ahead of time. With an R.I.I. value of 0.79, the most influential technical parameter is the construction methods and techniques used. To avoid unnecessary delays, it is vital to go one step further in terms of upgrading and adopting new ideas and approaches, equipment and tools, and construction planning processes. Under the management parameter, the most important aspect is an inefficient work schedule, which has an R.I.I. value of 0.76 and affects labour productivity. Labor management is critical to a construction project's performance, and it can be maximised and maintained by careful planning and scheduling of construction activities.

Following are the major findings –

- Timely completion of the site visits by the concerned authorities has to be done by planning.
- Labour management plays a key role in the success of a construction project and this factor can be optimized and maintained by proper planning and scheduling of the construction activities.

3.1.3. Productivity Analysis of Small Construction Projects in India. Yogendra Kumar, Gadde Harish Kumar, Satish Babu Myneni (2014). Asian Journal of Applied Sciences 7 (4): 262-267, 2014 ISSN 1996-3343 / DOI: 10.3923/ajaps.2014.262.267

He discovered that productivity was higher in places with a higher percentage of direct work. The study demonstrates that by reducing the fraction of workers' effort spent on no work and indirect labour, productivity can be greatly improved. Also, by conducting caring interviews at all levels of the construction sector, the reasons for the no-work % were discovered..

Following are the major findings –

- Any increase in direct work effort will directly increase the output and productivity. The result also shows that the work sampling result is in line with the labourers productivity.

- Root cause for the higher percentage of no work was found to be inconsistency in skilled to unskilled worker ratio.
- Component of No-work category can be reduced by maintaining appropriate ratio of skilled and unskilled workers at site.

3.1.4. Thomas, H. R., and Mathews, C. T. (1986). "An analysis of the methods for measuring construction productivity." Source Document No. 13, Construction Industry Institute (CII), Austin.

In the construction industry, productivity is crucial. Many researchers looked into it and came to the conclusion that productivity rates have been stagnant or declining for the past two decades. Traditionally, research studies have defined productivity for the construction sector to suit a certain aim, whether at the economic, project, or activity level. The "amount of products and services produced by a productive factor in a unit of time" is a broad definition of productivity. Productivity studies are conducted for two reasons: to control project costs and schedules, and to acquire data for future project planning. Following are the major findings –

- Productivity studies are carried out with following two reasons to control project cost and schedule; and to obtain data for planning future projects data for planning future projects.
- Understand Time study is the basic technique of work measurement. This method is used in measuring labour productivity.

3.2. Data Collection
3.2.1. General

Data was gathered from two different locations. The sites were chosen because they were easily accessible and close to one another. The site conditions were comparable, as were the materials and building techniques used. Work sampling necessitates the collection of data from the same locations. The first location for observation was chosen. It is a G+5 residential building with ground-floor parking. On all levels, there are both 1BHK and 2BHK flats. On each floor, different activities were taking place. At the time of data collection, the first floor was nearly finished. The second site comes from the same area as the first. It is a G+3 residential structure. On each floor, various construction activities were taking place. The ground level of both sites was used for material storage. This material is then transported to required places from ground floor. Data had been collected from both the sites in month March.

3.2.2. Work sampling
It's a statistical technique for calculating how much time workers spend in several defined areas of activity.

3.2.3. Categorization of activity
All of the actions were then divided into three categories. There are three types of work: direct, indirect, and idle.

3.2.4. Sampling size
Many construction and industrial engineering magazines include a formula for calculating sample size based on expected category percentages and desired inaccuracy.

3.3. Data Analysis –

Table 1: Analysis of work sampling. No of observation and percentage time spend by worker on direct work, indirect work and no work for various activities at job site.

Activity	Category of work	No of observation		Percentage of observation		Average Percentage
		Site 1	Site2	Site 1	Site2	
Reinforcement	Direct work	108	89	28	23	25.5
	Indirect Work	150	147	39	38	38.5
	No work	128	150	33	39	36
Form work	Direct work	126	111	33	29	31
	Indirect Work	158	142	41	37	39
	No work	100	130	26	34	30
Brick work	Direct work	146	134	38	35	36.5
	Indirect Work	169	173	44	45	44.5
	No work	69	77	18	20	19
Plastering	Direct work	150	176	39	46	42.5
	Indirect Work	135	156	35	41	38
	No work	100	52	26	13	19.5

Table 2: Result of workers' productivity measure at different job sites

Activity	Unit	Productivity		Average
		Site1	Site2	
Reinforcement	Kg/man day	57	49	53
Form work	Sqm/man day	6.10	5.60	5.85
Brick work	Cum/man day	0.71	0.64	0.675
Plastering	Sqm/man day	9.58	11.34	10.46
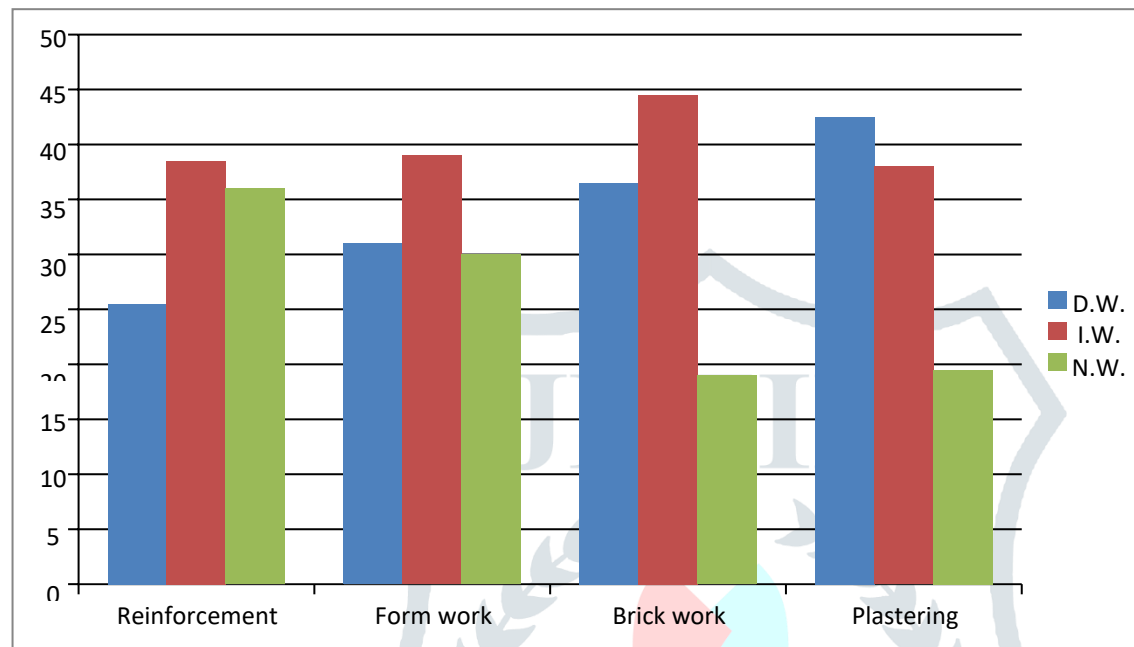
Fig: 3.1Average percentage time spend on various categories of work by worker

IV. CONCLUSION

• Work sampling method shows that percentage of direct work was lowest in reinforcement on site 2 (23%) and highest in plastering on site 2 (46%). Percentage of no work was highest in reinforcement on site 2 (38%) and lowest in plastering on site 2 (13%). Indirect work contributes major percentage (average of 40%) which is essential for any activity.

• It is clearly observed from results that productivity is directly proportional to direct work. Productivity increases with increase in direct work proportion and decreases with increase in no work proportion.

• In order to improve productivity focus should be on improving direct wok percentage and decreasing no work percentage.

• During the interview, it was learned that a variety of factors contribute to poor working conditions, such as a lack of resources, tools, coordination, poor communication, low material quality, absenteeism, security, a high skilled to unskilled labour ratio, poor layout planning, and so on. Absenteeism and a high ratio of skilled to unskilled labour have been cited as major drivers to the rise in no-work situations.

• These two criteria must be prioritised in order to reduce no-work conditions and boost productivity. A training programme for newly hired workers should be held, or skilled labour should be hired, in order to preserve the skill-to-unskilled labour ratio. Workers should be motivated to come on a regular basis by giving a consistent job, a better working environment, and timely wages, among other things. Human resource optimization improves the productivity of building projects.

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