

# **Work Measurement for Productivity Improvement of Bride Construction**

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## **ABSTRACTS**

*Improvement in productivity of labours has become vital area to focus for industry last two decades. Construction industry mostly depends on labour productivity. Complete project without delay and cost overrun is challenging for construction industry and researchers to work. Many factors affecting on productivity of labours in construction industry are determined by researchers. This paper discusses literature reviews on construction productivity measurement methods. The paper gives a review on different factors affecting on construction productivity and different theories and innovations on improvement of construction productivity. On reviews it is noted that there are different techniques of improvement in construction productivity and different methods of productivity measurement. But there are different adverse conditions and factors influencing on productivity improvement.*

***Keywords: Improvement in productivity, labor productivity, delay, cost overrun, factors affecting, productivity measurement.***

## **I.INTRODUCTION**

Many researches are related to poor level of productivity and performance in construction industry. Productivity of workers plays an important role in overall performance of onsite construction project. In India after agriculture construction industry has given second highest employment. All over the world, India is second in population therefore many labours are available for construction sector. The paper gives a review on different innovative methods of productivity improvement with appropriate productivity measurement technique.

To Productivity improvement necessary qualified and skilled workers are required for minimizing resources as well as time overrun form different activities of the construction project. In construction industry productivity management and control on performance time of labour and actual cost measurement is very difficult. Labour performance is increased with the help of productive use of labour working hours (Tinivavi Moyo et al 2014).

Not only Proper utilization of resources but also selection of labours for different job for improving productivity and successful completion of project. Crew formation in labour management plays an important role because 30% to 50% of cost of project account for labours (Florez et al 2016).

Improper management of resources leads to low productivity at on site construction. Therefor contractors, consultants and project managers are to be aware of different methods to find out productivity of equipment and workers. For efficient utilization of resources and improving productivity, proper control on the productivity is necessary aspects like workers, equipment, material, cash flow etc. (Mostafa E. Shehata 2012).

This paper discusses reviews on site productivity measurement which is considerably depending upon site location and its size which is very challenging. Different productivity measurement methods and analysis for improving productivity are work measurement, setting baseline, total productivity, average labour productivity (ALP), automated technologies for site material management like Radio Frequency Identification (RFID), Global Positioning System (GPS).

## **II.PRODUCTIVITY AND METHODS OF WORK MEASUREMENT:**

Definition: Work measurement is the application of techniques designed to establish the time for a qualified worker to carry out a specified job at a defined level of performance.

There was not worry about exact meaning of terms mentioned in definition like “a qualified worker” and “a defined level of performance”. That was nothing other than “Work measurement”. The term which was described different techniques, which were used for work measurement. Measuring the time required to perform job, it mean’s work measurement. Management of time required for performance of job or its activity and ineffective time was separated from effective time. Ineffective time was accepted as “natural things”. Work measurement played another role to set standard time for performing the job. If there was any unproductive time it was instantly shown the more than standard time thus management pay- attention on it.

Objective of the measurement was to analyse the productivity with the help of different work measurement methods.

Different work measurement methods are as follows;-

1. Historical data
2. Time study
3. Work sampling
4. Estimating
5. Synthesis

All these methods mostly concern with time study. This study was the basic work measurement and other methods developed from it. The basic steps were necessary for effectively carrying out the work measurement.

The steps involved in work measurement are as follows:

1. Select the job for study.
2. Record appropriate data related to different conditions of job. Standard method was used for performing job and different activities in them.
3. All the details of work and working condition are necessary to record. Work break down into activities or elements.
4. Find out the standard time for the operation to do every single element including relaxation and personal need etc.
5. Issue the standard time for activities of job and specific method of operation.

If work measurement was used as investigation tool of method study or find out the effective alternate method and unproductive time. Only first four steps are used in that case.

### **III.PRODUCTIVITY MEASUREMENT**

Linguan Song et al (2008) measured the productivity to find out in terms of labour work output per unit time. Labour input was measured in working hours. Due to different construction activities, labour workout was diversified. In historical data, productivity measurement requires three steps as mentioned below.

1. Productivity measurement number.
2. Data acquisition number.
3. Productivity model development.

Company's historical data records were used for improving company's productivity in future on the past performance and productivity details. They used theoretical model of different analysis for improve productivity.

In time study Tirivari Moyo et al (2014) studied that there were many challenges for using that technique. They found different difficulties as follows:

1. Less number of workers was studied and it required several observers for study.
2. Limited data was gathered for time study.
3. Observers study was not sufficient, for detail study with less accuracy.

Valuable information was provided by work sampling technique to construction manager for taking corrective action in the areas of low productivity. It was valuable for allocating workforce and improving productivity onsite. Work sampling was very simple and low cost method for managers to control cost and time overrun of projects. Estimating method was divided into two types analytical and comparative estimating. First was based on the skill and experience of workers. Comparative estimating depends on time interval allocated for job. Work measurement method was mostly used for measurement work around 95% comparing to order methods

#### **IV.FACTORS AFFECTING ON PRODUCTIVITY**

##### **4.1 MANAGEMENT**

The poor management in the construction project leads to poor productivity. Decisions of management play key role at actual construction work. For great productivity not only proper management but also proper decisions are required. Fulford and Standing (2013) selected the companies which operate differently, one takes the government projects another takes infrastructure development and major sub projects and third organisation produces supply facility for case study. They implemented collaboration in construction productivity. They developed model of collaborative network approach to study every company's strengths and weaknesses. Productivity was improved by collaboration between companies; one was very good in other company's weaknesses. But there were some limitations in decision making and controversies between companies.

Oral Musatfar et al (2011) concluded that statistical method was not effective for labour productivity prediction in construction. They found supervised learning method was advantageous in modelling ease prediction accuracy.

Different methods of supervised learning:

1. Free Forward Back Propagation (FFBP)
2. General Regression Neural Network (GRNN)
3. Self-Organising Maps (SOM)

These methods were used for decision making with the help of neural network. Onsite problems were resolved by these methods with the great accuracy. Self-organising maps (SOM) were more accurate than other two methods in prediction of crew productivity.

Rana Singhe Upal et al (2012) studied new method for improving productivity on construction site. Construction productivity improvement officer (CPIO) was appointed for decision making on project. (CPIO) took the responsibilities of work productivity planning, monitoring, coordinating and listening requirements of stakeholders. Decisions of (CPIO) were implemented for 10 weeks at case study. They found 6.72% saving of time due to implementation of (CPIO). Due to good impact of decisions, this method was implemented for other projects.

##### **4.2 LACK OF MEASUREMENT**

Cost overrun and time overrun in construction project cause due to poor productivity of workers. Records of different activities on construction site were kept and productivity of crew was measured on regular interval. These records were compared with standard benchmarks. Focus of standardized data collection to measure

work accomplished by every worker in a single shift. Ratb J. sweis et al (2009) found that daily output fall between upper and lower control limit. The accurate baseline productivity of other projects or old projects had similar scope, design, specification, conditions. That baseline records was used by them for estimating crew in new projects. They distinguished good performing projects with poor performing projects. They found that the measurement of productivity was helpful for proper management and improvement in productivity. Mostafoe et al (2012) focused on workload of workers and their output with the help of project management index. (PIM) was more accurate method for measuring the output of workers.

#### **4.3 MATERIAL PROCUREMENT**

Planning storage of material and material procurement leads to improvement in onsite construction productivity. Appropriate planning and execution of material procurement and storage was overcome on the shortage or excessive material at construction site. Misham Said et al (2011) used Construction Logistics Planning (CLP) model for decision optimisation of material procurement and storage material. This model was useful for difficult task of planning and storage decisions and optimisation of material procurement. In this online collaboration system was developed between owners, contractors, suppliers and designer. Proper utilisation of onsite space and indoor space of buildings was used for storage of material inventory.

David Gua et al (2009) used automated material tracking process like Radio Frequency Identification (RFI) and Global Positioning System (GPS) for improving productivity. They compared the traditional material tracking process with automated material tracking process. Time recorded by traditional tracking process was 36.8 minutes for 400 components of Steel. Automated process of tracking was faster than traditional process, which recorded 4.56 minutes. Traditional method was containing 9.52% of unidentified components while automated tracking was containing 0.54% only.

#### **4.4 SITE LAYOUT AND DESIGN**

Job site layout affects the working capabilities of site. Site layout contains different facilities like temporary offices, sanitation, workers rest area, storage, access points, access roads, workshops, health and safety, security features, proper locations of material and equipment improves the productivity.

Edgar P. Small et al (2016) focused on improving job site productivity. They carried out response survey for importance variable of job site layout and design. Highest ranking given for crane locations, access points of vehicles and inventory storage area. The owner's or contractor's office received lowest ranking as per response survey. Survey was carried out to find, who was responsible for site planning and design of job site layout, out of owner, contractor, designer, consultant, etc. Majority of tasks were performed by contractor 39% then consultant 30%. Contractor was required to show interest in the relationship between productivity and site layout.

#### **4.5 MOTIVATION AND SAFETY**

Suitable motivation played key role for improving crew production. The lack of motivation was the effect on behaviour of workers, which resulted to coming late to job, careless work, failure to achieve target, absentees. For achieving better output, management took the responsibility to motivate the labours. Khan ahsanali (2015) collected empirical data to find out, how management played the role for motivating workers. They found that management required high productivity and completion of the project within the deadline. Project was having deficiency of facilities like security, transport, canteen, safety measures in many organisations. Management was not interested to spend money on motivational factors for achieving more productivity.

Proper safety provisions were required for the workers to work safely on construction site. Shree raja Gopal T.G. et al (2016) conducted detailed analysis which concluded, if the safety measures were not provided; productivity of workers get reduced. Proper safety management were conducted with the help of safety engineer then more productivity was achieved. Proper management of safety equipment, maintenance of equipment, inadequate lights were not conducted due to that loss of labour productivity.

#### **4.6 SKILLS AND ABILITIES OF LABOUR**

Productivity of construction industry usually depends upon personal qualities and abilities of workers. Qualities like worker's skills, training, experience and education were helpful for improvement in workers output. Skilled workers had high physical and mental ability than the unskilled workers. Iaura Florez (2016) took case study of missionary construction for improving productivity. They found that every meson was having different personalities, method of work, qualities. Some meson's productivity was more while working together and some have less productivity. They recorded the complex missionary work for several days. They found that meson having different skills, abilities made balance between complexities off work. High rate of performance was achieved on the basis of skills and abilities of worker.

Ghate Prachi R. et al (2016) studied the productivity of skilled and unskilled workers while construction of columns. Abilities and skills of workers were affecting on productivity. Skilled workers reduce time of work by 5 days as well as cost by 46,500 for column construction. They calculated that productivity of skilled labour was more than unskilled labour.

#### **4.7 EXTERNAL ISSUES**

Adverse climate situations, dust, radiations, noise, crowded work area, new technology, changes in specification and design, change in agreements, complexity and size of project this were different external issues. This issue effects on productivity of workers directly or indirectly. There were high health and safety risks in construction projects as compared to other industries. M. Abrey et al (2014) used self-administrated questionnaire survey for finding adversely affecting site conditions. Unsatisfactory conditions were converted in to increase of injuries

and accidents of workers. That may cause for delay and loss of productivity. Old construction technique and increase in large scale of corruption reduces the productivity.

Markus Liberda et al (2014) used Prioritised Index for identifying different factors under human, external issues, and management category. These factors were affecting on site productivity. They found that the external factors have low rating while management factors have high rating, out of top 10 high rated factors. 8 factors of external issues were considered for Prioritised Index Rating.

## **V.CONCLUSION**

Above literature concluded that there are many methods of work measurement for improving productivity in construction industry. Work measurement techniques are used for controlling cost and time overrun, factors affecting on productivity of works. Different methods consists martial tracking and procurement, effective management system, motivation and safety to workers, external issues and other factors to improve onsite productivity.

Some effective methods to improve onsite productivity and to control cost and time overrun are as follows:

1. Work measurement by estimating and work sampling technique.
2. Automation to material taking and control.
3. Collaboration in different industries.
4. For controlling activities onsite with the help of CPIF.
5. Controlling the factors affecting on productivity.

These methods are successfully used to minimise the factors affecting on the productivity onsite in construction industry. There are many companies invests in work measurement techniques to achieve different benefits.

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