

# **IMPROVING PRODUCTIVITY OF THE CONSTRUCTION INDUSTRY**

**<sup>1</sup>MANIVANNAN.S, <sup>2</sup>MEGHALA.P**

**<sup>1</sup>PG Student, <sup>2</sup>Assistant Professor**

**Construction Engineering And Management,  
The Kavery Engineering College, Mecheri, Tamilnadu, India.**

## **ABSTRACT**

Productivity plays an important role in the construction industry. It helps the construction industry to be competitive to achieve goals and to meet the value propositions. The objective of this research is to identify the key factor affecting the productivity of the construction industry. Four type of analysis is done for brick work and concrete work; they are process analysis, activity analysis, operation analysis, cost analysis. Through process analysis scope of work, material and manpower involved are identified. Activity analysis aims to analyze sequence of work and complete method of work involved. Operation analysis helps in understanding responsibility of every individual involved in the process. Cost analysis helps to identify the total cost of brick work and concrete. And also factors affecting on-site productivity are identified. Recommendations and suggestions will be given to improve productivity.

**Keywords: Productivity, Factors affecting productivity, Analysis.**

## **1.1 INTRODUCTION**

Several studies related to labour productivity are performed for construction industry in past. Several of them were related to calculating the effect of productivity factors. Measureable calculations about the effects of those factors are required for several purposes, it includes estimation of the construction project, it's planning and scheduling. However, past study shows that it is tough to calculate such an impact, and a present there are no universally accepted standards to measure factors causing labour productivity loss in construction industry. This lack

of methods form assuring effects highlights the need to enhance measureable assessments for the factors affecting productivity in building construction.

For every project, productivity, cost, quality, and time have been the main concern. Better productivity can be achieved if project management includes the skills of education and training, the work method, personal health, motivational factors, the type of tools, machines, required equipment and materials, personal skills, the workload to be executed, expected work quality, work location, the type of work to be done, and supervisory personnel.

## **1.2 BACKGROUND ABOUT PRODUCTIVITY**

Productivity is generally defined as the average direct labour hours required to install a unit of material .It is said that perfect productivity can be achieved with a 40-hourwork week, with people taking all the holidays and vacation days as planned all of the engineering drawings would be100%complete there would be no delays of any kind during construction; everyone would work safely; everything would fit perfectly the first time; the weather would be70°F; and there would be no litigation at the end of the project.

## **1.3 DEFINITION OF PRODUCTIVITY IN CONSTRUCTION INDUSTRY**

The term “productivity” expresses the relationship between outputs and inputs. Output and input differ from one industry to another. Also, the productivity definition varies when applied to different areas of the same industry. Labour is one of the basic requirements in the construction industry. Labour productivity usually relates manpower in terms of labour cost to the quantity of outputs produced.

In 1883, Littre defined productivity as the “faculty to produce ,”that is, the desire to produce. In 1950, the Organization for European Economic Cooperation (OEEC) introduced the definition of productivity as a quotient obtained by dividing the output by one of the production factors .Depending on measurement objectives and the availability of data, several productivity definitions are encountered.

## **1.4. SIGNIFICANCE OF PRODUCTIVITY**

Productivity has a great significance in construction. Labour productivity constitutes a significant part of production input for construction projects. In the construction industry, many external and internal factors are in ever constant and are difficult to anticipate. This factor leads to a continuous variation in labour productivity. It is necessary to make sure that a variation in productivity does not affect the plan and schedule of the work and does not cause delays.

## **1.5 DIFFERENT FACTORS AFFECTING LABOUR PRODUCTIVITY**

Productivity is the outcome of several interrelated factors. Discussed below are various factors affecting labour productivity and are reviewed from past studies.

### **1.5.1 Time**

During construction projects, there are many tasks which cause a loss of productivity. Past study shows productivity decreases with working overtime. The most frequently stated reasons are fatigue; increased absenteeism; decreased morale; reduced supervision effectiveness; poor workmanship, resulting in higher rework; increased accidents. Working overtime initially result in increased output, but continuing overtime may lead to increased costs and reduced productivity. Time used by a construction laborer on productive activities averages about 30% of the total time available. An employee in the field only works effectively for 3.5 hours of his 8-hour shift and spends 20% of his time on direct value-adding activities.

### **1.5.2 Type of Project**

To accomplish substantial productivity, every member of crew requires adequate space to perform task without being affected with/by the other crew members. When more labor's are allotted to perform particular task in a fixed amount of space, it is probable that interference may occur, thus decreasing productivity. Additionally, when multiple trades are assigned to work in the same area, the probability of interference rises and productivity may be reduced. Interference among the various crews and labourers is due to mismanagement on construction sites. For example, steel-fixtured crew has to wait before fixing the reinforcement rods if the

carpenter's framework is incomplete. The types of activities and construction methods also influence labour productivity.

### 1.5.3 Safety

Accidents have high impacts on labour productivity. Various accident types occur at the site, such as an accident causing death and resulting in a total work stoppage for a number of days. Small accidents resulting from nails and steel wires can stop work and, thus, decrease productivity. Even insufficient lighting shows decreased productivity because sufficient lighting is required to work efficiently and because insufficient lighting has negative effects. Employing a safety officer helps labor's to recognize the required safety regulations and to follow them, which can reduce the number of accidents, thus increasing productivity.

### 1.5.4 Quality

Inefficiency of equipment and poor quality of the raw material are factors which cause low productivity. The productivity rate of inefficient equipment is low. Construction equipment is subject to a great number of breakdowns, and it takes a long time for the labourers to complete the work, thus reducing productivity. Poor-quality material used for work is the other factor because poor materials generally lead to unsatisfactory work and can be rejected by supervisors, thus reducing the productivity.

### 1.5.5 Managerial Factors

Managers' skill and attitudes have a crucial bearing on productivity. In many organizations, productivity is low even though the latest technology and trained manpower are made available. Low productivity is because of inefficient and indifferent management. Experienced and committed managers can obtain surprising results from average people. Employees' job performance depends on their ability and willingness to work. Management is the catalyst to create both. Advanced technology requires knowledgeable labourers who, in

turn, work productively under professionally qualified managers .It is only through sound management that optimum utilization of human and technical resources can be secured.

## **1.6 OBJECTIVE**

The main objectives of this study include the following:

- To identify the various works involved in the construction.
- To understand the sequence of work involved in the construction.
- To analysis each work.
- To measure the productivity by work sampling method.
- To find the factors affecting on site productivity
- To find the methods to improve the labour productivity.

## **1.7 SCOPE**

The scope of this study is follows

- The analysis of the work is helpful to find the process of that work, activities involved in that work, operation process of the work and cost associated with the work.
- The site inspection helps to identify the factors affecting the on site productivity.
- The ideas will be helpful to eliminate the productivity affecting factors
- The implementation of those ideas will be helpful to improve the productivity.

Process through the analysis as well as can reduce the cost of labour.

## 2 ANALYSIS OF WORK

### GENERAL

In this chapter four types of work analysis is done, they are process analysis, activity analysis, operation analysis, and cost analysis. Through process analysis we can able to understand the scope of the work carried out, what are all materials involved in the work and the manpower required for the completion of that work. Activity analysis will be helpful to understand the sequence of work, and the complete method of work involved. Operation analysis helps to understand the responsibilities of every individual involved in the work. The cost involved to do a work can be understood through the cost analysis. In my project above mentioned analysis is done for brick work and concreting work. In which productivity of brick work and concrete work is identified. First the analysis is done for ground floor for  $23.36\text{m}^3$  brick work and  $23.85\text{m}^3$  concrete works. Factors which affect the productivity will be identified. By improving the factors same amount of work is carried out in the first floor and the comparison is made between the ground floor and the first floor.

### 2.2 PROCESS ANALYSIS

Through this analysis scope of the work, material used for that work, manpower involved in that work are found.

#### 2.2.1 Process Analysis of Brick Work

Scope of work	: Brick work in superstructure
Area of work	: $23.36\text{ cu.m}$
Material used	: Brick (500 no's/cu.m) Cement mortar 1:6
Manpower involved	: Supervisor Mason Mazdoor

### 2.2.2 Process Analysis of Concrete

Scope of work	: Concrete for ground floor
Area of work	: 25.84 cu.m
Material used	: Cement concrete of mix 1:2:4
Manpower involved	: Supervisor
	Mason
	Mazdoor
	Operator
	Fitter

## 4.3 ACTIVITY ANALYSIS

Activity analysis is used to understand the sequence of work, and the complete method of work involved.

### 2.3.1 Activity Analysis of Brick Work

Sequence of work	: Marking
	Laying first line of brick
	Checking with measurements
	Raising up to sill level
	Marking joinery opening
	Raising up to lintel level
	Raising up to roof level

### 2.3.2 Activity Analysis of Concrete

Sequence of work	: Leveling
	Watering the surface

Concreting

Rough leveling the concrete surface

Ponding

Curing

## 2.4 OPERATION ANALYSIS

This analysis is used to understand the responsibility of each individual involved in the process.

### 2.4.1 Operation Analysis of Brick Work

Supervisor	: Supervising the work done by labour's
Mason	: To develop the structure
Mazdoor	: To help the mason

### 2.4.2 Operation Analysis of Concrete

Supervisor	: Supervising the work
Mason	: Laying concrete and leveling the surface
	Compacting the concrete
Mazdoor	: Transporting the concrete and helping the mason by giving the required tools

## 2.5 COST ANALYSIS

### 2.5.1 Cost Analysis of Brick Work

Brick	: Rs.4.5 / no
Cement	: Rs.370 / bag
Sand	: Rs.3000 / unit



Mason	: Rs.550 / day
Men Mazdoor	: Rs.400 / day
Women Mazdoor	: Rs. 250 / day
Cost of brick work	: Rs.5100 / cu.m
Area of brick work	: 23.36 cu.m
Total cost of B.W in G.F	: $5100 \times 23.36 = \text{Rs.}1,19,136/-$

### 2.5.2 Cost Analysis of Concrete

Cement	: Rs.370 / bag
Sand	: Rs.3000 / unit
Steel	: Rs.48 / kg
20mm course aggregate	: Rs.2200 / unit
Mason	: Rs.600 / day
Operator and fitter	: Rs.500 / day
Women Mazdoor	: Rs.300 / day
Cost of Concrete	: Rs.12,500 / cu.m
Area of concrete	: 25.84 cu.m
Total cost of concrete	: $12500 \times 25.84 = \text{Rs.}3,23,000/-$

### 2.6 OUT-TURN OF LABOUR

Table no 2.1 Outturn of Labour in Brick Work

Date	Mason Per day	Men Mazdoor Per day	Women Mazdoor Per day	Outturn Cu.m / day
03.11.2015	4	4	4	5.5

04.11.2015	4	4	4	6.5
05.11.2015	4	4	4	6.5
06.11.2015	4	4	4	5.0
Total	16	16	16	23.5

Above table describes the labour schedule and the outturn of the labour per day work. The outturn of first day was low because at the first day during the starting time of brick work the line marking thread line measurement checking process are carried out. So the outturn was low. For  $1\text{m}^3$  brick work 500 no of first class bricks are required. Here totally  $23.5\text{m}^3$  of brick work has been completed. Totally 13,000 bricks was used. One brick costs Rs.4.5. Total brick was Rs.58,500/-salary for mason per shift ( 8 hrs of work ) Rs.550, for men helper Rs.400, and for women helper Rs.250. Total labour cost for  $23.5\text{m}^3$  of brick work was Rs.21,600/-total quantity of cement used for brick work was 29 bags, cost of one cement bag was Rs.300, total cement cost was Rs.8,700/-. Quantity of sand for  $1\text{m}^3$  of brick work  $0.23\text{m}^3$  cost of total quantity of sand for the total quantity of brick work was Rs.5,825/-. So total cost of the brick work for  $23.5\text{m}^3$  was Rs.94.625/- (excluding supervision cost, consulting fee, mason commission, etc...).

Table 2.2 Out-turn of Labour in Concrete

Date	Mason	Mazdoor	Operator	Fitter	Out turn
13.11.2015 (8 a.m to 2.30 p.m)	4	20	4	2	$26\text{m}^3$

Total quantity of cement used 170 bags, Cost of 1 bag of cement was Rs. 300/-, Total cost of cement Rs. 51,000/-, Total quantity of sand 5.5 unit, Cost of 1 unit was Rs.3000/-, Total cost of sand was 16,500/-, Total quantity of 20mm coarse aggregate 9.5 unit, Total cost of coarse aggregate was 20,900/-, Wages for mason Rs. 600 per shift, Total mason involved was 4 members, Total mason cost Rs.2,400/-, Wages for mazdoor Rs.300 per shift, Total cost of mazdoor was Rs.6000/-, Wages for operator Rs.500/-, Total cost for operator Rs.2,000/-, Wages for fitter Rs.500/-, Total cost for fitter Rs.1,000/-, Total cost of concrete for 26m<sup>3</sup> was approximately Rs.1,00,000/-.

### **3 FACTORS AFFECTING ON SITE PRODUCTIVITY**

#### **3.1 INTRODUCTION**

This chapter discuss about the some of the factors which affect the on site productivity of the construction. These factors are identified in the site analysis and discussion with the engineers.

##### **3.1.1 Substance Abuse**

Substance abuse means the usage of the drugs in the construction site. Some of the substance abuse in the site are smoking, drinking, use of panmasala, gutga etc. How the substance abuse affect the productivity is if the worker is smoking he takes five minute to complete, if he smokes for ten time the time is fifty minutes nearly one hour. Through smoking there was a loss of one hour in work per day. This will reduce one hour productivity of the worker.

##### **3.1.2 Environmental Condition**

Worker productivity is based on the environment he is working. If the worker is working in the peace full environment the productivity of the labour will be high when compared with the other.

##### **3.1.3 Skill of Labour**

The onsite productivity of the labour is mainly based on the skill of the labour. Well skilled labour will work faster than the new labour. Work done by the skilled labour will show high productivity when compared with the unskilled labour.

### **3.1.4 Material Distance**

If the material is near the working area it is easy to the helper to give the material continuously to the masons without any delay. Through this there will be a continuous work process and increase in productivity.

## **CONCLUSION**

Process analysis, activity analysis, cost analysis and operation analysis is done for brick work and concrete work. From this analysis quantity of material used, responsibilities of every individual involved in the work, cost associated with each work is identified. During the process some of the factors that affects on-site productivity is identified. The similar work carried out in the next phase by improving the factors affected on-site productivity. The comparison is made between the ground floor and first floor. Recommendations and suggestions will be given.

## **REFERENCE**

1. A .A. Attar, Prof. A.K. Gupta, Prof.D.B.Desa “**A STUDY OF VARIOUS FACTORS AFFECTING LABOUR PRODUCTIVITY AND METHODS TO IMPROVE IT**” IOSR Journal of Mechanical and Civil Engineering.
2. Alwi, S “**FACTORS INFLUENCING CONSTRUCTION PRODUCTIVITY IN THE INDONESIAN**” EASTS Conference 2003.
3. Arun Makulsawatudom, Margaret Emsley, Kuldej Sinthawanarong “**CRITICAL FACTORS INFLUENCING CONSTRUCTION PRODUCTIVITY IN THAILAND**” The Journal of KMITB Jul-Sep 2004.

4. Keiko Ito, Moosup Jung, Young Gak Kim, Tangjun Yuan **“A COMPARATIVE ANALYSIS OF PRODUCTIVITY GROWTH AND PRODUCTIVITY DISPERSION: MICROECONOMIC EVIDENCE BASED ON LISTED FIRMS FROM JAPAN, KOREA, AND CHINA”** Japan Center for Economic Research march 2008.
5. Mistry Soham, Bhatt Rajiv **“CRITICAL FACTORS AFFECTING LABOUR PRODUCTIVITY IN CONSTRUCTION PROJECTS: CASE STUDY OF SOUTH GUJARAT REGION OF INDIA”** International Journal of Engineering and Advanced Technology (IJEAT) April 2013.
6. Mohammed Salleh HAMMAD, .Abdelnaser OMRAN, .Abdul Hamid Kadir PAKIR **“IDENTIFYING WAYS TO IMPROVE PRODUCTIVITY AT THE CONSTRUCTION INDUSTRY”** ACTA Technica Corviniensis - bulletin of Engineering 2011.
7. Shashank K, Dr. Sutapa Hazra, Kabindra Nath Pal **“ANALYSIS OF KEY FACTORS AFFECTING THE VARIATION OF LABOUR PRODUCTIVITY IN CONSTRUCTION PROJECTS”** International Journal of Emerging Technology and Advanced Engineering may 2014.
8. S. Thomas Ng, R. Martin Skitmor, Ka Chi Lam, Anthony W.C. Poon **“DEMOTIVATING FACTORS INFLUENCING THE PRODUCTIVITY OF CIVIL ENGINEERING PROJECTS”** International Journal of Project Management 2004.
9. Sunil V. Desale, Dr. Sharad V. Deodhar **“A STUDY OF LABOUR PRODUCTIVITY AND WORK-HOUR LOSS -CASE STUDY FOR BRICK MASONRY”** American Journal of Engineering Research 2013.
10. Takashi Goso, Kohei Imoto, **“DEVELOPMENT AND IMPROVEMENT OF LABOR PRODUCTIVITY ASSESSMENT SYSTEM IN CONSTRUCTION SITE BY USING INFORMATION TECHNOLOGY”** Journal of construction management research may 2010.

IJSER