



## STUDY THE EFFECT OF LABOUR PRODUCTIVITY ON OTHER RESOURCES IN CONSTRUCTION

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**ABSTRACT:** Modernization and industrialization have helped the construction industry to grow in leaps and bounds. Small towns and cities have become more urbanized and the construction sector too has got a boost. Irrespective of occasional slumps in the economy or in construction works, the sector is going through a faster growth. Apart from old / traditional urban/ industrial centres, new industrial / urban centres have appeared on the map where construction works are going on. Expanding and fast growing construction sector, in general, has drawn large number of workers due to lack of greater employment opportunity elsewhere. There are more than 20 million of construction workers in India at present. Cities, like Delhi alone have around more than 600 thousand of them. Apart from metros other cities, like Jamnagar in Gujarat, Guwahati & Shillong in the Northeast are also expanding at fast rate.

### INTRODUCTION:

Migration from different states to other states in India has now become so rampant that its impact is felt in every aspect of life. Migration becomes a way of life to many, who are unskilled and semi- skilled and find it difficult to get better jobs within their native and locality. These migrant workers are spread across the width and length of the country. Most of the construction labourers have migrated from different regions and states leaving their native villages in search of job. These people in general are nomadic in their life and usually do not return to their birthplace or natives. They travel from one area of work to other area along with their families and live in a place, which is either provided by the owner of the construction company or somewhere nearby, building temporary shelters.

They have maximum mobility because of the nature of their work. These labourers are engaged in huge industrial constructions, residential flat constructions, city beautification works. These construction labourers, comprising the unorganized work force remain the most exploited ones even after five decades of independence. In the recent past the trend shows that all big cities in the country have become the centers to recruit casual labourers as construction labourers to cities and urban areas. Most of the construction labourers migrate to cities and metros are from poor families and are illiterate. Their lack of education and skill make their choices very limited. When they come to big cities, they have to face a number of problems because of their inexperience and lack of skill. They become easy victims of exploitation and have to work for their day-to-day sustenance. The present work is to analyze the extent of construction labour problems that affect productivity. The construction

business is booming encouraged by the employment mobility of business class people, blue collar officers, IT employees, students etc. Since need of accommodation is essential, the construction industry is also finding their business growing to peak levels.

### OBJECTIVES

The Objectives of this study are to identify major factors affecting productivity & show effect of labour productivity on other resources using Microsoft Project. To determine problems faced by labour and suggest measures to reduce the problems and to improve productivity. Previous studies were concentrated on the matters of labour, material and equipment separately. For example, one finds studies on work productivity and productivity in construction. The work on labour productivity and its simultaneous effect on other resources of construction such as material, equipment, and capital are almost non-existent. This study is focused on primary data search by obtaining views from labourers as well as contractors/ owners/ managers.

### PRODUCTIVITY

Productivity consciousness has acquired worldwide momentum. Higher productivity is necessary for the survival of any nation. It stands for proper utilization of available resources to achieve the best results with minimum cost. Improvement in productivity is the only answer to the problems in the industrial sphere and it is the only path to national prosperity. In India it assumes special significance owing to the resource gap. In order to overcome the hurdle of shortfall in resources, stepping up of productivity is a

must. During the last 40 years productivity measurement has emerged as a distinct and separate branch of study in management. A number of studies employing highly sophisticated mathematical and statistical techniques and tools of analysis have been conducted to measure productivity. Specialized agencies of the United Nations (UN) like the International Labour Organization (ILO), affiliated agencies of regional organization like European Association of National Productivity Centres (EANPC) of the Organization for Economic Cooperation and Development (OECD) have been published comprehensive, detailed and elaborate manuals explaining the concepts, methodologies, data requirements etc. for the measurement of plant level and overall measurement of productivity of various factors and inputs. Regional, national and local productivity organizations / associations / agencies / councils were organized and established to stimulate productivity consciousness. In India the National Productivity Council (NPC) was established in 1958. The Asian Productivity Organization (APO) with headquarters in Tokyo was established in 1961 and all countries that are members of APO established national and local productivity councils- centres / bureaus in their respective countries.

### Concept of Productivity

Frederick W. Taylor in his "Task Study" said, "Human work can be made infinitely more productive not by 'working harder' but by 'working smarter'". Productivity means the economic yield from:

- Each factor of production (land, labour, capital and organization) Each input (raw materials, fuels, time and knowledge)
- An overall yield of the joint factors and resources enumerated above in combination.

Productivity denotes the efficiency with which the various inputs are converted into goods and services. Technically, it signifies the ratio between the input and output. Productivity is said to be high when more output is derived from the same input, or the same output is obtained from a less input. It is well understood as the ratio of output to input with respect to given resources. When more is produced with the same expenditure of resources it may be termed as effectiveness; when the same amount is produced at less cost it may be termed as efficiency. It should be recognized that the long-term productivity improvements can be achieved by the human

factor through positive and innovative attitudes. In this sense productivity is an attitude of mind which is intolerant of waste of every kind and in any form. Productivity does not refer merely to work systems but to the development of right attitudes and a strong concern for efficiency. Efficiency, maximum output, economy, quality, elimination of waste and satisfaction of human beings through increased employment, income and better standard of living are some of the objectives of productivity movement in our country or for that purpose in any other country.

### Labour Productivity

European productivity agency defines productivity as, "Productivity is a state of mind...an attitude that seeks the continuous improvement of what exists. It is a conviction that once can do better today than yesterday and that tomorrow will be better than today" In relation with output.

Output measures how much we produce. Productivity measures how much we produce per unit input. Higher productivity leads to lower costs, shorter construction programs, better value for money and a higher return on investment.

$$\text{Productivity} = \text{Output} / \text{Input (Earned hours / Worked hours)}$$

To understand above formula we can take the example of an equipment operator. For instance an excavator operator operates it effectively for 5hr. 30 min. deducting lunch, tea and rest time out of total 8hr. shift. The productivity of the operator can be calculated as

$$5.5/8=0.687.$$

Similarly five workers doing placement of concrete for an hour can place  $10 \text{ m}^3$  of concrete. The productivity of the labour can be calculated as

$$5/10=0.5 \text{ man-hours/m}^3.$$

i.e. each labour can place  $2 \text{ m}^3$  of concrete every hour; hence the reciprocal formula for productivity can be,

$$\text{Productivity} = \text{Input} / \text{Output (Man-hours per unit produced)}$$

Above formulae says that productivity is mainly dependent on hours earned by the labour and the working hour of the labour or else it is highly dependent on how many man hours are required for producing one unit.

## REVIEW OF LITERATURE

### INTRODUCTION

Many researchers across the world have done many works related to labour productivity. Such literatures were studied, and those relevant to my project topic were reviewed and they are given below.

### REVIEWS

Ronald Gulezian and Frederic Samelian (2003) provide a statistical approach for establishing a productivity baseline which reflects a contractor's normal operating performance and which overcomes some of the limitations in the measured mile approach and other methods. The approach presented for determining baseline productivity comprises the following general steps:

- i. Use individual productivity values as a basis for the analysis associated with a particular work effort in dispute.
- ii. Successively apply a process control chart to the productivity values in order to eliminate unusual values, resulting in a set of productivity values that reflects a contractor's normal operating conditions.

- iii. Calculate the baseline productivity as the mean productivity,

based on the productivity values making up a contractor's normal operating performance.

C. Di Guilmi, F. Clementi, T. Di Matteo, M. Gallegati (2007) extend the analysis of the relationship among network and productivity in two directions.

First, they exploit the link between social capital, social network, and productivity distribution among firms. The second aspect of novelty consists in the method of analysis. Indeed, the impact of social network structure on productivity is quantitatively evaluated by means of labor productivity distribution features.

William F. Maloney (2000) presents a philosophical argument for new construction labor productivity models based on actual factors affecting productivity. The paper reviews various work-study models that have been borrowed from industrial engineering. These are the delay, activity, and task models. Using research data, these models are shown to be inadequate and unreliable productivity models. It is suggested that these models emphasize work methods, and that the best opportunity to improve productivity is to focus on the factors that management can control. Different measures of productivity serve different purposes. It is

important to choose a measure that is appropriate to the purpose. Work-study models serve different goals than productivity models. Work-study techniques developed for the manufacturing industry are characterized by continuous, machine-dominated, repetitious processes of long duration. The emphasis of these methods is on the time required to perform certain tasks and on improving the work method.

AwadS. Hannaetal (2005) presented an analysis of the impacts of extended duration overtime on construction labour productivity. The results show a decrease in productivity as the number of hours worked per week increase and/or as project duration increases. The research focuses on labor intensive trades such as the electrical and mechanical trades. Overtime in this research is defined as the hours worked beyond the typical 40 h scheduled per week. The paper begins by presenting the effects of overtime and the need for an updated overtime productivity model. Data for the quantitative analysis was collected from 88 projects located across the United States by means of a questionnaire. Various statistical analysis techniques were performed to develop quantitative relationship curves, including multiple regression, P-value tests, and analysis of variance. The statistical productivity model produced through this study was developed from current project data in a well-documented database. The size and recent nature of the project database eliminates many of the questions of reliability raised by previous studies. Additionally, the new overtime model is broader in its application than previous studies.

Adnan Enshassi, Sherif Mohamed, Ziad Abu Mustafa and Peter Eduard Mayer(2007) identifies factors affecting labour productivity within building projects, and ranks these factors according to their relative importance from a contractor's viewpoint. The analysis of 45 factors considered in a survey indicating the main factors negatively affecting labour productivity namely: material shortage, lack of labour experience, lack of labour surveillance, misunderstandings between labour and superintendent, and drawings and specification alteration during execution. 45 factors which were considered in the study were divided into 10 groups, which were ranked according to their importance index.

H. Randolph Thomas (1998) Concludes that lean improvement initiatives should focus more on workforce management strategies to improve labor

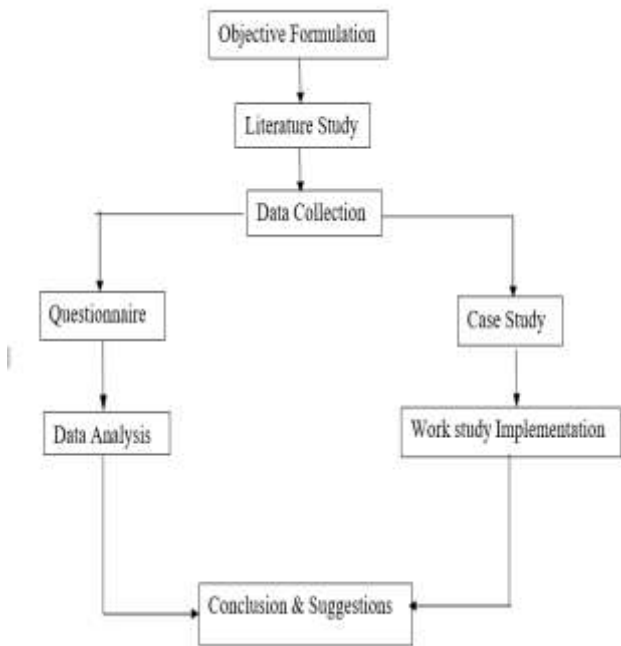
utilization that will lead to better labour performance. Labour flow is an important component of lean flows. Lean construction proponents have skimmed over the labor resource as a component of flow management. In a survey result of three projects, 58% of the total inefficient work hours attributed to ineffective flow management were attributed to ineffective labor flow.

**METHODOLOGY**

The preliminary insight of the subject data for this study has been collected through a literature review followed by the use of a questionnaire survey targeted at contractors, subcontractors and labors. The survey was carried out using convenient random sampling. Data were collected from medium to large size construction sites of Chennai and Mumbai. Different residential sites are visited to get variety of data. Figure 3.1 outlines methodology used to carry out the study.

**DATA COLLECTION**

Data collection is the most critical part of the study since the accuracy of the data will determine the success or failure of the research. The data's are obtained through literature studies and questionnaire that are analyzed using appropriate analytical techniques in order to portray a clear perspective on their search.



**Figure 3.1 Methodology Flowchart**

**ANALYSIS AND RESULTS**

**GENERAL**

The case study of a residential project construction was done. This study covers review of the labour productivity and the causes for poor productivity. The list of activities involved in construction of a residential building project was studied and the data was fed into Microsoft Project 2007 program in consultation with the Project Engineer. The details of different activities were obtained from different sources and from which the conclusions are drawn on the productivity levels and the causes, of the poor productivity.

**COST BREAKUP OF TYPICAL PROJECT**

**Typical breakup**

Material	-	40%
Equipment	-	20%
Labour	-	20%
Indirect costs	-	10%
Overheads	-	5%
Profit	-	5%
Total	-	100%

**Cost Breakup with 25% overrun in labour**

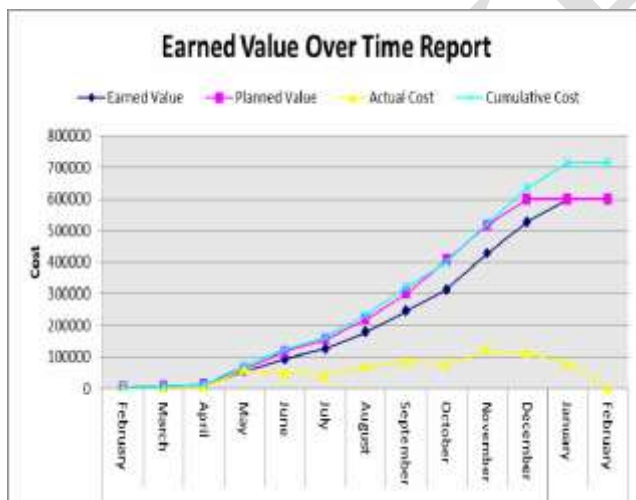
Material	-	40%
Equipment	-	20%
Labour	-	25%
Indirect costs	-	10%
Overheads	-	5%
Profit	-	0%
Total	-	100%

Now it can be clearly seen that a 25% overrun in the labour component which has the second major share in construction and is most critical to control wipes away total planned profit. Construction processes inherently involve complex interactions among variables including, but not limited to, physical attributes, resource availability, budget restrictions, and management techniques. Labour productivity, a key variable in the profitability of a project, is influenced by complex and competing factors such as skill level, motivation, and schedule pressure. Contractors continue to struggle with a fragmented industry where competitive pricing and labour productivity are defining factors in their competitive advantage. Two major impacts upon labour costs are reduced productivity and pay scale increases. The latter is a factor when changes delay progress such as required to be performed at a time when higher wages are in effect. Reduced productivity takes many forms, but implies a loss from some established normal or anticipated level of productivity.

**REPORTS**

**Baseline Cost Report**

The Baseline cost Report of the project is shown in Figure 4.1.

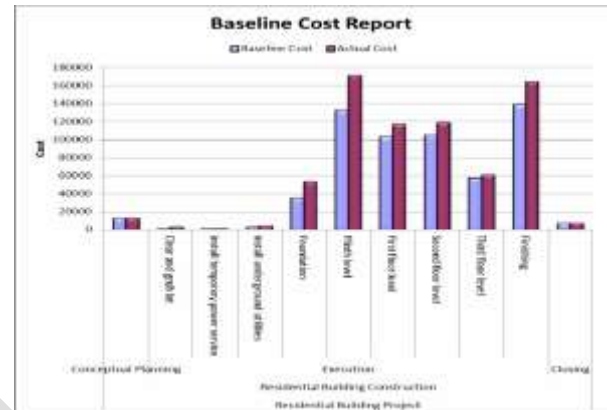


**Figure 4.1 Baseline cost Report**

The report shows the difference between planned cost indicated as baseline cost and the actual cost incurred on each level of construction mainly divided into three stages namely: Conceptual planning, execution, and closing. Detailed report is attached in Annexure IV.

**Baseline Work Report**

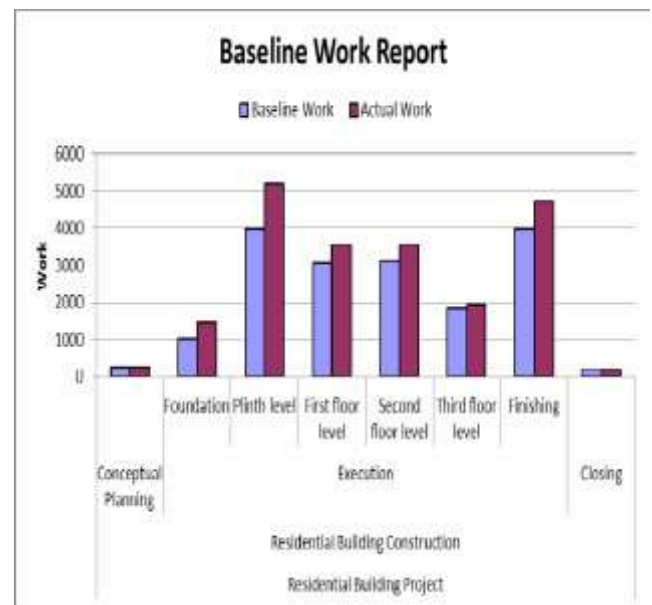
As seen in Figure 4.2, this report shows the difference between planned work hours indicated as baseline work and the actual work incurred on each level of construction. This is in context with low productivity resulting in increased work hours. Detailed report is attached in Annexure IV.



**Figure 4.2 Baseline Work Report**

**Cash flow Report**

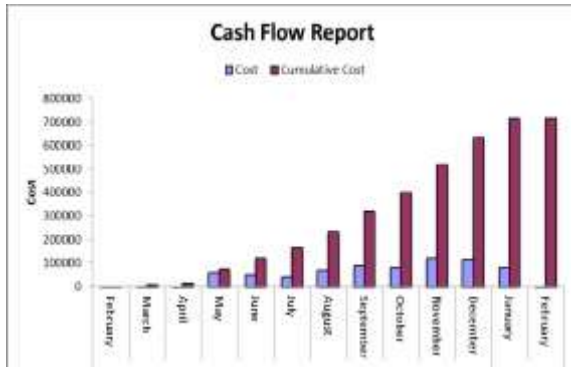
As shown in Figure 4.3, this report shows the expenses incurred in each month of the project. It is seen that the costs are comparatively low in the beginning and at the end as compared with the core duration of project and the cumulative cost shows a linear distribution.



**Figure 4.3 Cash flow Report**

**Earned value over time Report**

As shown in Figure 4.4, this report indicates the relation between Actual cost, Earned value, planned value and cumulative cost with respect to the duration of the project.



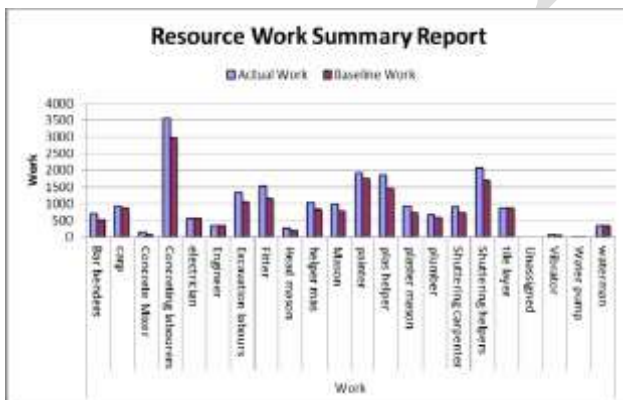
**Figure 4.4 Earned Value over time Report**

**Resource Cost summary Report**

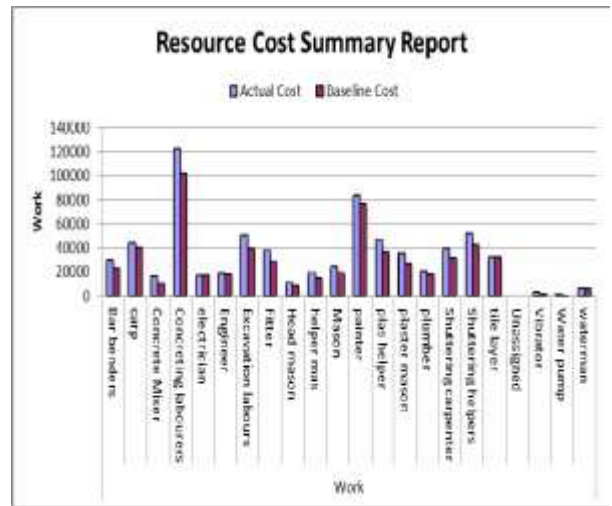
As shown in Figure 4.5, this report shows the difference between planned costs indicated as baseline cost to actual cost with respect to every resource of the project.

**Resource work summary Report**

As shown in Figure 4.6, this report shows the difference between planned work hours indicated as baseline work to actual work hours with respect to every resource of the project.



**Figure 4.5 Resource cost summary Report**



**Figure 4.6 Resource work summary Report**

**EXTERNAL FACTORS AFFECTING PRODUCTIVITY ON CONSTRUCTION SITE**

**Space limit**

The delay is offset by increasing labour, materials and equipment. However, due to space or area limitations, it may not be feasible to permit more than a fixed number of workers onto the site at any one time. If there is a physical space constraint, the project may not be completed on time.

**Availability of resources**

The five resources identified as critical for labour productivity can be scarce. It is often cost-prohibitive to obtain access to an unlimited supply of material and equipment in a short period of time. The pool of labour is often very limited, particularly when skilled labour is necessary. And there can be stiff competition amongst firms to retain good management and planning resources. If the project suffers from a schedule delay, desired human resources needed to complete a project on time may exceed management's capacity to adequately manage the labour and the project may not be able to overcome the schedule delay.

**Overtime**

Allowing the use of overtime can increase the Completion Rate without hiring additional labour. The use of overtime (expending more than eight hours in a workday and/or working on weekends) is a management decision. Naturally, there is a limit to overtime - no one is

able to work more than twenty-four hours in a single day. The extended use of overtime may have an adverse impact on productivity.

### Learning Curve

As new employees gain experience, their productivity increases which, in turn, raises the Completion Rate. The less time New Employees need to gain experience, the less need to hire additional people to complete the project on time. An increase in the Time to Gain experience leads to a lower rate of flow from New Employees to Experienced Employees.

### Willingness to hire

Project managers may not be willing to hire additional labour at the end of a project. Therefore, they have to rely on overtime at some point rather than going through the process of hiring and training new people for a short period of time. It also captures the idea that labour may be unwilling to commit to working on a project if for only a short time. In the construction project management, management's willingness to increase labour declines towards the end of the project. One of the attributes of the construction worker is the ability to perform the duties of this trade in a variety of environments. How long will it take the worker to adjust to a new task and environment depends on how closely related the task is to his experience or how typical it is to the work usually performed by his craft. The time required for a worker (or crew) to reach full productivity in a new assignment is not constant. It will vary with skill, experience, and the difference between the old and new task. For example, an ironworker is moved from placing reinforcing bars to the structural steel erection crew. He is qualified by past training to work on structural steel, but the vast majority of his experience has been with rebars, and the two tasks are significantly different. If the same ironworker is moved from placing reinforcing bars for Building A to the same work in Building B, which is similar but not identical to Building A, the loss of productivity would be significantly less.

### PRODUCTIVITY IMPROVEMENT USING WORK STUDY

Productivity can be improved by using two techniques namely, employee-based and task-based techniques. From the beginning, there has been a need to recognize that people are a very important part of the work

system. Productivity improvement does not just happen by accident. It requires on-going commitment from both management and employees to do the job right the first time, at the source, through the application of basic skills, tools and techniques.

### Field Observation

A project is identified and field work is done for about two months. The work done and the labour category are observed in the site and using that the productivity rate is calculated for every day. At the period of first month, the progress and the outcome of the project relating to the productivity is observed. And in later month, the work studies are implemented to improve productivity in the site. Meanwhile the process and outcome of activities for the second month is also observed. Thus the differences in the work efficiency and productivity rate between two months clearly show the improvement of productivity in project.

### Procedure

The productivity rate is calculated using the data that was acquired from direct site observation. Labour plays a major role in construction productivity. Thus labour productivity can be measured from the formula

$$\text{Labour Productivity} = \frac{\text{Work done}}{\text{No of labourers}}$$

Thus the productivity is calculated for each sort of activities separately for carpentry, bar bending and concreting or masonry. The rate is found out for each and every day of the month of February. Then the average production rate is calculated for the month of February. Table 4.1 shows the productivity rate for February.

### Implementation Of Work study

In the next month of March, the work study was implemented in the site. A review of the previous month's productivity was conducted so that for future, work study can be discussed and implemented at site. Based on the past review, the following work study is implemented in the site.

- Provided training on work to be done.
- Planning for following days work. i.e. earlier arrangement for each and every activity.
- Using skilled supervisors and labors for appropriate type of activities.

- Reduction of distance between material storage place and workplace.
- Adopting lean construction principles such as reduction of wastage.
- Usage of machines for cutting and bending the reinforcement.

Thus the productivity has been hiked up to some extent by implementing the above work study. Table 4.2 shows the productivity rate of the month of April in which the productivity rate for shuttering, reinforcement and concreting has been increased from 5.31, 0.19, 1.47 to 6.42, 0.23, and 1.73 respectively. Therefore the productivity rate for shuttering, reinforcement and concreting has been boosted for about 20.9%, 21.05% and 17.7% respectively.

**Summary**

Hence proper work study should be carried out to enhance the productivity rate in construction; obviously the contractor would be benefited. Alternatively the wastage of the materials can also be prevented on conducting eminent work study. Thus the contractor should take care of productivity and its related issues to render enough profit.

**PREFERENCE ANALYSIS**

To obtain the data required for the study, 3rd questionnaire was prepared. Different factors were listed in the questionnaire. To analyze the data obtained by survey, statistical methods were used. The first was to acquire percentage values based upon the frequencies of the answers received. The other was to calculate a Relative Importance Index (RII). For this purpose, a rating scale of 1 to 5 was adopted with 1 representing the lowest level of effect and 5 representing the highest level. The RII was evaluated using Eqn 5.1.

$$RII = \frac{\sum_{i=1}^5 W_i X_i}{\sum_{i=1}^5 X_i}, \quad (1 \leq RII \leq 5), \quad \dots\dots\dots \text{Eqn (5.1)}$$

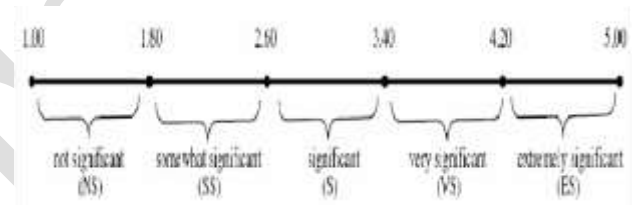
Where,

$W_i$ ,-The rating given to each factor by the respondents ranging from 1 to 5, with 1 representing „not significant“ and 5 representing „extremely significant“;  $X_i$  - The percentage of respondents scoring;  $i$  - The order number of respondents.

The numerical values calculated by the above formula were then differently classified as can be seen in Figure 5.35, because a single point or number changing from 1 to 5 in questions no longer symbolizes each verbal scaling expression in the evaluation phase.

Namely, since the results are obtained as decimal numbers instead of integer numbers, a specific scale should be established. Thus, 5 expressions are defined by the intervals of 0.8. In addition to calculating the relative index scale, the percentages of respondents scoring 2 or fewer, 3, and 4 or more, on the significance scale were also evaluated for each factor. These were used to rank the factors in which relative importance indices were the same.

**Figure 5.35 Scale for the Calculation of the Preferences**



**Factors out of classification**

In the construction industry, many factors have potential to affect labour productivity. However, two factors that can get an effect on construction productivity have not been included in the groups, while 37 factors have been formed by searching related books and articles. Four factor groups have been decided by inspection of the factors. After these factors had been determined at beginning, they were divided into groups. The first of excluded factors is technological advancements that has been the main driver behind improved productivity and reduced workforces.

**Findings**

Among the 4 factor groups affecting construction labour productivity, organizational factors were found as the most important group with a mean index of 4.04 (very significant V/S), as can be seen in Table 5.2. Ten factors were investigated in this group, and quality of site management (extremely significant/ES-4.52), material management (ES-4.46), and systematic flow of work (ES-4.28) were ranked by the participants as the 3 most effective factors. On the other hand, relaxation allowances were determined as the least predominant factor with the index of 3.12 (significant/S). The other 6



factors have „very significant“ impact upon efficiency. These „results“ columns indicate the most promising 10 factors that can initially give opportunities with a particular care for improving labour productivity.

The second most important group is economic factors (VS- 3.82). 6 factors were totally researched as shown in Table 5.3, and on- time payment (ES-4.44) was ranked by the sector professionals as the most effective motivator. However, union membership was found out as the least important factor with the index 2.88 (S). The other 4 factors have „very significant“ impacts upon efficiency. Moreover, it is seen that there are 2 economic factors among the top 10 factors. After the financial factors, physical factors (VS- 3.46) including 9 elements are the most considerable group.

## **MAJORFACTORS**

### **Quality of Site Management**

Improving productivity could be best carried out by means of development in management quality. Namely, the principal difference in construction productivity is the management influence. Stages of estimating construction time and cost reliably, where the knowledge of labour productivity takes a considerable part, are the main items of successful management understanding. In the study of Sanvido (1988), ineffective management was cited as the primary cause of poor productivity rather than unmotivated or unskilled manpower. One of the primary means of rising worker productivity through management is to procure and control adequate working conditions since productivity in construction is greatly affected by work conditions that change from project to project.

A good estimate of productivity requires a careful analysis of work conditions and their impact on productivity. On the conditions that change from project to project. A good estimate of productivity requires a careful analysis of work conditions and their impact on productivity. On the other hand, it is difficult or nearly impossible to quantify the impact of work conditions on productivity. Under inadequate working facilities, no employer can expect that labour satisfactorily work. Managers, therefore, should be aware that even highly motivated and skilled operators, working under poor conditions, will not continue to produce quality work. Investment in working facilities will not only enhance operatives“ performance, such as high technology equipment and replacing immediately broken, lost, or

stolen tools and machinery with the new ones, but also can be used as a potential contributor in placating other concerns such as safety onsite.

The workforce and management team share a strong and positive relationship in terms of construction performance, and, thus, an evaluation of labour resources requires joint consideration of operatives and management. For this purpose, a flexible management style and a simple organizational structure should be established in construction. Central management, lack of confidence in employees, and formalities are the obstacles to this type of management. In this point, communication is a vital aspect of organizational life. There should always be a positive dialogue between professional site staff and labour, and these staff should also keep the worker motivation high. On the other hand, conflict is predictably preponderant in industries such as construction with its proliferation of human relationships, and it is impossible to make it high continually, since morale is a concept that has different perspectives. In such cases, labour contractor, who constitute communication between construction workers and managers should be seriously interested in every kind of labour problems. There is no doubt, that it should not be used some sorts of communication, in which hesitation and pressure exist, but be founded a relationship comprising mutual respect to reach high levels of productivity. Especially in developing countries, such as India, if the low levels of education of construction operatives, who come from patriarchal regions of society, are considered, they will be very pleased with the verbal and behavioural appreciation and recognition of their contributions and efforts on the project. To this aim, the management staff on site should have neither rigid nor ignoring attitudes, but act appropriate to the social and cultural structures of workers. Meanwhile, it does not mean that the mutual respect and hierarchy will not be preserved. Many of the participants have importantly stressed that Indian construction workers are very emotional and their productivity could be mostly improved by inciting speeches, but it is also inevitable to consider that they may misuse the sincere interest.

The last choice that can be applied to get a productivity boom by management is the selection of the right people to control certain functions. Workers are given proper guidance and motivation, increasing productivity. The qualification level of managers and supervisors is one of the vital elements determining the

level of labour productivity. Experienced staff leads to proper coordination of resources of the project. Particularly in the international construction tenders, an attention is paid to the qualification of technical personnel rather than labour employed in project since the personnel is the most important factor that assures good performance of workers. Managerial errors of site engineers and managers who lack proper experience, knowledge, and management skills can negatively affect worker efficiency. Some senior engineers in this study have claimed that workers do not take such individuals into consideration, who also make labour demotivated. In addition, the upper management should clearly determine the responsibility areas or task boundaries of lower management on site. Otherwise, these staff will be demotivated, and more importantly, do not want to take any responsibility in a work environment, where dictated instructions are dominant, authorities are maximally limited, and any motivation tool is not used for them.

### **Material Management**

Problems with adverse material management conditions that consist of supplying and shipping have been cited in the literature among major causes of productivity loss. Effective material management systems are counted as taking measures against fluctuations in material prices, informing vendors or fabricators precisely concerning the desired material features, and suitable material planning and organization, i.e. logistics management. The problems that can be appeared in material management applications are the following:

- Running out of materials,
- Extensive multiple-handling of materials,
- Improperly sorted or marked materials, which makes to define them difficult,
- Wrong or damaged materials that exceed acceptable specification tolerances, or production errors pointing to a poor quality,
- Unsystematic flow of materials,
- Production rates of materials in plant incongruous with those on site.

In addition to these factors, distributing materials to the desired places, when they are needed, becomes too hard,

if the project, e.g. a high-rise building, is located in a densely populated urban area or in a confined area. This type of sites possesses more traffic and congestion owing to the inventory problem, which means that materials are not ready to use just in time, even if supplied. Short planning and design change durations leaving management with little time to order the necessary materials are the other common problems, encountered in the procurement process. If the duration mentioned is small, loss of efficiency tends to be much higher than when it is adequate. Lack of material is a universal problem and has a significant degrading effect on site productivity. Improper material planning and on-site transportation difficulties are amongst the sources of lack of material. The case appeared as a result of materials shortage and it is likely the most considerable part of material management practices related with labour performance. When an adequate supply of materials is not possible, workers try to not exhaust their current stockpile of supplies, so they may slow down their pace or output in anticipation of a delivery, resulting in idle times and cost over runs.

### **Amount of Pay And on-Time Payment**

Remuneration is seen as the most important reason of why an individual has to work in a job. Because it both meets the physiological needs that are the most basic requirement of people, and gives esteem in a society. The amount of pay and on-time payment is the most vital factors required to meet the first hierarchy need of Maslow. A worker, for example, will probably quit the job if a higher wage is offered by another firm. Despite Herzberg's argument that money is not a satisfier and thus not a motivator, the present survey seems to indicate the contrary. The money is one of the most powerful motivators of construction workers, while low pay levels are a major source of discontent to many construction operatives. Hence, with inadequate wages one cannot expect operatives to perform a challenging task competently. Similarly, a project manager in this survey has stated that to agree on the periods and the amounts of wage increases especially before long-run projects is a very critical subject keeping the worker's ease. Another manager interviewed, on the contrary, has mentioned that the amount of pay is not an effective factor in productivity, since nobody in India is satisfied with own wages in general. However, it does not mean that determining a fair level of pay always causes high

worker productivity. By another view, in the construction industry like many other sectors, pay level is usually not a motivation tool determined by taking individual productivity into consideration. This is actually not practically applicable. The production levels of all workers are accepted as similar, and thus, equal wage levels are paid. Timely payment is also one of the primary principles of any working agreement. Whilst adequate working facilities can reduce to some extent the demotivating effects of low levels of pay, delay in payment simply cannot.

### **Systematic Flow of Work(PLANNING)**

It is almost axiomatic in construction management that a project may be regarded as successful if the building is completed on time, within budget, to the specified quality standards and overall client satisfaction. Judicious planning of labour resources are the foremost agent in fulfilling these constraints. Poor planning, however, can adversely affect labour productivity through the need for rework and can result in lost time for workers, since operatives are often paid on work done satisfactorily alone. Most workers take considerable pride in the work they have accomplished that can be seen from the very start of construction through completion. For workers to go back again and take apart what has been completed can be extremely frustrating and can cause them to put forth less effort for the remainder of the work. Resource levelling is of paramount importance in planning as well. Changes in the number of labour during project should follow a gradual move since rapid changes can cause organizational mistakes and make adaptation process difficult among both workforce and management staff. Accordingly, the curves which show how number of workers changes with project duration, should be carefully studied by managers in the inception of project against the trend problem of change.

Construction labour efficiency is affected by deviations from the normal flow of work. That is, worker productivity can be estimated by analysing, how the work flow deviates from which has been planned. Governments possess a major share of the construction investments made in India, and thus most of the construction companies are dependent on these investments. However, the sector has been in a stagnant period since last 5 or 6 years, and cash flows or payment claims are neither regular nor on time, since governments have not

appropriated sufficient funds for construction investments. In such a business and economic environment, it is not quite possible that projects are professionally planned, and that the firms take labour productivity into consideration and evaluate it in a robust manner, as emphasized by many of the participants. Nevertheless, it can be asserted that most of the companies do not still become standardized and specialized in a particular field of construction, and therefore managerial drawbacks have a strong influence on the work force productivity.

### **Supervision**

To follow-up and supervise labour while working is a vital aspect of any organization because both it can result in extensions of project time and cost, and the quality on site is controlled through inspection of the work completed by the gang. In this context, labour-only subcontracting makes some aspects of site management more difficult. The supervision level of labour-only gangs tends to be lower than that of employed workers, and the general contractor has little control, at best, over subcontractors' workforce. In other words, the lump sum poses the problem of which lump sum workers cannot be controlled, while firms possessing employed workforce have their own effect on labour relations. Moreover, subcontractors have no control over other subcontractors' labourers. The number of site engineers, whose primary function is to supervise, changes in proportion to site area and project characteristics. Therefore the quantity of workers inspected and the responsibility area of each supervisor should be at the optimum level.

Meanwhile, it is also very advantageous and effective on labour that top managers audit the works on site at intervals. Supervisor's incompetence is another phenomenon. Labour is highly critical to the inspection personnel and questions of their competency. Questions of workers about tasks should be accurately replied by inspectors as quick as possible; waiting for the answer is so bad for the project in terms of authorities and images of these staff, reducing the work quality. Supervisors' communication with labour has a supreme importance as well. It is a fact that workers feel embarrassed and pressed with the existence of tight audits. Multiple tiers of field supervision reduce overall crew efficiency. To control workers periodically by making them aware of the existence of inspectors rather than to wait close to them without leaving is the most



favorable method of supervision, as was specified by many of the respondents. The technique mentioned should not be interpreted as poor supervision, but be perceived as a fundamental principle of labour management. In this point, piece-work or task basis supervision will be ideal. On the other hand, a smaller span of control has been shown to foster worker's interference and to impair construction productivity. In the present survey, it was similarly revealed that many of the participants control their labour uninterruptedly. Some of the companies, however, ignore the control mechanism and supervise the Workforce at random.

### **Site Layout**

Layout can influence productivity and enhance space management capability. It defines the location of the tools and supporting utilities for optimum product flow, and thus has a direct impact on the facilities' time and cost of construction. In this context, the location of the management office has a strategic importance as well as worker dormitories on site, especially there are many shifts that may cause loud noise and thus a possibility to sleep.

### **Work Discipline**

One of the primary conditions for improving systematic working habits is to have a complete work discipline on site. Discipline can be defined as a concept that determines the human being behaviour by means of reward or punishment. This concept becomes more important in India, since workers in the construction sector are still composed of individuals coming from the rigid regions of patriarchal society. The basic rule of keeping discipline among the workers is that the work discipline of management staff is at the top level. It has a vital aspect that these staff members start working before the workers and finish it after them. Site managers should also pay attention to using their authority on workers according to a personal plan, which has to conform to their characters. However, work discipline will not be able to be kept in any case, if workers have not any job responsibility or working ethics. In this situation, a project will likely be unsuccessful, if site manager does not take any precaution.

### **Occupational Education and Training**

Vocational education, particularly in developing countries, is the total of activities, which enable the reasonable employment of unskilled labour by educating and directing them to vacant fields of labour market, to regulate and control those who come from

farming and do not have any continuous working habit. Poor productivity and high costs in every branch of industry are due partly to low levels of training. Lack of occupational education in construction is now a reality in many countries around the world.

Construction workers in India are composed of unqualified and uneducated individuals, in general. In a business environment, where little educated people are employed as a craftsman, workers are mostly educated only by the apprentice-craftsman relationship on site, but this type of relation, which is in fact essential under normal conditions, becomes meaningless, since craftsmen are also uneducated. Inexperienced workers bring about large amounts of resource waste such as material, equipment, and tool until they are trained, and thus the triple constraint of project, i.e. cost, time, and quality, is directly influenced.

Several ways of finding a permanent solution to these problems are available, but the most sensible one may be occasional short training programs or day-release courses and seminars in educational establishments in support of firm managers, employers' associations, trade unions, societies of engineers and architects, universities, and governments. This solution, however, has a serious disadvantage. Whether or not construction companies undertake the financial loan of their current labor is a big questionmark because the workforce in construction is generally highly mobile. For this reason, contractors are often reticent to invest capital to train those who may soon be someone else employees, which may result in a decrease in the construction workforces average capability level. The answer in this phase is that governments should accept all the educational expenses incurred by the firms in proportion to their scales and financial structures as an input in improving productivity, and in this way, as a tax deduction on money spent for training, because the return on investment from craft training occurs well within the first year.

### **Working at Similar Activities**

To work constantly in the same or similar activities in the construction sector, where tasks vary in a very wide spectrum, or, in other words, to have a complete experience in one trade is one of the key elements guaranteeing the work to be performed by a worker in a definite standard. Experience is the warranty of success and productivity in any job. Working with experienced crews in the sector has many advantages. If experienced

labour is known to be available, supervisors do not have to explain details of how to perform the tasks to experienced workers. Moreover, an estimator can foresee that the learning curve will not be significant, and productivity and quality of work will be better than those of a new or inexperienced worker. As the skill levels and experience of fellow workers increase, job-site safety and health concerns are likely to decline. This, in turn, may reduce workers' compensation costs and insurance costs in this industry. As a result, sustainability of the productivity level of construction workers now depends completely on specializing in a craft whatever are their positions as skilled or semi-skilled workers. On the other hand, experience and seniority concepts do not necessarily go hand in hand because the number of years that someone has been working in an industry may not be as relevant as the specific activities performed, and, thus, the quality and diversity of the work performed is far more important than the number of years in a particular position.

### **CONCLUSIONS**

The conclusions made from the present study are as follows; Construction labourers are migratory in nature and therefore geographically mobile searching for employment, because of which it is not possible for both the parties (construction labourers and employers) to develop long-term relationships and loyalty. It also affects the seriousness with which they approach their work which is the major prerequisite for high productivity. Also most of the construction labour is also engaged in some other profession like farms, factory, domestic servant etc. and hence they do not give full importance to construction work and tend to work informally. Due to this labour cultivates informality, and informality lowers productivity growth. Preference analysis survey reveals that technical, social, physical, psychological, economic, and security problems lowers labour productivity on the construction sites.

The case study suggests that differences in the marginal labour productivity cause large output losses. From survey it is found that employers of construction labour do not consider their labour as their employees. Profit margin is only the criteria for many of the construction firms and hence construction firms engage little in technology adoption, have high labour turnover and do not invest in training workers. Less training, experience and skills of construction labourers results into huge wastage of resources. By providing proper required training for the activities, labour can work more

efficiently and productively. Most of the firms do not find it reasonable as most of the labour on the sites are project specific or even activity specific. Hence, Indian construction industry is facing problems of improper handling and inefficient utilization of resources like material and equipment's which reduces profitability due to low and decreasing labour productivity. Following are the suggestions drawn out from the study to improve labour productivity:

### **Use of Modern Management techniques**

The construction firms are slow in accepting and using modern management methods to plan and execute projects. Every actor should improve their performance by developing project goals and working towards their fulfillment. Use available management systems and techniques to make construction managers more effective.

### **Proper Planning**

Planning begins from the day a project is conceived. Managers should try to plan the project in such a way that there are no repetition of work, no emergency and less number of overtime in the project. For this, manager should develop an overall plan providing a general outline of work using bar or flow charts. He should also develop contingency plans if the original plan fails. He should prepare a detailed planning for work execution at the task level.

### **Provide skills Training**

Labour should know what kind of work he is doing and what is the best method to do it. It improves labour productivity in a big way. It can be understood that labour are not permanent employees to any organization but then if training will be provided to them, they will be motivated to work for the same organization for longer duration.

### **Enough tools in working order**

Labour should not sit idle just because of non availability of tools. Labour should be provided with enough number of tools those are required by them to carry out the work. For this supervisor should be asked about the requirements of all the tools well before any specific activity starts.

### **Motivation through incentives and other programs**

Incentives always motivate your people to work for you. Labour should also be given incentives as

they are the actual executer of any successful work. It also attracts labour to work for longer time for an organization.

#### **Proper amenities to be provided**

Labour should be provided with all their basic requirements like permanent shed, appropriate bathrooms and toilets on sites, transportation etc. All above things may not be demanded by them as they come from very poor background and hence they do not care for all those things but, if these things are provided they tend to concentrate more on work. Hygienic accommodation and toilet keep them healthy to work for you.

#### **Good supervision**

Good supervision is very much essential to get maximum output from the labour. Good supervision avoids mistakes and in turn rework. Supervisors should have good interpersonal skills to get work done through labour.

#### **Safety programs**

Accidents on sites are now common phenomenon in complex and congested site locations. Labour should be provided with full safety training and required PPEs to safeguard themselves from dangerous accidents. Apart from losing on man-hours, an accident on site can spoil all the reputation of the company in the mind of all the stakeholders including labour. Labour feel secured at safe sites and tend to produce more.

#### **Departmental workforce**

It is found that departmental labour tend to work more efficiently and qualitative as compared to other type of labour. Try to hire more and more labour for longer duration. It will give confidence of availability of labour with organization and will also help in qualify for bigger projects.

#### **Government involvement**

Huge numbers of labour are working for different infrastructure project which are going on now a days. Infrastructure projects always have perspective of employment of labour into these projects. The contracting companies working for these projects are not satisfied with labour productivity and hence, are planning to go for mechanized work. More mechanized work will increase unemployment in labour. Government should look into training and development of labour. There should be special budget allotment for training and development of construction labour. Trained labour can be more productive and employer may find themselves satisfied with the work. Employer can also be asked to help and

support the initiative to allow their labour to attend such training. The expense of training can be recovered from labour themselves by loan system, as their wages will be increased with more skills and they will be able to take out extra money from their wages to train and upgrade themselves.

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