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A COMPARATIVE STUDY FOR PRODUCTIVITY ENHANCEMENT IN CONSTRUCTION FIELD WITH LOCAL AND MIGRANT LABOURS

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Abstract **-** Construction labour management can make or break the profit on that job. Good relationship between workers and supervisors can improve the productivity in a high margin. By identifying the problems that each worker faces and finding appropriate actions to overcome those problems, one can improves the output to a high ratio. In this study a checklist is prepared to compare the characteristics of local and migrant labours. Different parameters such as Resource Utilization, Communicative Ability, Work Quality, Job Knowledge, Profit Sensitivity, Cost Sensitivity and Safety Consciousness etc, are used to compare local and migrant labours. Problems are identified based on the checklist and solutions are identified in such a way that improves productivity**.**

I. INTRODUCTION

1.1 General

The Construction industry is the second largest economic activity in India, and plays an important role in the nation's economy. It is a front line activity of several other key sectors of economy whose performance is dependent on the satisfactory performance of this industry. A change in the level of construction activity affects the GDP and manufacturing, and the general employment and incomes of people. Construction has accounted for about 40 percent of the investment in the country during the last 45 years. Around 16 percent of the nation's working population depends on it for their employment.

Construction is the world's largest and most challenging industry. Human resource today has a strategic role for productivity increase of any organization, and this makes it superior in the industrial competition. With the effective and optimum uses of it, all the advantages supplied by the productivity growth can be obtained.

Construction is a key sector of the national economy for countries all around the world, as traditionally it took up a big portion in nation's total employment and its significant contribution to a nations revenue as a whole. However, until today, construction industries are still facing number of problems regarding the low productivity, poor safety and insufficient quality.

Productivity is the one of the most important factor that affect overall performance of any small or medium or large construction industry. There are number of factors that directly affect the productivity of labour, thus it is important for any organization to study and identify those factors and take an appropriate action for improving the labour productivity. At the micro level, if we improved productivity, ultimately it reduces or decreases the unit cost of project and gives overall best performance of project. There are number of activities involved in the construction industry. Thus the effective use and proper management regarding labour is very important in construction operations without which those activities may not be possible.

1.2 Construction Industry in India

"Construction activity accounts for more than 50 percent of the National plan outlays. These are related to all types of construction, be it housing, other building construction, roads, infrastructure, dams, canals, railways, etc. The work on the same is looked after by the Central Government through various Ministries and Departments depending upon the sector it is representing and by the state Government construction departments like Public Work, Irrigation, Building and Roads and other Departments. This is also the sector which contributes to the second largest employment generation opportunity in the country. There are over 2.5 crore of construction workers in the country covering unskilled, semi-skilled and skilled levels constituted by masons, carpenters, bar benders, plumbers, electricians, tile layers, glass fitters, concrete workforce, etc. Other than those directly involved in the construction process a large amount of employment is produced due to the forward and backward linkages with the industry e.g.

construction materials industry, real estate etc.The work is handled by builders from the private sector, small contractors or petty contractors (Chotta Thekkedars) and construction groups with different degrees of capabilities from the micro to macro level projects. The present state-of-art of construction industry capabilities with appropriate professionalism, specialization, financial and delivery capabilities leave much to be desired, considering the vast majority of agencies contributing to various types of services in the construction sector. A strong need has been felt for the professional, managerial, technical and financial upgradation of the construction agencies operating in the construction field.Construction skills were transferred from father to children on a hereditary basis, more so skills of masonry and carpentry. These have undergone changes over the years and construction skills are now acquired by the workers as a part of on-the-job training. They come to the Construction Projects as unskilled workers and over a period of time working with the main mason at the construction site, acquire levels of skilled workers. Normally, a learning curve of the order of 5 to 10 years is needed for the transformation. As a result, their productivity and quality of work in the initial period are also reflected in the work progress.

Unlike other formal education systems for higher order manpower development, namely architects, engineers and specialists coming through various educational avenues like polytechnics, engineering colleges, architectural schools, technology universities and acquiring either diploma, degree or postgraduate degree or doctorate, the construction workers have been left more or less uncovered.

1.2 Objective

The objective of this study focuses on views from the construction industry about various factors affecting labour productivity, Analyzes factors affecting the labour productivity, impact and suggests appropriate measures that can be taken to improve labour productivity. The aim is supported by the objective stated below.

Study and discuss various factors affecting labour productivity in construction industry

Analyze and calculate the Relative Important of those factors affecting labour productivity

To make recommendations to improve labour productivity in construction

To statically analyze the factors affecting labour productivity.

1.4 Participants in India's Construction Industry

The construction industry consists of numerous fragmented firms. Developers engage main contractors who in order to maintain minimal overheads, subcontract most of the construction tasks to smaller, non-registered groups of workers. Although these subcontracted workers have some specialization in their respective trades, almost none of them provide truly professional and specialized services to construction firms. The industry then is made up of developers, contractors, subcontractors and workers.

1.4.1 Client

Government agencies like municipal corporations are the major clients in any city for various projects like commercial complexes, row houses schemes, government quarters, institutional buildings etc. they finance and consult for such projects and ultimately the end users of the project. Generally local bidding is done for tendering of such projects

1.4.2 Developers

Property developers, typically small landowners, start the construction process by commissioning construction work to contractors. The government and big corporations account for only a small share of Building as they develop large projects of multi-storied buildings. Developers devote most of their efforts to procuring land and obtaining building permits, cutting through multiple layers of red tape.

1.4.3 Contractors

Main contractors, mostly small registered companies, are responsible for construction work at the site. After receiving the contract from the developer, main contractors typically subcontract all construction work and concentrate on top-level supervision and material procurement. In the case of individually built houses, the contractor's function is typically undertaken by the house-owner.

1.4.4 Labor Subcontractors

Labour subcontractors, mostly individual, non-registered entities, directly procure and engage the labour required at the site. Labour subcontractors are typically construction workers who have established themselves by enhancing their reputation in their local area or by following a main contractor from site to site. Although labour subcontractors are organized by trade, high labour turnover and lack of formal training severely limits their ability to provide truly specialized services.

1.4.5 Workers

Workers are often recruited directly from villages by labour subcontractors who facilitate their migration to cities by providing finance and assuring employment. These workers often leave their families and small landholdings behind and return to their villages during the monsoon to participate in agricultural activities.

1.5 Categories of Labor

The nature of skill mix in building trades is of significance. The skills required to perform in building trades vary considerably. A Mazdoor could easily be used to assist a mason, concreter, painter or a carpenter. But the skill requirements begin to increase as one moves up the technology ladder. Skills required to become a formwork and centering carpenter are different from those required in a furniture making carpenter. Each of these trades is semi-independent, though a part of the construction process. On

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a building site the job exist in clusters of different trades, but the level of performance skills criteria cuts across clusters. Workers are classified as unskilled, semi, and skilled in each trade.

The myth of 'unskilled' worker should be noted. Even a head load carrier possesses a certain level of skill to arrange 22 bricks on her head; without this skill she may not be able to carry even 10 bricks at a time. Every person becomes minimally 'low skilled' worker within a few days of work on the site. Thus, a more appropriate classification would be unskilled, low skilled, semi-skilled, skilled and highly skilled, the last category should have the ability to train others and be interchangeable with supervisor.

Generally, masons, carpenters, blacksmiths, stone cutters, mechanics, drivers etc. are skilled workers. These personnel were called mistris if they reported directly to the Engineer, whereas if all the above categories of workers are working under or reporting to a mistri comes under semi-skilled category. In unskilled category, there are workers who are engaged on earth work, stone breaking and crushing, digging, transshipment, load carrying and similar works.

1.6 Profile of Building Labor

Some studies have found that construction labour is dominated by young, married, illiterate and unskilled males, mostly belonging to the scheduled caste and scheduled tribe, backward classes and the Muslim community, with a high family dependency load. Workers in the construction industry are often rural migrants who were mostly landless labour and on the brink of starvation in villages. They move to cities in search of work. About half of the total workers start as unskilled labour. Many remain unskilled. 90 percent of the workers say they entered jobs in the construction sector due to the compulsion of circumstances.

Labour laws for contract labour in the construction industry are, by and large, at par with those for other categories of labour employed in various industry groups. However, mentioned must be made of some laws which are of direct relevance to construction labour, namely:

- Contract Labour (Regulation and Abolition) Act, 1970;
- Inter-State Migrant Labour (Regulation of Employment and Conditions of Service) Act, 1979;
- Building and Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996;
- Building and other Construction Workers Welfare Cess Act, 1996

1.7 Scope of the Study

The scope of the study is confined to the building workers engaged in housing construction and is specific to these parameters, namely

- Direct employment
- Productivity of labour

1.8 Objectives of Project

- Improve productivity
- Reduce labour cost
- Minimize idle time
- Maximize resource utilization

II. METHODOLOGY

Survey research is defined as collection of different data by asking people questions. The data collection process used in this research had the option of two basic methods: questionnaires and personal interviews. A questionnaire was preferred as the best effective and suitable data-collection technique for the study. It was concluded that the questionnaire was described as a self-administered tool with web design questions, an appropriate response. A questionnaire in a web-survey format comparatively requires less duration and saves cost for the researcher while permits respondents to response the questionnaire at their personal ease. However, for this approach the reply rate is usually lower as compared to face-to-face interviews. Data was collected from literature reviews from books, journals, articles, seminar conferences, and websites which emphasize building construction's labour productivity.

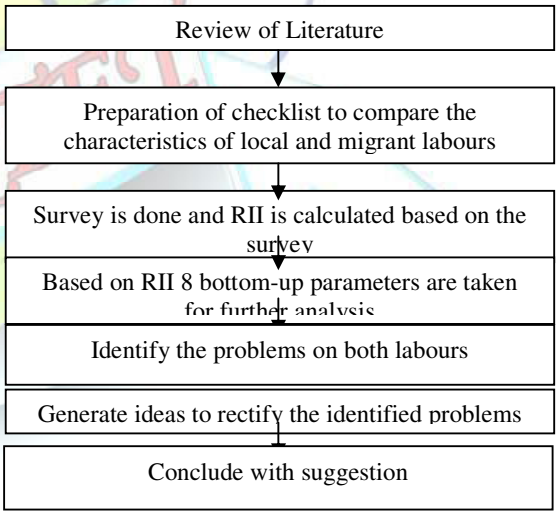

Fig 2.1 Methodology Chart

III. LABOR MANAGEMENT

3.1 Labor Productivity

Productivity can be defined in many ways. In construction, productivity is usually taken to mean labour productivity, that is, units of work placed or produced per man-hour. The inverse of labour productivity, man- hours per unit (unit rate), is also

commonly used. Productivity is the ratio of output to all or some of the resources used to produce that output. Output can be homogenous or heterogeneous. Resources comprise: labour, capital, energy, raw materials, etc.

Productivity may then be defined as the ratio of earned to actual hours. The problem with this concept is in establishing reliable, for setting standards. It also depends on the method used to measure productivity, and on the extent to which account is taken of all the factors which affect it. At a project site, contractors are often interested in labour productivity. It can be defined in one of the following ways.

Labour Productivity = (Output / Labour Cost)

Productivity measures can broadly be placed into two categories. Single factor, or partial, productivity measures relate a particular measure of output to a single measure of input, such as labour or capital. Multi-factor or total productivity measures (MFP) relate a particular measure of output to a group of inputs, or total inputs used. Productivity measures can also be distinguished by whether they rely on a particular measure of gross output or on a value-added concept that attempts to capture the movement of output. Of the most frequently used MFP measures, capital-labor MFP relies on a value-added concept of output while capital labor-energy- materials MFP relies on a particular measure of gross output.

The five most widely used productivity concepts are

Labor productivity, based on gross output: This productivity measurement traces the labour requirement per unit of output. It reflects the change in the input coefficient of labour by industry and is useful for the analysis of specific industry labour requirements. Its main advantage as a productivity measure is its ease of measurement and readability; particularly, the gross output measure requires only price indices on gross output. However, since labour productivity is a partial productivity measure, output typically reflects the joint influence of many different factors. .[3] analyzed microwave waveguides and components such as microwave T junctions , circulators, attenuators and Isolators.

Labor productivity, based on value-added: Value-added based labor productivity is useful for the analysis of micro-macro links, such as an individual industry" s contribution to economy-wide labour productivity and economic growth. From a policy perspective, it is important as a reference statistic in wage bargaining. Its main advantage as a productivity measure is its ease of measurement and readability, though it does require price indices on intermediate inputs, as well as to gross output data. In addition to its limitations as a partial productivity measure, value-added labour productivity has several theoretical and practical drawbacks including the potential for double counting production of benefits and double deflation.

Capital-labor MFP, based on value-added: This productivity measurement is useful for the analysis of micro-macro links, such as the industry contribution to economy-wide MFP growth and living standards, as well as, for analysis of structural change. Its main advantage as a productivity measure is the ease of aggregation across industries. The data for this measurement is also directly available from national accounts. The main drawback to the value-added based capital-labour MFP is that it is not a good measure of technology shifts at the industry or firm level. It also suffers the disadvantage of other value-added measures that have been double deflated with a fixed weight Laspeyres quantity index.

Capital productivity, based on value-added: Changes in capital productivity denote the degree to which output growth can be achieved with lower welfare costs in the form of foregone consumption. Its main advantage as a productivity measure is its ease of readability but capital productivity suffers the same limitations as other partial productivity measurements.

Multi-factor productivity: It is used in the analysis of industry-level and sectoral technical change. It is the most appropriate tool to measure technical change by industry because it fully acknowledges the role of intermediate inputs in production. Domar's aggregation of MFP across industries renders an accurate assessment of the contributions of industries to aggregate MFP change. The major drawback to MFP is its significant data requirements, in particular timely availability of input -output tables that are consistent with national accounts. It is also more difficult to communicate inter industry links and aggregation across industries using MFP than in the case of value-added based MFP measures.

3.1.1 Productivity and Labor

On any construction site the contractor's financial gain is dependent, amongst other things, on completion of the work in good time and at the least cost, and the productivity of labour has a direct bearing on this being achieved. The factors affecting the performance of labour generally fall into three categories

i. The human capacity for work;
ii. The competence of site management;
iii. The motivation of the workers.

3.1.1.1 The Human Factor

3.1.1.2 Competence of Site Management

The various measures that may be taken to improve the physical work capacity or to motivate the workers will not be effective if site management is substandard. It is essential for the workers to have confidence in their supervisors. If the workers observe that site management is poor, unfair or corrupt, their morale,

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motivation and consequent productivity will be reduced. Examples of management shortcomings which reduce efficiency and productivity in this way include

- Delayed, unclear or inadequate instructions
- Delays in delivery of materials, tools or equipment
- Provision of poor tools and equipment
- Unbalanced work gangs
- Use of wrong methods
- Bad advance planning or allocation of work tasks

3.1.1.3 Motivation of Workers

Workers are motivated in their work by a variety of methods, all of which may be present in varying degrees. They include

A. Fear
B. Discipline
C. Job satisfaction
D. Financial incentives.

A. Fear

This includes fear of the supervisor and fear of losing a job and being out of work and destitute, especially in a country where no form of social security exists. This is a negative and unsatisfactory form of incentive.

Factor	Explanation	Comments and suggestions for
Age	Peak capacity for physical work is generally reached between the age of 20-35	In older persons, especially in skilled jobs, experience and efficiency
Nutrition	Capacity is related to calorie protein content of food	Establish project canteens to provide balanced meals. Arrange
Temperature & Humidity	Affect the rate at which heat can be dissipated from the human body by radiation, convention and evaporation of sweat, heat and humidity increase dangers of heat stroke and reduce work capacity	Start work at first light and avoid working during the heat of the day.
Health	Resistance to disease is affected by diet. Good hygiene and sanitation is essential to avoid occurrence of debilitating intestinal parasites.	Enforce strict site hygiene. Arrange talks on hygiene and sanitation

B. Discipline

This is exemplified by punctuality, lack of absenteeism, good standards of workmanship and the observance of site cleanliness and hygiene. When discipline is lacking, site morale is generally low and productivity is unsatisfactory. Ways of achieving site discipline include:

- Site rules drawn up and explained to all workers by either supervisors
- Supervisors; by personal example, setting a high standard in self-discipline
- Workers encouraged to feel that they are working with, rather than under, the supervisor (but at the same time the supervisor should leave no doubt in their minds that he is the leader)
- Retribution should be a matter of inevitability rather than severity. No breach of discipline should go unchecked
- Developing self-discipline through pride in achievement. Good work should always be praised
- Taking a personal interest in the worker, discussing problems fairly, never showing favoritism
- Disciplinary action should be taken as soon after an infringement as possible

C. Job Satisfaction

Apart from work providing the means of satisfying the workers' basic needs as to food, clothing and shelter, job satisfaction is obtained when the higher psychological needs of the worker, e.g. self-respect and personal dignity, are met. Individuals have a need to belong and for their usefulness to be apparent. Job satisfaction is obtained through a sense of achievement as to quality, output or other contributions, particularly if that achievement as to quality, output or other contributions, particularly if that achievement is recognized and acknowledged. Pride in craft and skill and a sense of responsibility are to be encouraged, and rewarded with opportunities for advancement and promotion. Negative aspects which detract from job satisfaction and morale, and which consequently affect productivity, are to be avoided. These are generally aspects which imply that the worker is held in low esteem by management and include:

- Poor working conditions and terms of employment
- Poor or subservient relations with supervisors

D. Financial Incentives

Incentive schemes of this nature are widely used in industrialized countries, but are often a source of contention and dispute between management and workforce. The schemes enable workers to earn bonuses over and above the normal rate of pay for achieving a rate of output at or above a predetermined standard. It is not always easy to work out what this standard performance should be, so that the output targets set by management of which the bonus earnings depend are often inaccurate.

3.2 Labor Characteristics

Performance analysis is a common tool for assessing worker quality and contribution. Factors that might be evaluated include:

- Quality of Work - ability of work produced (or) talented.
- Quantity of Work - volume of acceptable work
- Job Knowledge - demonstrated knowledge of requirements, methods, techniques and skills involved in doing the job and in applying these to increase productivity.
- Related Work Knowledge - knowledge of effects of work upon other areas and knowledge of related areas which have influence on assigned work.
- Judgment - soundness of conclusions, decisions and actions.
- Initiative - ability to take effective action without being told.
- Resource Utilization - ability to delineate project needs and locate, plan and effectively use all resources available.
- Dependability - reliability in assuming and carrying out commitments and obligations.
- Analytical Ability - effectiveness in thinking through a problem and reaching sound conclusions.
- Communicative Ability - effectiveness in using oral and written communications and in keeping subordinates, associates, superiors and others adequately informed.
- Interpersonal Skills - effectiveness in relating in an appropriate and productive manner to others.
- Ability to Work Under Pressure - ability to meet tight deadlines and adapt to changes.
- Security Sensitivity - ability to handle confidential information appropriately and to exercise care in safeguarding sensitive information.
- Safety Consciousness - has knowledge of good safety practices and demonstrates awareness of own personal safety and the safety of others.
- Profit and Cost Sensitivity - ability to seek out, generate and implement profit-making ideas.
- Planning Effectiveness - ability to anticipate needs, forecast conditions, set goals and standards, plan and schedule work and measure results.
- Leadership - ability to develop in others the willingness and desire to work towards common objectives.
- Delegating - effectiveness in delegating work appropriately.
- Development People - ability to select, train and appraise personnel, set standards of performance, and provide motivation to grow in their capacity. Diversity (Equal Employment Opportunity) - ability to be sensitive to the needs of minorities, females and other protected groups and to demonstrate affirmative action in responding to these needs.

Item	Very Bad	Bad	Neither Good Nor Bad	Good	Very Good
Scale	1	2	3	4	5

3.3 Relative Importance Index

The analysis was done using Relative Important Index (RII) method and found the bottom most factors leading to affect the labour productivity at construction site. The following formula is used to calculate the relative important index.

Formula used in Relative Important Index

$$RII = \frac{\sum (X_i * Y_i)}{(Z_i * 5)}$$

Where,

RII = Relative Importance Index

X_i = number of responses to the factors

Y_i = the value of rating

Z_i = total number of responses to the factors

3.4 Questionnaire Design

The factors affecting labor productivity were obtained from the various books, literature review and the questionnaire design was undertaken to determine the opinion of owner, contractor, and consultant regarding the causes of labor productivity in construction industry. Questions were made in simple English which can be understood by the entire respondent. Likert scale was used to rank the importance of the importance of each factor as shown in Table 3.2 and check list for local and migrant labors given in Table 3.3

IV. DATA ANALYSIS

4.1 Rii and Ranking of Labor Productivity Factors.

Rii and Ranking of Labor Productivity Factors for local and migrant labors are given in table 4.1 and 4.2

4.2 Bottom-Up Problems for Local Labors

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- Safety Consciousness
- Punctuality
- Motivation
- Resource utilization
- Dependability
- Communication with higher authority
- Communication with co-worker
- Leadership quality

4.3 Bottom-Up Problems for Migrant Labors

- Resource utilization
- Communication
- Dependability
- Safety Consciousness
- Judgment
- Leadership quality
- Work performance
- Dedication

4.4 Various Factors Affecting Labor Productivity

Based on the study & survey, Factors affecting construction labour productivity have been identified and are grouped into 15 categories according to their characteristics, namely1)Design factors 2) Execution plan factors 3) Material factors 4) Equipment factors 5) Labour factors 6) Health and safety factors 7) Supervision factors 8) Working time factors 9) Project factors 10) Quality factors 11) Financial factors 12) Leadership and coordination factors 13) Organization factors 14) Owner/consultant factors 15) External factors

4.4.1 The Top Ten Factors That Affect the Small And Medium Company

1) Lack of material 2) Labour strikes 3) Delay in arrival of materials 4) Financial difficulties of the owner 5) Unclear instruction to labourer and high absentissm of labours 6) Bad weather (e.g. rain, heat,etc.) 7) Non discipline labour and use of alcohol and drugs 8) No supervision method, design changes, repairs and repetition of work, and bad resources management 9) Bad supervisors absentissm and far away from location of material storage, and 10) Bad leadership

4.4.2 The Top Ten Factors That Affect Large Companies

1) Unclear instruction to labourer 2) Delay in arrival of materials 3) Lack of material and financial difficulties of the owner 4) There is no definite schedule 5) Low supervisor‟ s capability/incompetence supervisors 6) No supervision method, lack of equipment, and high absenteeism of labours 7) Supervisors absenteeism, frequent damage of equipments, and labour strikes 8) Design changes 9) Incomplete drawing and inspection delay 10) Poor communication in site and inaccurate design.

4.4.3 Factors That Affect In General All

Lack of material , Delay in arrival of materials , Unclear instruction to laborer, Labour strikes, Financial difficulties of the owner, High absenteeism of labours, No supervision method, Supervisors absenteeism, Lack of equipment and design changes, There is no definite schedule, Poor management, Unproductive time (internal delay, extra break, waiting & relaxation), Lack of skill, Supervision delay, Lack of tools & equipment, Poor instructions, Poor quality of labour, Supervision factor, Material factor, Execution plan factor, Health & safety factors, Labour shortages, Working time factor, Accidents, Organization factors, Improper training, Bad weather , Use of alcohol & drug.

4.5 Guidelines for Improving the Labor Productivity

1. Properly training to the laborers
2. Motivation to workers towards project completion
3. Properly and in advance material procurement and management
4. On time payment to the workers
5. Systematic flow of work
6. Properly, clearly & in time supervision
7. Advance site layouts
8. Maintain work discipline
9. Facilities to the laborers
10. Clearance of legal documents before starting of work
11. Systematic planning of funds in advance
12. Premansoon plan to avoid work stop
13 Maximum use of machinery and automation system
14 Advance equipment planning.

V CONCLUSION

The expected outcome of the study will reveal the proper solution to the identified problems based on survey and it will also help to control the problems prior to the start of work, which will directly improve the productivity of labours.

REFERENCES

1. Attar,(2008),“A Study of Various Factors Affecting Labour Productivity And Methods To Improve It”, Journal of Mechanical and Civil Engineering.

2. Mahesh Madan Gundecha, “Study of Factors Affecting Labor Productivity At A Building Construction Project In The USA”.

3. Christo Ananth, "A Detailed Study Of Microwave Passive Components [RF & Microwave Engineering Book 3]”, Kindle Edition, USA, ASIN: B06XRXJ6MK, ISBN: 978-15-208-926-1-0, Volume 10, March 2017, pp:75-128.

4. William F. Maloney, R. Malcolm W. Horner, Gary R. Smith, Vir K. Handa, And Steve R. Sanders,(1990),“Modeling Construction Labor Productivity”, Journal Of Construction Engineering And Management.

5. William f. Maloney,(1983),“Productivity Improvement: The Influence Of Labor”, Journal of Construction Engineering and Management.

6. Chris Hendrickson, (2008),“Project Management for Construction”.