

A LITERATURE REVIEW OF LABOUR PRODUCTIVITY IN BUILDING CONSTRUCTION

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Abstract - Worldwide labour productivity is at the forefront of concern facing professionals in the construction industry. Productivity helps construction industries to be competitive, to achieve the goals. The main objective of the paper is to critically review the factors affecting labour productivity, grouping of factors and methods to evaluate Productivity. The study on productivity of labour is important in developing country like India, where most of the building construction is in manual basis. Based on review it was observed that supervision, skill of labour, tools and equipment, absenteeism and financial constraints were the most significant factors affecting labour productivity, however in case of grouping of factors it was prominent that human group, management group, material and tool group, environmental group and technological group are relatively groups. In case of analysis of labour productivity, factor analysis plays a vital role in identifying the independent and group factors which can be used to improve the factors affecting labour productivity.

Keywords - Construction, Labour, Manpower, Machine, Material, Productivity, Building construction.

I. INTRODUCTION

The Ratio of Output of required quality to the input for a specific production situation. Productivity signifies the how to well an individual entity uses its resources to produce outputs from input. Improving productivity is major concern for any profit oriented organization. In general terms productivity is termed as ratio between input and output. Proper management of available asset can help in improving productivity. Labour is the most important asset to a construction company. 30% to 50% of total cost of project is spent on labours. Quality of the construction largely depends upon the quality of work done by labour. Labour productivity directly affects construction productivity, it is important to know the factors affecting labour productivity. Construction productivity and labour productivity are two important words that determine the profit and loss of the construction business. Productivity can be defined in many ways. In construction, productivity is usually taken to mean labor productivity, that is, units of work placed or produced per man-hour. The inverse of labor productivity, man-hours per unit (unit rate), is also commonly used.

$$\text{Productivity} = \frac{\text{Output}}{\text{Resource used}}$$

There are two measures of construction productivity: (1) total factor productivity, where outputs and all inputs were considered; and (2) partial factor productivity, where outputs and single or selected inputs are considered.

In construction, productivity is usually taken to mean labour productivity, that is, units of work produced per man-hour. So, here productivity is the ratio of output to labour cost or output to work hour.

Construction is labour oriented industry. Most of the construction laborers 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 numbers of problems because of their inexperience and lack of skill.

Performance of labour in building construction is affected by so many factors and is usually linked to the performance of Time, Cost and Quality. Therefore, it is important to evaluate factors affecting labour productivity in building construction.

II. DEFINITATIONS

The origin of the term productivity can be traced back to 1766 when it was first mentioned in article by Quesnay (Vaggi 1987, Abdulaziz and Camille 2012). In 1883, Litre defined productivity as the faculty to produce (Jarkas 2005). In 1950, the organization for European Economic Co-operation (OEEC) introduced a formal definition of productivity as quotient obtained by dividing output by one of the production factors (Sumanth 1984). Two measures of productivity namely total factor productivity (TFP) and partial factor productivity (PFP) are commonly used in construction industry (Vaishant and Kansal 2014). The first measure of productivity total factor productivity is defined as the ratio of total output to total input. Total factor productivity is expressed as shown in the equation (1).

$$TFP = \frac{\text{Total output}}{\Sigma(\text{Labour+Material+Equipment+Energy+Capital})} \dots\dots\dots 1$$

The second measure partial factor productivity it is defined as the ratio of the output to a single or selected set of input. Equation (2), (3), (4) gives partial factor productivity for selected set of inputs.

$$\text{Labour Productivity} = \frac{\text{Output Quality}}{\text{Labour hours}} \dots\dots\dots 2$$

$$\text{Capital Productivity} = \frac{\text{Output Quality}}{\text{Capital input}} \dots\dots\dots 3$$

$$\text{Labour Productivity} = \frac{\text{Output Quality}}{\text{Equipment hours}} \dots\dots\dots 4$$

III. CRITICAL LITERATURE REVIEW

The following are the previous research based on labour productivity in building construction.

AynurKazaz et al (2008) moreover surveyed 82 firms on factors affecting labour productivity in Turkey and identified the following nine factors as most important to labour efficiency; 1. Quality of site management, 2. Material management, 3. Amount and on payment, 4. Planning, 5. Supervision, 6. Site layout, 7. Work discipline, 8. Occupational education and training, 9. Working at similar activities, based on relative importance index method.

Vaishant and Kansal (2014) based on relative importance index identified the top ten following factors affecting labour productivity in Chambal region, India were: (1) Classification in technical specification, (2) Labour supervision, (3) Method of construction, (4) Delay in payment, (5) Labour fatigue, (6) Lack of construction managers leadership, (7) Extents of variations/change order during execution, (8) Late arrival, early quit and frequent unscheduled break, (9) Labour skill and (10) Availability of experienced labours.

Soekiman et al (2011) explored various factors affecting labour productivity in Indonesia and shortlisted the following as most significant: Lag of materials, Delay in arrival of material, Unclear instruction to labour, Labour strikes, Financial difficulties, Higher absenteeism of labour, No supervision method, Supervisors absenteeism, Lag of equipment and design change. In another study by Attar et al on various factors affecting labour productivity and methods to improve it at Sangli, Kolhapur and Pune district concludes with the same parameters given by Soekiman et al (2011) as most significant factors affecting labour productivity.

Makulsawatudom et al (2004) researched the influence of 23 factors on the productivity of the construction industry in Thailand and deducted that lack of material, incomplete drawings, incompetent supervisors, lack of tools and equipment, labour absenteeism, poor communication, instruction time, poor site layout, inspection delay and rework, are the most critical.

Lim and Alum (1995) classified various factors impacting the construction productivity in Singapore and shortlisted the following as most significant; 1. Lack of qualified supervision, 2. Shortage of skilled labours, 3. High rate of labour turnover, 4. Labour absenteeism and 5. Communication with foreign labours.

Attar et al. (2012) carried survey of building projects in Sangli, Kolhapur and Pune districts, where an increase in productivity is being sought. He identified ten most significant factors affecting labour productivity for small, medium and large companies. The groups of factors which are highly effective are: supervision, material, execution plan, and design. He said that for large companies, equipment factors have also highly effective. While in small and medium companies, owner/consultant factors also need special attention.

Vekaria (2012) concluded that project management skills were acceptable as the most important factor that influenced the productivity among the labour a part of the other factors such as technology exploration, skill and training, labour organization, project uniqueness and wage trends. He strongly agreed that technology exploration will increase the productivity. He said that explorations of new technology or transfer technology are very essential to develop better performance of project in line with globalization in construction industry.

Ameh et al. (2011) established the relationship between time overrun and labour productivity on construction sites in Lagos, Nigeria. He concluded that factors causes time overrun are inadequate fund for the project, inadequate planning of project before take-off, inadequate tools and equipment, delay in delivery of materials, subcontractors' incompetency and design changes during project execution. And factors that affect productivity in the construction sites are use of wrong construction method, inadequate construction materials and inaccurate drawings/specification were the most significant. Based on the outcome of the study, he gave recommendations which improved productivity in the construction industry and to reduce time overrun on projects in Nigeria.

Shashank et al. (2014) grouped factors affecting labour productivity in six different group which are Motivation group, Manpower group, Material/Equipment group, Safety group, Managerial group, Quality group. They said Motivation factor has the highest impact on labour productivity. So they suggested that, the construction company should increase labour satisfaction by paying a reasonable salary, developing financial reward or recognition program and improving the living condition on site.

Loeraa et al. (2013) developed methodology to assess the labour productivity of industrial maintenance projects. In this methodology they proposed the work sampling tool in order to identify the main factors that affecting labor productivity as well as they proposed apply lean thinking to improvement labor productivity.

Shah Meet et al. (2014) stated that productivity can be an influential factor in minimizing the project losses or increased profits. Productivity can help a company gain competitive advantage and slim profit margins. He suggest the top factors which affects productivity based on the survey conducted in the central Gujarat region were low payment, poor

construction methods, use of technology/level of mechanization, delays in material delivery etc.

Khaled et al. (2013) comprised 30 productivity factors and classified them under three primary categories: Human/labor, Industrial and Management. Their study represented five factors which are most significant in construction labour productivity in Egypt: (1) Labour experience and skills, (2) Incentive programs, (3) Availability of the material and ease of handling, (4) Leadership and competency of construction management and (5) Competency of labour supervision.

Shehata et al. (2012) said proper management of resources in construction projects can yield substantial savings in time and cost. Here State-of-the-art methods and techniques of productivity measurement are used. And also concluded that the key for productivity improvement is not to complete as many tasks as possible or to maximize workload but focus on maintaining a predictable workflow and thus be able to match the available workload with capacity (work hours).

Dayakar et al. (2012) concluded important factors affecting labour productivity are quality of site management, material shortage, timely payment of wages, labour experience, misunderstanding between labour and superintendent. Work concentrated on labour productivity ratios that reduced day by day, which in turn harm organization's profitability. MS excel methods and SPSS software used for analysis. Fifty one factors were considered for study and categorized into four different groups which were work content issues, work environment issues, workforce issues and regulations.

Raj et al. (2014) focused on human resource management in construction field. They conduct questionnaire survey with 100 labours of different company. And studied the impact of human resource management practices on productivity and financial performance in construction industry. They concluded that 75% of people fairly agree that site congestion is creating them to work uncomfortably.

Dharani et al. (2015) found that construction laborers are migratory in nature and therefore geographically searching for employment. Thus their employers keep on changing and it is impossible for both the parties to develop long-term relationships and loyalty to their employers. He found 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.

Varma et al. (2014) told that productivity can be measured by monthly planned/targeted concrete and actual consumption of concrete data. Here, targeted concrete is the input value and actual consumption of concrete is the output of the productivity. They considered single factor type of productivity i.e. concrete they have calculated the productivity for shell and core type of contract.

Thiyagu et al. (2015) proposed fifteen independent groups affecting the labour productivity in the construction projects. The topmost factors affected the labour productivity are given Sanitation and hygiene of the construction site and the temporary shed; Labour injuries on site; Alcoholism; Working overtime; Shortage of construction materials; Payment delays; Change orders from the designers; Improper equipment; Poor quality of construction materials; Misunderstanding among laborers.

Kazaz et al. (2015) said that among all inputs, labour force is the most difficult one to manage. In their study, it was aimed to compare labour productivity perspectives of manager and craft workers. They concluded the most influential factors that affect labor productivity were grouped under organizational factors.

Rao et al. (2015) used three test for research study which are reliability test, factor analysis, regression analysis they concluded that most of respondents think that planning and scheduling has to be improved at site.

IV. CONCLUSIONS

Conclusions based on literature review are as follows:

1. Major factor affecting labour productivity are low payment, poor construction methods, use of technology/level of mechanization, delay in material delivery etc. in central Gujarat region.
2. Factors affecting productivity are categorized under four groups such as Organizational, Economical, Physical and Socio-physiological.
3. Technology exploration will increase the productivity.
4. Some construction labours are 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.
5. For large companies, equipment factor is highly affecting labour productivity. While in small and medium companies owner/consultant factor need special attention
6. Key for productivity improvement is not to complete as many tasks as possible or to maximize workload but focus on maintaining a predictable workflow.
7. A 1.03 units reduction (or increase) in time overrun causes 1.0 units increase in labour productivity.
8. Proper management of resources in construction project can yield substantial saving in cost and time.
9. The stakeholder attention is focused on improved resource utilization and productivity. From the review it was observed that, inefficient management of construction resources can result in low productivity.

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