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REVIEW ARTICLE

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FACTORS AFFECTING LABOUR EFFICIENCY

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ABSTRACT

Construction tasks are costly and frequently cause in arguments and claims, which generally affects progress of construction projects. The environment of construction organizations should be appropriate to implement projects with successful completion. In the construction industry, it is necessary to find the weaknesses of particular task in order to solve and overcome them. . This chapter deals the possible solutions and suggestions for the factors affecting the onsite labour productivity that was identified on the inspection of the brick work and plastering work that was carried out in the site. Additionally some of these suggestions have been implemented in the site to improve the productivity. A construction company should analyze each phase of its process to determine what the barriers are to improving productivity. It should begin by measuring key factors and setting benchmarks and goals for improvement.

1. INTRODUCTION

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

For every project, efficiency, cost, quality, and time have been the main concern. Better efficiency can be achieved if project management includes the skills of education and training, the work method, personal health, motivational factors, the type of tools, machines, required equipment and materials, personal skills, the workload to be executed, expected work quality, work location, the type of work to be done, and supervisory personnel. Efficiency is generally defined as the average direct labour hours required to install a unit of material .It is said that perfect efficiency can be achieved with a 40-hourwork week, with people taking all the holidays and vacation days as planned all of the engineering drawings would be100%complete there would be no delays of any kind during construction; everyone would work safely; everything would fit perfectly the first time; the weather would be70^{O}F; and there would be no litigation at the end of the project.The term "productivity" expresses the relationship between outputs and inputs. Output and input differ from one industry to another. Also,

the productivity definition varies when applied to different areas of the same industry. Labour is one of the basic requirements in the construction industry. Labour productivity usually relates manpower in terms of labour cost to the quantity of outputs produced. In 1883, Littrede fined productivity as the "faculty to produce ,"that is, the desire to produce. In 1950, the Organization for European Economic Cooperation (OEEC) introduced the definition of productivity as a quotient obtained by dividing the output by one of the production factors .Depending on measurement objectives and the availability of data, several productivity definitions are encountered.

2. OBJECTIVE

The main objectives of this study include the following:

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

3. DIFFERENT FACTORS AFFECTING LABOUR PRODUCTIVITY

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

3.1 TIME

During construction projects, there are many tasks which cause a loss of productivity. Past study shows productivity decreases with working overtime. The most frequently stated reasonsare fatigue; increased absenteeism; decreased morale; reduced supervision effectiveness; poor workmanship, resulting in higher rework; increased accidents.Working overtime initially result in increased output, but continuing overtime may lead to increased costs and reduced productivity. Time used by a construction laborer on productive activities averages about 30%of the total time available. An employee in the field only works effectivelyfor3.5 hours of his 8-hour shift and spends 20%ofhistime on direct value-adding activities.

3.2 TYPE OF PROJECT

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

3.3 Safety

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

3.4 QUALITY

Inefficiency of equipment and poor quality of the raw material are factors which cause low productivity .The productivity rate of inefficient equipment is low. Construction equipment is subject to a great number of breakdowns, and it

takes a long time for the labourers to complete the work, thus reducing productivity. Poor-quality material used for work is the other factor because poor materials generally lead to unsatisfactory work and can be rejected by supervisors, thus reducing the productivity.

3.5 MANAGERIAL FACTORS

Managers' skill and attitudes have a crucial bearing on productivity .In many organizations, productivity is low even though the latest technology and trained manpower are made available .Low productivity is because of inefficient and indifferent management .Experienced and committed managers can obtain surprising results from average people. Employees 'job performance depends on their ability and willingness to work. Management is the catalyst to create both. Advanced technology requires knowledgeable labourerswho, in turn, work productively under professionally qualified managers .It is only through sound management that optimum utilization of human and technical resources can be secured.

3.6 MANPOWER GROUP

Literature shows that a lack of labour experience is the factor which negatively affects labour productivity and proves that, to achieve good productivity, labour plays a significant role .Contractors should have sufficiently skilled labourers employed to be productive .If skilled labour is Unavailable and a contractor is required to complete specific task with less-skilled labour, it is possible that productivity will be affected .The absence of any crew member may impact the crew's production rate because workers will, typically, be unable to accomplish the same production rate with fewer resources and with different crew members. Misunderstanding among labourers creates disagreements about responsibilities and the work bounds of each laborer, which leads to a lot of work mistakes and decreases labour productivity. Lack of compensation and increased labourers a negatively affect labour productivity because labour speed, agility, and strength decline over time and reduce productivity.

3.7 MOTIVATION

Motivation is one of the important factors affecting construction labour productivity. Motivation can best be accomplished when labor's personal ambitions are similar to those of the company. Factors such as payment delays, a lack of a financial motivation system, non-provision of proper transportation, and a lack of training sessions are grouped in this topic.

3.8 SUPERVISION

Generally, projectscome across some design, drawings and specification changes during construction .If drawings or specifications are with errors and unclear productivity is expected to decrease since labourers in the field are uncertain about what needs to be done. As a result, task may be delayed, or have to be completely stopped and postpone it until clear instruction. There is a 30% loss of productivity when work changes are being performed .Work inspection by the supervisor is an essential process to proceed. For example, the contractor cannot cast concrete before an inspection of the formwork and steel work, thus affecting labour productivity. With non-completion of the required work according to the specifications and drawings, supervisors may ask for their work of a specific task. Supervisors' absenteeism stops the work totally for activities that require their attendance, such as casting concrete and backfilling, further delaying inspection of the completed work which, in turn, leads to delays in starting new work.

3.9 MATERIAL AND TOOLS

Material management is one of the most important factors in construction industry. Productivity can be affected if required materials, tools, or construction equipment for the specific are not available at the correct location and time. Selection of the appropriate type and size of construction equipment often affects the required amount of time it is, therefore, essential for site managers to be familiar with the characteristics of the major types of equipment most commonly used in construction .

In order to increase job-site productivity, it is beneficial to select equipment with the proper

characteristics and a size most suitable for the work conditions at a construction site .Labourers require a minimum number of tools and equipment to work effectively to complete the assigned task .If the improper tools or equipment is provided, productivity may be affected.The size of the construction site and the material storage location has a significant impact on productivity because labourers require extra time to move required materials from inappropriate storage locations, thus resulting in productivity loss.

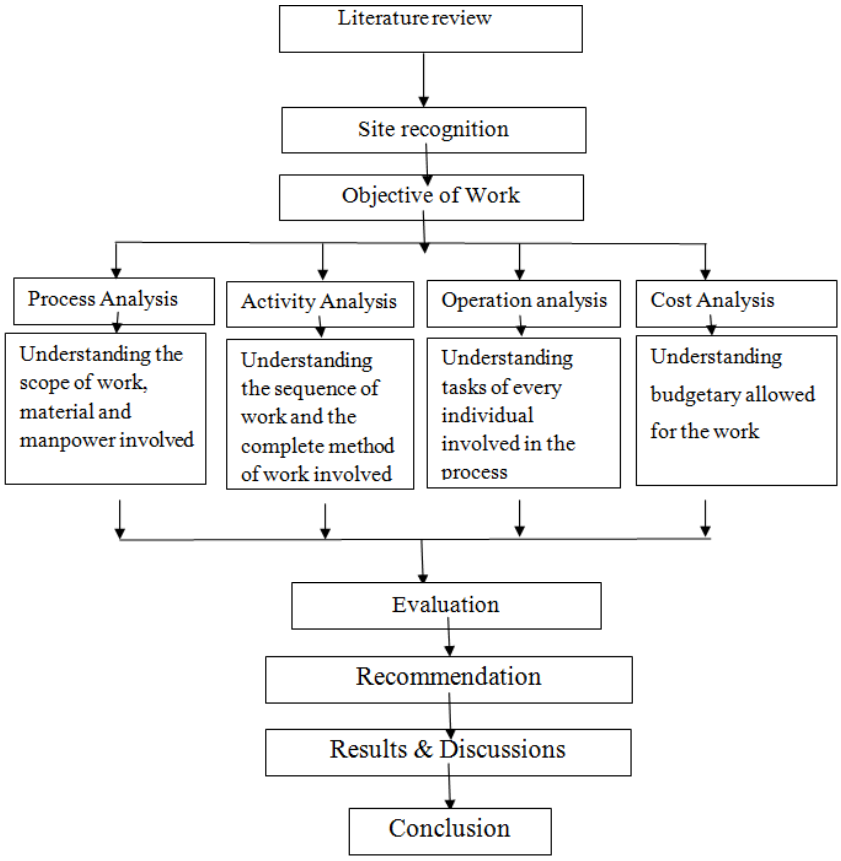
3.10 PROJECT MANAGEMENT FACTORS

Improper scheduling of work, shortage of critical construction equipment or labour, may result in loss of productivity .Improper planning of project-initiation procedures generally lead to lost labour productivity .Additionally; poor site layout can contribute to loss of productivity.Labourers have to walk or drive along way to lunch rooms, rest areas, washrooms, entrances, and exits, affecting overall productivity.

3.11 NATURAL FACTORS

Various natural factors affecting labour productivity collected from previous study are weather conditions of the job-site and geographical conditions. Others factors such as fuel, water, and minerals also affect productivity to certain extent. Productivity is found to be highly affected if weather recorded is too being extreme (too cold, heavy rainfall, too hot.

4. METHODOLOGY



5. LITERATURE REVIEW

Shashank K et al (2014) identified the key factors affecting the variation of labour productivity in the construction projects in Bangalore, India, second, assessing the impact of the influenced factors on the variation of labour productivity and lastly, providing recommendations to reduce the variation of labour productivity. The above objectives have been achieved through the analysis of 53 questionnaires and the result of this analysis shows that, there are six main groups which have

significant impact on the labour productivity variation in the construction projects. They are Manpower group, Managerial group, Motivation group, Material/Equipment group, Safety group and Quality group.

S.Kamal, et al (2013)analyzed the productivity of the building starts from the superstructure and it observed that the productivity of a construction labour gets lower when the work progresses at about 5 feet level from the floor level. In this case, the worker needs to work on the temporary scaffolding where the material have to be shifted from the floor level to the required elevation along with construction equipment. Work at height lead the labour to a disturbed mindset about their safety and belongings which directly affect the productivity in quality and quantity. To avoid such unnecessary situations, a structural rigid working platform is required which could reduce the construction cost.

An innovative instrument is required which would fulfill all the following terms and conditions:

- It should be more economical than other option like scaffolding
- It should be structurally rigid
- Sufficient for material storage to ensure continuation of the work
- Should have enough space to keep the construction tools and minor equipment

Mistry Soham and Bhatt Rajiv (2013)carry out this study is to find critical factors affecting labour efficiency. A survey was carried out in south Gujarat region cities, on civil contractors. Total 51 feedbacks were analyzed through the Analytic hierarchy process (AHP) and Relative Importance Index (RII) techniques. Five most crucial factors in descending order from RII Technique are Delay in payments, Skill Of Labour, Clarity Of Technical Specification, Shortage Of Materials, and Motivation of Labour. According to AHP Technique first 5 crucial factors in descending order are High/Low Temperature, Rain, High Wind, Motivation of Labour, and Physical Fatigue. Contractors shall act on these factors to improve labour efficiency in construction projects.

Relative Importance Index technique: Relative Importance Index method helps to determine the relative importance of the various factors affecting on labour productivity. The four-point scale ranging from 1 (less important) to 4 (extremely important) is adopted and it is transformed to relative importance indices (RII) for each factor.

Analytic Hierarchy Process: In this technique, For each factor questions should be asked it has particular application in group decision making, and is used around the world in a wide variety of decision situations, in fields such as government, business, industry, healthcare, and education. A numerical weight or priority is derived for each element of the hierarchy, allowing diverse and often incommensurable elements to be compared to one another in a rational and consistent way. This capability distinguishes the AHP from other decision making techniques.

MehrdadArashpour et al (2013)investigated the effects of two even flow production principles on production parameters in volume homebuilding sector. These two principles are using fewer but cross-trained subcontractors and limiting the number of houses under construction (work-in-process inventory). The positive effects of these principles have already been proved in manufacturing (Hopp& Spearman 2008). However, their impact on production construction has not been investigated yet. This investigation was conducted in order to bridge this gap. Volume homebuilding in Australia was selected as the scope of this work. We designed four experiments by varying process times and their distribution, number of trade contractors, and rate of starting new homes. Care was taken to realistically model major production homebuilding elements. The experiments were simulated over 1000 working days using ARENA in order to compare and contrast associated performance measures the base case involving 20 specialized subcontractor.

Mohammed Salleh HAMMAD et al (2011) identified the ways to improve productivity. A quantitative approach has been conducted with 25 project managers, contractors, consultants who are working

within the city of Benghazi in Libya. Based on their opinions and suggestion, the useful effective ways has been these are the most effective ways that recommended by theInterviewers who are working the construction filed within the city of Benghazi in Libya. They are as following

- Analyze the entire construction process in detail
- Train supervisors and the crew
- Regular meetings

These are ideas given in this paper to improve the productivity.

A.SOEKIMAN et al (2011)identified the key factors that affect project-level productivity in Indonesia. Data were collected through questionnaires distributed to respondents who work at various projects in wide area in Indonesia. The questionnaire explores factors identified from past researches and then measured their level of affect to project-level productivity in Indonesia. The data collected were analyzed using the Relative-Importance-Index (RII) to find the key factors. The results show that the most influential factors to project level productivity in Indonesia are: design, implementation plan, labor, supervision, material, field management, equipment, leadership and coordination. Furthermore, each factor has their key component. Research finding also identifies seven components which have high influence to project-level productivity, that is inaccurate design, unclear command to workers, changes in design, incomplete design, low skill levels of worker, inappropriate work methods and poor schedule plan. The results will become worthwhile information in efforts to improve the productivity in Indonesian construction industry. Groups of factors that need special attention in an effort to increase the productivity of project completion are factors relating to the design, the factors associated with implementation and planning, factors related to labor, factors associated with supervision, factors associated with material, factors related to site management, factors associated with equipment, factors associated with leadership and coordination, and external factors. Factors associated with occupational safety and health (OSH) also require attention even if only a has relatively low position, according to its role in improving motivation and loyalty of workers and increasing dignity, and quality of life of workers.

Keiko Ito et al (2008) aimed to explore differences in firm-level productivity and growth between Japan, Korea, and China, while at the same time illuminating the mechanism that has driven the narrowing in the productivity gap that can be observed. We pursue two strategies. First, we compare the firm-level TFP distribution of major industries in these three countries over time to examine catch-up patterns within and across industries. Second, in order to examine patterns of technology diffusion across these three countries, we conduct a regression analysis on TFP convergence to the national frontier and to the global frontier. Our main results can be summarized as follows. First, although Japanese firms enjoy the highest average TFP level in many industries, their TFP growth rate has been relatively low during the past two decades. Korean firms have achieved considerable TFP growth in certain industries. The average TFP level of Chinese firms is still much lower than that of Japanese and Korean firms in many industries. Second, within-industry dispersion of TFP levels is very small for Japanese firms. While the within-industry ranking of TFP levels hardly changes in the case of Japan, fluctuations in the ranking are relatively frequent in the case of Korea. Third, in Korea, the TFP levels of low-performing firms are approaching those of the national frontier firms at a more rapid pace than in Japan.

ArunMakulsawatudom et al (2004) identified the factors that should be focused upon, when productivity improvement is to be initiated. To do so, 34 project managers working in the construction industry in Thailand complete a structural questionnaire survey and the factors were ranked according to their perception of their levels of influence and their overall experience in managing projects in the industry. To supplement the questionnaire data, in depth interview were conducted with some projects managers. Through this survey founded that there have been construction productivity in Thailand as lack of

materials, incomplete drawing, incompetent supervisor, lack of tools and equipment, absenteeism, poor communication poor site layout, inspection delay and rework. This study is indented to create the foundation for further study of construction productivity measurements and improvement in Thailand, which aims to lead to overall productivity improvement.

S. Thomas Ng et al (2004) aimed to improve worker productivity by identifying factors that are likely to induce the demonization of workers. Predominant demotivators and their effects on the productivity of workers in civil engineering projects are identified through an empirical survey in Hong Kong. Time losses due to demonization were found to be as much as 13.6 man T hours/weeks, with material availability, overcrowded work areas and rework being the most significantdemotivators involved.

S. Thomas Ng et al (2003)analyzed those workers on civil engineering projects are frequently confronted with problems that could lead to demotivation. Demotivation is caused not simply by a lack of motivators but the existence of certain situations that cause dissatisfaction and discourage individuals from pursuing desired goals. Workers who are inadequately motivated tend to make only a minimal effort, therefore reducing overall productivity potential. It is believed that removing certain demotivators will increase motivation without necessitating the addition of motivators. This paper aims to improve worker productivity by identifying factors that are likely to induce the demotivation of workers. Predominant demotivators and their effects on the productivity of workers in civil engineering projects are identified through an empirical survey in Hong Kong. Time losses due to demotivation were found to be as much as 13.6 man-hours/week, with material availability, overcrowded work areas and rework being the most significant demotivators involved.6.

SUGGESTIONS AND DISCUSSIONS

Construction tasks are expensive and frequently cause in arguments and claims, which generally affects progress of construction projects. The environment of construction organizations should be suitable to implement projects with successful completion. In the construction industry, it is necessary to find the weaknesses of particular task in order to solve and overcome them. Mentioned below are the recommendations which were found to be important factors for improving labor productivity in the construction industry. This chapter deals the possible solutions and suggestions for the factors affecting the onsite labour productivity that was identified on the inspection of the brick work and plastering work that was carried out in the site. Furthermore some of these suggestions have been implemented in the site to improve the efficiency.

7. CONCLUSION

Process analysis, activity analysis, cost analysis and operation analysis is done for brick work and concrete work. From this analysis quantity of material used, responsibilities of every individual involved in the work, cost associated with each work is identified. During the process some of the factors that affect on-site productivity are identified. Practically it is difficult task to improve all labour productivity affecting factors up to 100%. But if there is proper control on above factors, productivity can be improved up to large extent. By considering the above suggestion there will be chance for the improvement in the productivity of the construction industry.

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