

A Study on Factors Affecting Labour Productivity on Construction Projects in Wolaita Zone, Ethiopia

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Abstract: Construction labour productivity has a significant impact on the performance of all construction projects. Poor labour productivity in construction projects resulted an adverse effect on the success of organizations engaged in Ethiopian construction industry. Productivity in construction is often broadly defined as an output per labor hour, which is a measure of the overall effectiveness of an operating system in consuming labor, equipment and capital to convert labour efforts into useful output. The study was focused on literature review and survey questioner to gather all essential facts for the investigation on the factors affecting job site productivities. To collect the facts for the study, an open conversations and interview at the time was held with the clients of private and public projects, contractors, consultants working on private and public projects, and on personal understanding with public construction projects obtained from purposively selected towns which include Sodo, Areka, Boditi, and Humbo. Wolaita Zone is situated in Southern Ethiopia, and 50 respondents for the prepared interview/questioner were selected from those towns. In the study, to rank the major factors negatively affecting labour productivity in construction projects the relative importance index (RII) method were used. Out of 32 essentially determined factors affecting labour productivity in construction projects of the study area, the top ten were appropriated with a high RII value and needs special consideration by the project teams. The top ten factors majorly identified and negatively affecting labour productivity observed from the study were: (1) Delays in decision making RII = 0.899, (2) Material shortages RII = 0.876, (3) Payment delays RII = 0.855, (4) Changing orders by the Client/Consultant RII = 0.791, (5) Poor labour experience RII = 0.772, (6) Equipment shortages RII = 0.746, (7) Site accidents RII = 0.722, Lack of inspiration to the work RII = 0.690, Poor workmanship RII = 0.658, and Shortage of periodic meeting with labour RII = 0.600. The study showed the factors affecting construction productivity. In order to alleviate such factors the project owners, managers, contractors, consultants, superintendents, financiers, suppliers, local authorities, personnel and any stakeholders have to solve misunderstandings and confusion between one another.

Key Words: Productivity, Labour, Project, Output, Performance, Delay

1. INTRODUCTION

The range of construction projects are divided into various segments usually Building constructions (residential buildings, commercial buildings, industrial buildings etc.), Road Constructions and Water Work Constructions. Construction industry comprises of a large number of labours [1]. Assessment and the improvement in productivity is a crucial for labour intensive processes [2].

Human resource today has a strategic role for productivity increase of any organization, and this makes it greater in the industrial competition. With the effective and optimum uses of it, all the advantages supplied by the productivity growth can be obtained [3]. Productivity in construction project is one of the most important factor that affect overall performance of any small, medium or large construction industry [1]. Poor productivity of construction workers is one of the causes of cost and time overruns in construction projects [3]. As per study of [3] 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. Construction projects in general involves various people or work men in capacity and capability (unskilled, skilled, and professionals or experts). Construction productivity can be simply illustrated by an association between an output and an input [4]. According to [4] there are two types of productivity: total factor productivity and single factor productivity. Total factor productivity (TFP) or multi-factor productivity includes multiple factors such as labor, equipment, materials, and capital as inputs. Total factor productivity is usually used in economics studies and not in construction. From his study [4] had observed that construction productivity rates differ between projects because of the varying environments, characteristics, and level of management implementation.

The major objective of this research paper is to study factors affecting labour productivity on construction projects in Wolaita Zone. And specifically the study addresses on assessing and evaluating the factors affecting productivity on construction projects, and ranking factors affecting labour productivity based on their effects on construction projects.

2. LITERATURE REVIEW

2.1. General

Productivity denotes the efficiency with which the various inputs are converted into goods and services. Productivity is said to be high when more output is delivered with same input or same output is obtained with less input [5]. Productivity is measured concerning outcome achieved against per unit time. It is an established phenomenon that in construction works consumes a significant amount of labour resource. Hence, the performance of labour has a direct effect on the construction cost. Hence, productivity in

construction is often measured regarding labour productivity [6]. An effective construction project is one that is completed on time, within budget, meets specified standards of quality, and strictly adapts to safety strategies. Productivity is commonly referred to as the ratio of output to input [7]. Two measures of productivity are commonly used in the construction industry the first measure of productivity is the total factor productivity (TFP), which is defined as the ratio of total output to total input, with the latter usually including labour, materials, equipment, energy and capital. According to [7] TFP is expressed as:

$$TFP = \frac{\text{Total out Put}}{\sum(\text{labour} + \text{materials} + \text{equipment} + \text{energy} + \text{capita})} \quad (1)$$

The second measure of productivity is the partial factor productivity (PFP), which is expressed as the ratio of the outputs to a single or selected set of inputs. [7] For PFP Labour productivity expressed as:

$$PFP = \frac{\text{Out Put Quantity}}{\text{Labour Hours}} \quad (2)$$

[5] In their investigation has been defined Labour productivity as the ratio of the output quantities to the input work hours, or as ratio of the work hours to the quantity (also called the unit rate) of work. Labour productivity also measures the amount of goods and services produced by one hour of labour [8].

2.2. Factors Affect Labour Productivity in Construction Projects

Construction production lies largely on the performance of labour [6]. Performance of labour involved in projects is affected by several factors. [6] From their study come up with the seven factors that are extremely significant are misuse of time schedule, increase of labourer age, weather changes, tool and equipment shortages, violation of safety precautions, working 7 days per week without taking a holiday and lack of financial motivation system. [7] In their study identified the top five factors affecting labour productivity in construction projects with the highest impact on productivity, considering all responses, are delayed material delivery by the supplier, strikes called by political parties, frequent revisions of drawing/design, resulting in additional work/rework, and unavailability of drawings at the worksite at the required time were the other major factors identified in the survey. Out of 34 recognized factors affecting the productivity of the labours in road construction [1] had reduced the factors of labour productivity in road construction based on relative importance index method analysis in to top most factors which were listed as work area restriction, inspection delays, construction method, poor soil condition, unavailability of experienced labours, delays in decision making, high quality of required works and lack of training. [9] In their research have been identified 45 factors negatively affecting labour productivity in building construction of the Gaza Strip and ranked them according to their relative importance. These factors have been classified into 10 groups: manpower, leadership, motivation, time,

materials/tools, supervision, project, safety, quality, and external factors. Ranking factors under manpower group include: (Lack of labour experience, Labour disloyalty, Labour dissatisfaction, Misunderstanding among labour, Lack of competition, Increase of labourer age, Labour absenteeism and Labour personal problems). Ranking factors under leadership group include: (Lack of labour surveillance, Misunderstanding between labour/superintendents and Lack of periodic meeting with labour). Ranking factors under motivational group include: (Payment delay, Lack of financial motivation system, Lack of labour recognition programs, Non-provision of transport means, Lack of places for eating and relaxation, and Lack of training sessions). Ranking factors in the time group include: (Working 7 days per week without taking a holiday, Misuse of time schedule, Method of employment (using direct work system), Increasing No of labour in order to accelerate work, and Work overtime). Ranking factors under materials/tools group include: (Material shortages, Tool and equipment shortages, and Unsuitability of materials storage location). Ranking factors under supervision group include: (Drawings and specifications alteration during execution, Inspection delay, Rework, and Supervisors' absenteeism). Ranking factors under safety group include: (Accidents, Violation of safety precautions, insufficient lighting, Bad ventilation, working at high places, Unemployment of safety officer on the construction site, and Noise). Ranking factors in the quality group include: (Inefficiency of equipment, Low quality of raw materials, and High quality of required works). Ranking factors under external group also include: (Weather changes, and Augmentation of Government regulations). [9] Also recognized the most 5 important factors negatively affecting labour productivity in building projects are: material shortages; lack of labour experiences; lack of labour surveillance; misunderstanding between labour and superintendents; and drawings and specifications alteration during execution. [10] In their survey revealed the ten leading factors affecting construction labour productivity in Trinidad and Tobago. These are: 1) the lack of labour supervision, 2) unrealistic scheduling and expectation of labour performance, 3) shortage of experienced labour, 4) construction manager's lack of leadership, 5) skill of labour, 6) delay in responding to requests for information, 7) payment delay, 8) communication problems between site management and labour, 9) rain and late arrival, 10) early quit and frequent unscheduled breaks. Construction Job-site productivity is influenced by many factors which can be characterized either as labour characteristics (include: age, skill and experience of workforce leadership and motivation of workforce), project work conditions (includes: job size and complexity, job site accessibility, labour availability, equipment utilization, contractual agreements, local climate, and local cultural characteristics) or as non-productive activities (includes: rework for correcting unsatisfactory work, temporary work stoppage, time off for union activities, absent time, non-working holidays, and Strikes) [5].

Human resource is one of the basic components of construction projects. Therefore, productivity improvement in construction industry mainly depends on an increase of labour productivity [11]. The study results of [11] revealed that among the investigated hygiene factors affecting labour productivity in construction projects “working in social insurance” factor was the most and 1st ranked. In other words, in craft workers perspective working with social insurance has more impact on their motivation compared to other factors within the job context factors. In Turkey, insuring the craft workers can be evaluated in context of company policy and practices. “On-time payment” and “amount of pay” were ranked in 2nd and 3rd places within the hygiene factors, respectively.

The above said scholars and researchers in their investigations discovered that in construction projects job-site productivity can be affected by different factors under varying constraints. It is important to note that the performance of field personnel is critical to the success of any construction project [5].

3. RESEARCH METHOD

The study is based on a survey prepared to gather all essential facts in an effective way. To collect the facts for the study an open conversations and interview at the time were held with the clients of private and public projects, contractors, consultants working on private and public projects, and on personal understanding with public construction projects. The study presents on 32 essentially determined productivity factors generated on the basis of related research work on construction productivity. The study was conducted in Wolaita Zone on purposively selected towns which include Sodo, Areka, Boditi, and Humbo. Wolaita Zone is situated in Southern Ethiopia, and

50 respondents for the prepared questioner were selected from those towns purposively as the players in the construction industry which were included from private and public sector clients, contractors, consultants, suppliers and end-users of construction projects in order to stimulate data from 32 determined factors affecting job-site labour productivity that were well-known through an attentive literature review and recurrence project site investigations on factors affecting labour productivity of the study area. In the study, to rank the major factors negatively affecting labour productivity in construction projects the relative importance index (RII) method were used to determine the relative importance of the various factors affecting labour productivity. And the analysis of RII for each factor used the following Equation [12].

$$RII = \left(\frac{\sum(W)}{A*N} \right) \quad (3)$$

Where: W = the weight given to each factor by the respondents, A = the highest weight = 5, N = the total number of respondent.

The assessment for the identified factors affecting labour productivity in the study area were carried based on the following five scale of measurements. For degree of significance: [1 for “Strongly Insignificant (SI)”, 2 for “Insignificant (IS)”, 3 for “Neutral (N)”, 4 for “Significant (S)” and 5 for “Strongly Significant (SS)”].

4. RESULTS AND DISCUSSIONS

For the study conducted in Wolaita Zone which is located in Southern Ethiopia, the essentially determined 32 factors that are negatively affecting labour productivity in construction projects of the study area have been recognized and ordered according to their relative importance. The said productivity factors have been measured, analysed and ranked accordingly using RII, table below shows the results obtained through an attentive study.

Table 1: Factors affecting labour productivity in construction projects with the analysed RII value

#	Productivity Factors	Relative Importance Index (RII)	Rank
1	Poor labour experience	0.772	5
2	Labour unhappiness	0.211	29
3	Misunderstanding between labour	0.431	17
4	Lack of competition	0.320	22
5	Inspection delays for works	0.460	15
6	Poor workmanship	0.658	9
7	Confusion between labour and managers	0.445	16
8	Absence of labour from work	0.491	14
9	delays in decision making	0.899	1
10	Payment delays	0.855	3
11	Lack of inspiration to the work	0.690	8
12	Absence of training for labours	0.400	18
13	Job size and complexity	0.160	32
14	Non Productive movement	0.582	11
15	Method of employment	0.360	20
16	Labour availability	0.382	19
17	Work overtime	0.340	21
18	Material shortages	0.876	2
19	Site accidents	0.722	7
20	Unsuitability of materials storage location	0.312	23
21	Equipment shortages	0.746	6
22	Changing orders by the Client/Consultant	0.791	4
23	Poor labour follow up	0.541	13

24	Superintendents' absenteeism	0.280	25
25	Extreme weather conditions	0.575	12
26	Violation of safety precautions	0.260	26
27	Unemployment of safety officer on the construction site	0.300	24
28	Inefficiency of equipment	0.250	27
29	Low quality of raw materials	0.236	28
30	High quality of required works	0.200	30
31	Shortage of periodic meeting with labour	0.600	10
32	Changing of Government regulations	0.180	31

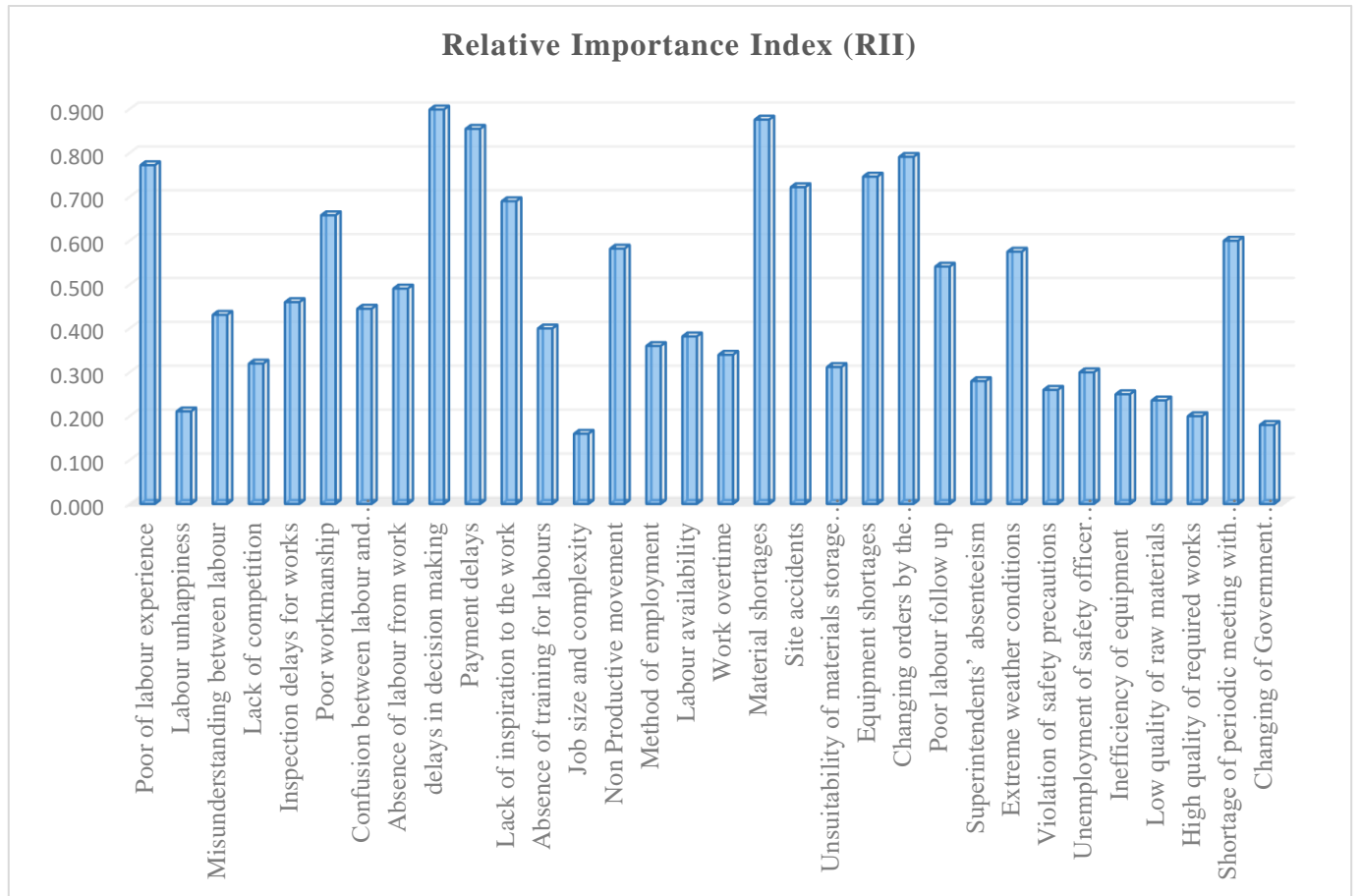


Chart 1: Factors affecting Labour Productivity

DISCUSSIONS:

However there are many factors that can affect construction labour productivity in the construction projects, the listed factors above are the most basic factors which need special

considerations in projects. The analysed RII values were fundamentally used to arrange and determine the severity of each factor on the productivity of projects.

Table 2: Majorly identified and arranged top ten factors affecting labour productivity of the study area

#	Productivity Factors	Relative Importance Index (RII)	Rank
1	Delays in decision making	0.899	1
2	Material shortages	0.876	2
3	Payment delays	0.855	3
4	Changing orders by the Client/Consultant	0.791	4
5	Poor labour experience	0.772	5
6	Equipment shortages	0.746	6
7	Site accidents	0.722	7
8	Lack of inspiration to the work	0.690	8
9	Poor workmanship	0.658	9
10	Shortage of periodic meeting with labour	0.600	10

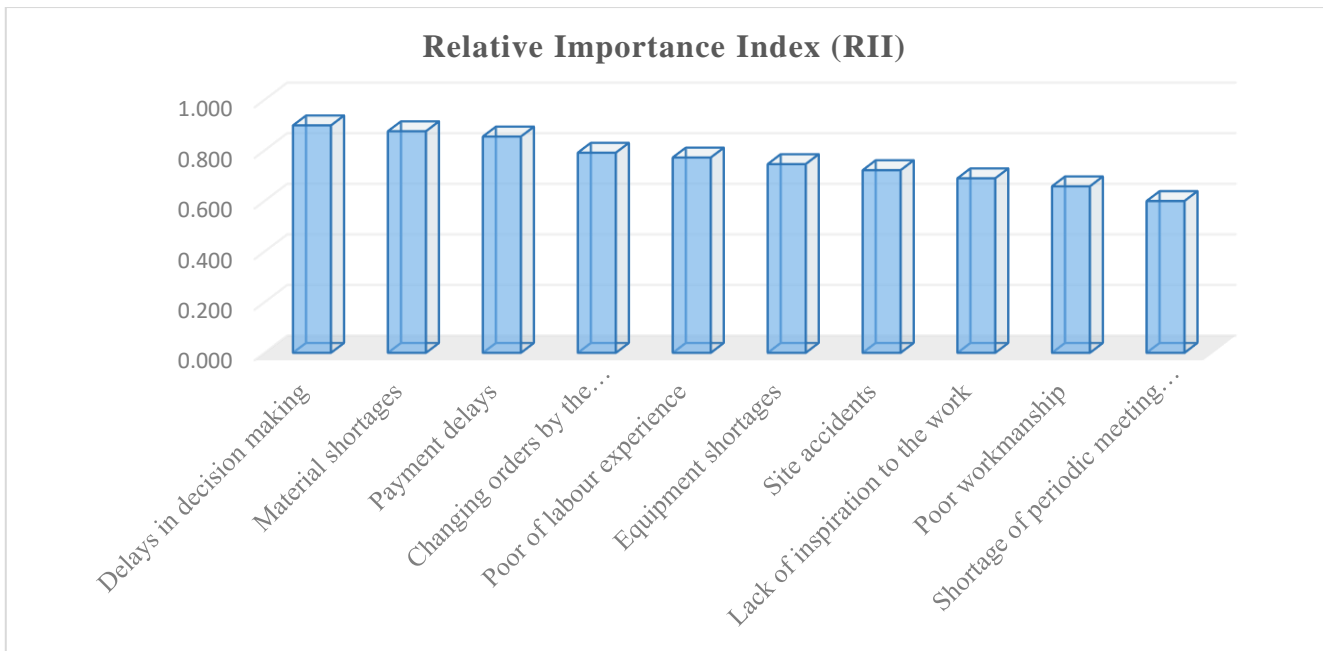


Chart 2: Top ten factors negatively affecting labour productivity

DISCUSSIONS:

The results of Table 2 and figure 2 above provides the top ten majorly identified factors affecting labour productivity in the construction projects of Wolaita Zone observed in the four reformed towns which are Sodo, Areka, Boditi, and Humbo towns. The results gathered from the respondents showed that delays in decision making for the statements requested by the contractors or consultants for specific purpose was believed having critical impact on the productivity of labour on projects and has RII = 0.899, which ranked “Delays in decision making” as the first factor. This factor has a high level of effect on the productivity of labour, which directly affects project cost and schedule. Based on the respondents regularity “materials shortage” was ranked the second critical factor causing low labour productivity with an RII = 0.876. Shortages of materials for projects undertaking result the labours to become idle for waiting of materials. The third factor with an RII value 0.855 observed was “payment delays”, this was particularly understood from the client side for the contractors and affect the project by causing labour productivity loss and increase in time-related costs and completion dates for the projects observed in Sodo, Areka, Boditi and Humbo towns.

The fourth significant factor affecting was “Changing orders by the Client or Consultant” with RII = 0.791, as observed from the survey of the study area contractors and consultants often disagree on the pricing of change orders, hence the contractors claim for the change ordered. Solving the claims requested by the contractor takes time, resulting negative impact on the labour productivity. More change orders requested, the greater the impact on the productivity or performance of the total project. The study resulted “Poor labour experience” having an RII value 0.772 as the fifth ranked factor by affecting projects. The experience of workforce was included under labour characteristics, a labour with a better experience can perform more than a one with a lower experience. In the study “Equipment shortage”

having RII = 0.746 took the sixth place by affecting productivity of projects, it was caused because of insufficient quality of equipment to meet the needs or requirements of the project. Site accidents with an RII value 0.722 averaged and understood as the seventh significant factor by affecting job site productivity. In construction works accidents and damages can happen for various reasons; causing death and resulting in a total work stoppage for a number of days. An injured person or group of people need sick leave, this in contrary results in a work decrease of the crew for which the injured employee worked. “Lack of inspiration to the work”, “Poor workmanship” and “Shortage of periodic meeting” with an RII value 0.690, 0.658 and 0.600 respectively took the eighth, ninth and tenth place by affecting job site productivity of the study area. People working in any organization need extrinsic or intrinsic inspiration. Lack of inspiration to the work in the workplace can result in lower productivity and, in turn, wastes companies’ resources in relation to time and money. Poor workmanship was one of those majorly identified factor that lead to reworks for the tasks or portion of works executed by the executor. The existence of reworks for the portion of work was a part of non-productive movement in construction works and consumes organizational resources without adding any production, rather than it decreased the performance or lowered the productivity of the project. Typically construction projects are the one which experienced most of the failures problems because of poor workmanship. Shortage of periodic meeting was also the one majorly identified factor which negatively affecting job site productivity in construction projects of the study area as observed by the study group. The basic outcomes of periodic meeting were solving problems by making a relevant decisions on the observed weakness of every party involved in the projects, so that the productivity of the projects increased in some amount.

5. CONCLUSIONS

The success of construction projects are determined by the personnel or labours involved in the construction projects. The major objective of the study was to identify, rank, and analyze the factors which affect labour productivity of the study area mainly conducted in Wolaita Zone specifically studied on Sodo, Areka, Bodoti, and Humbo towns. Totally 32 factors negatively affecting labour productivity were identified in this study. The influence of each identified factor was ordered and analyzed using Relative Importance Index (RII), out of those factors the study outcomes concentrated on the top ten factors negatively affecting labour productivity of the observation area which were: (1) Delays in decision making, (2) Material shortages, (3) Payment delays, (4) Changing orders by the Client/Consultant, (5) Poor labour experience, (6) Equipment shortages, (7) Site accidents, (8) Lack of inspiration to the work, (9) Poor workmanship, and (10) Shortage of periodic meeting with labour. Lastly, to have any influential improvement in labour performance in Wolaita Zone construction projects or industries, there should be measured effort by the management or participants to increase the performance of construction companies. And the study team also noted that every short coming should be properly analyzed, and corrected for critical success of construction projects.

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