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Critical factors influencing construction labour productivity in carpentry and steel fixing in North-Central Nigeria

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Abstract

This paper evaluate productivity factors influencing the output of steel fixer (iron bender) and carpenter in North-Central Nigeria with a specific objective to identify critical a factors influencing steel fixers and carpenters labour productivity on site, ranking the seventy level of the influence of these factors on their output. The research adopted a triangulation method (mixed method) of data collection into achieve the set objectives. These involved the use of structured questionnaire and direct observation on site. The analysis of data uses Relative Importance Index (RII) and direct calculation of productivity using the labour productivity formula. From the result of the analysis, the average daily labour productivity for steel fixers and carpenter in the North-Central Nigeria was found to be 377.8kg and 3.02m^2 with an average variation of 20.05kg and 0.35m^2 respectively. These were in line with the previous studies. The study identified 21 factors that are critical to the performance of steel fixers and carpenters in North – Central Nigeria. Among these factors, designed shape and size, alteration of drawings and specification during execution and lack of experience were ranked as the most critical factors for carpenters while designed shape and size, alteration and working at high places were ranked the most critical factors for steel fixers. The study concludes that the labour productivity of steel fixers is slightly below average while that of carpenter is slightly above average.

Keywords: Four to eight keywords come here. Divide the keywords by semicolon.

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1. Introduction

In many countries of the world today, productivity consciousness has become the watch word. Poor productivity of craftsmen is one of the most daunting problems that are facing the construction industry, especially, those in the developing nations like Nigeria (Olomolaiye et al., 1987). Higher productivity is necessary for the survival of any Nation and any profit oriented organization as it represent effective and efficient conversion of resources into marketable product and determines business profitability (Sangh, (nd); Wilclox et al, 2000). In the construction sector, construction activity is a key activity within any economy as it influences and is being influenced by a nation's Gross Domestic Product (G.D.P) (Madi, 2003).

The sector's output contribute one-half of the Gross Capital and is about 3-8% of the (GDP) in most countries (Ardit and Moditar, 2000; Ameh and Odusami, 2002). The construction projects are mostly labour-based with basic hand tools and equipment. Thus labour cost of construction project ranges from 30 to 50% of the overall cost of project (Guhathakurta and Yates, 1993). Labour productivity measure the overall effectiveness of an organizational system in utilizing labour, equipment and capital to labour efforts into useful output. Poor labour productivity of craftsmen causes cost overrun on building projects and an increase in labour out put causes real income and standard of living for an encony (Sarri, 2006, Bruce, 2007).

Several factors influenced construction productivity. Enshassi (2007) opined that for productivity to be improved. A study of factors affecting it, whether positively or negatively is necessary. If all the factors influencing productivity are known, it will be possible to make use of those affecting it positively and eliminating or controlling those factors that negatively affect it, thus improve the productivity, (Lema, 1995).

In Nigeria, the construction operatives have over the years being subjected to a work environment that have not encouraged higher level of productivity. The building industry in Nigeria, like any other sub-Sahara Africa, is highly labour intensive as it is largely insitu construction. According to Adamu et al. (2011), The Nigerian construction craftsmen are exposed to extremes of hot and cold weather conditions, poor wages, Hazardous working environment etc. This greatly affects the output of the craftsmen.

Several investigations have been carried out on factors affecting labour productivity on construction site (Lim, & Alum 1995; Them et al., 1991; Kaming et al., 1998; Ayandele, 1992, Iyagba and Ayandele, 1998; Makulsawatudan and Emsley, 2011; Ameh Odusami, 2002; Udegbe, 2005; Makulsawadutom et al., 2004; Alinative et al., 3007;), but in developing countries like Nigeria, there are still gaps to filled. This research intent to fill such gaps by focusing on formwork as a special area in carpentry work and steel fixer (iron bender) both of which depend so much on the designed shape and size.

2. Objectives

The specific objectives of this research are:

- To identify critical factors affecting labour productivity of carpenters and steel fixers (iron benders) in North-Central Nigeria.

- To rank the severity level of the influence of these factors on the productivity of carpenters and steel fixers on construction site.
- To determine the daily and total productivity of carpenters and steel fixers on the selected building sites.
- To determine the variation in daily productivity of carpenters and steel fixers on the selected sites.

3. Methodology

The quality and the type of information required for this study calls for triangulation method (mixed method). Two major approaches were used for data collection in this study.

3.1. Data collection

The data collected for this study was based on two sources of information or data collection techniques. The structured questionnaire and direct observation through work study technique on site.

The structured questionnaire was divided into two sections the first section was used to collect demographic information about the respondents while in the second section each respondent was asked to identify factors affecting their output on site, and rate the influence of the factors on scale from 1 (no influence) to 5 (very much influence).

The target pupation of the study include all indigenous building firm in the North Central Nigeria who are currently executing one project of the other.

For a fair representation of samples across the states of the North-Central geopolitical zone, Hogg and Tannis (1997) formular was used to sample population.

$$M = \frac{Z^2 \text{ x } P \text{ x } (1\text{-}P)}{\Sigma^2}$$

$$n = \frac{M}{1 + \frac{M - 1}{N}}$$

where m = sample size of unlimited population

n = sample size of limited population;

z = value (e.g. 1.96 for 95% confidence level);

p = degree of valance between the elements of population (0,5); Σ = maximum error of the point estimate.

Thus a total of 25 building firms were surveyed within the zone.

Data collected through questionnaire was analyzed using relative importance index.

RΠ

$$RII = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + n_1}{5(n_5 + n_4 + n_3 + n_2 + n_1)}$$

where: n_5 = very much influence

n_4 = much influence

n_3 = moderate influence

n_2 = little influence

n_1 = no influence

Data was also collect through direct observation. In this case, trained observes were used for the collection of data. The selected craftsmen were monitored directly on site and records of their productive and unproductive time were taken and their outputs were measured at the close of work for each day. Also causes of unproductive time were noted. Data obtained from this source was analyzed using productivity formula.

$$Labour\ productivity = \frac{input}{output} = \frac{man\ hour}{Equivalent\ quantities}$$

4. Results and discussion

In this study 21 factors negatively affecting labour productivity of steel fixers and carpenters in form work construction and steel fixing (iron bender) were identified and the severity levelly of their influence on their productivity were ranked according to their relative importance.

Table 4.1 illustrates the factors influencing steel fixers output and their ranking.

Table 4.1 and 4.2 above illustrate the factors identified and their effect on labour productivity of steel fixers and carpenters in North-Central Nigeria the table depict that the then most critical factors influencing labour productivity of steel fixers are:- the designed shape and size, alternation of drawing and specification during execution, lack of labour experience, poor wages, lack of financial motivation, working at high place, increase in age, use of obsolete tools and equipment, supervisors absenteeism and weather changes with importance index of 0.852, 0.734, 0.689, 0.653, 0.644, 0.640, 0.637, 0.632, 0.628 and 0.621 respectively. On the other hand the result also indicate that the five least critical factors affecting the productivity of the steel fixer are violation of safety precaution, accident, unsuitable storage location, low quality of raw material and work overtime with importance index of 0.283, 0.290, 0.295, 0.301 and 0.312. However, among the five most influential/critical factors, the designed shape and size was ranked by steel fixers as the number one problem with the highest influence on their output on site.

When comparing this ranking with previous work from literature, Enshassi etal (2007) in their ranking of the 45 factors indicated in the Gaza strip. Drawing and specification was 5th, lack of labour experience 2nd, material shortage 1st, and lack of financial motivation 21st. The ranking and the factors identified in this study agrees with previous studies (Makulsawatudom and Emsely, 2001; Enshassi et al, 2007, Ayandele, 1998).

Table 4.1. factors affecting steel fixers productivity

S/N	IDENTIFIED FACTORS	IMP. INDEX (RII)	RANKING
1.	Designed shape and size	0.852	1
2.	Alternation of drawings and specification during execution	0.734	2
3.	Working at high places	0.689	3
4.	Lack of experience	0.653	4
5.	Poor wages	0.644	5
6.	Lack of financial motivation	0.640	6
7.	Use of obsolete tools/equipment	0.637	7
8.	High quality work required	0.632	8
9.	Material shortage	0.628	9
10.	Weather changes	0.621	10
11.	Supervisors absenteeism	0.615	11
12.	Increase in age	0.608	12
13.	Unsuitable material storage location	0.362	13
14.	Work over time	0.349	14
15.	Working 7 days per week without taking holiday	0.345	15
16.	Interference	0.320	16
17.	Low quality of raw materials	0.312	17
18.	Accident	0.301	18
19.	Violation of safety precaution	0.295	19
20.	Mode of employment	0.290	20
21.	Labour personal problem	0.283	21

Table 4.2. factors affecting productivity of carpenter

S/N	IDENTIFIED FACTORS	IMP. INDEX (RII)	RANKING
1.	Designed shape and size	0.683	1
2.	Alternation of drawings and specification during execution	0.681	2
3.	Lack of experience	0.678	3
4.	Poor wages	0.671	4
5.	Lack of financial motivation	0.667	5
6.	Working at high places	0.662	6
7.	Increase in age	0.659	7
8.	Use of obsolete tools/equipment	0.450	8
9.	Supervisors absenteeism	0.448	9
10.	Material shortage	0.435	10
11.	Weather changes	0.426	11
12.	High quality work required	0.417	12
13.	Mode of employment	0.403	13
14.	Interference	0.382	14
15.	Working 7 days per week without taking holiday	0.380	15
16.	Labour personal problem	0.375	16
17.	Work over time	0.371	17
18.	Low quality of raw materials	0.366	18
19.	Unsuitable material storage location	0.360	19
20.	Accident	0.358	20
21.	Violation of safety precaution	0.351	21

For the carpenter, the same factors were identified as being the factors affecting their labour productivity on site. However, the ranking of the factors according to their influence on their out put differs from the steel fixers.

The first seven factors rankled as the most influential factors by carpenter are designed shape and size, alteration of drawings and specification during execute, lack of labour experience, poor wages and lack of financial motivation working at high place and increase in age.

Table 4.3. Average Productivity for carpentry and Steel Fixing

Project Number	Average productivity (Steel Fixer) kg	Average Variation (Steel Fixer) kg	Average Productivity (carpenter) (m^2)	Average Variation (carpenter) m^2
001	390	0	3.66	0
002	401	11	2.93	0.75
003	376	25	3.50	0.57
004	378	02	2.81	0.69
005	380	02	2.85	0.04
006	381	01	3.00	0.15
007	375	06	2.94	0.06
008	370	05	3.05	0.11
009	365	05	2.92	0.13
010	381	16	3.00	0.08
011	378	03	3.56	0.36
012	356	22	2.71	0.85
013	420	64	3.00	0.27
014	390	30	2.90	0.10
015	366	24	3.12	0.22
016	387	21	3.21	0.09
017	397	10	3.42	0.21
018	405	08	3.31	0.11
019	415	10	3.11	0.02
020	401	14	2.85	0.26
021	289	112	3.77	0.92
022	381	92	2.74	1.03
023	379	02	3.55	0.81
024	380	11	3.63	0.08
025	385	05	2.71	0.92
Overall average	377.8kg	20.05	3.02m^2	0.35

Table 4.3 illustrates average daily productivity and range of variation for each of the 25 projects surveyed. The overall average productivity for steel fixer and carpenter was found to be 377.80kg and 3.02M^2 respectively.

These values agrees with Ayandele, (1997) who evaluated the productivity of steel fixer and carpenter in the south western Nigeria and found average daily productivity to be 382.85kg and 2.725M^2 for steel fixer and carpenter respectively. According Ayandele (1997) the maxim performance value for steel fixer and

carpenter in the study area were established to be 1014kg and 5m^3 and the averages 382.85kg and 2.725m^2. The values of average daily productivity are within the range of the values found in this study.

The average daily variation in the productivity of steel fixers in the 25 projects suvrted was 20.05kg. This is above the normal range of variation (0.438) due to work environment as prescribed by SWEIS et al (2008). On the other hand the average variation in productivity of the carpenter was found to be 0.350. This is within the normal variation due to work environment factors prescribed by sweis et al (2008).

Figures 4.1, 2, 3 & 4 illustrate the average daily productivity for steel fixer and carpenter in the North central geopolitical zone of Nigeria.

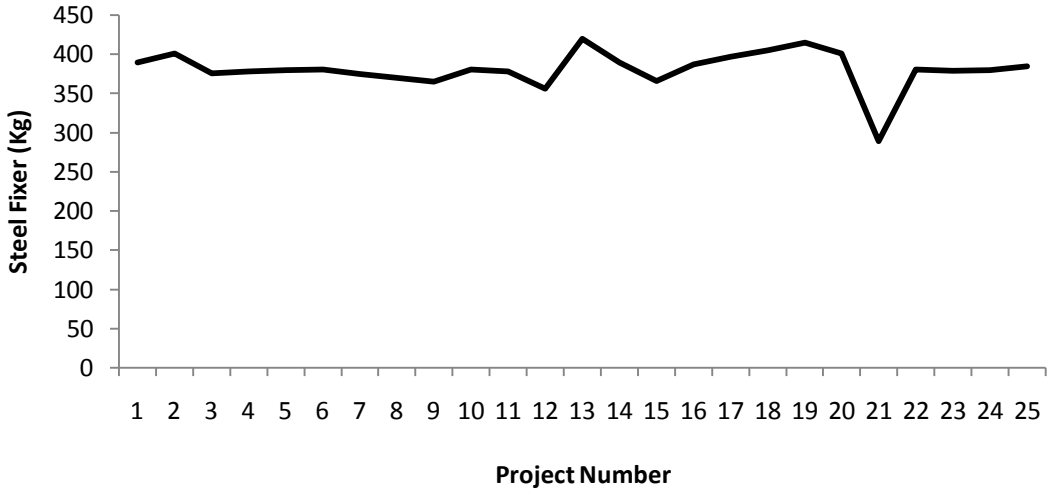

Figure 4.1. Average Productivity of Steel Fixer

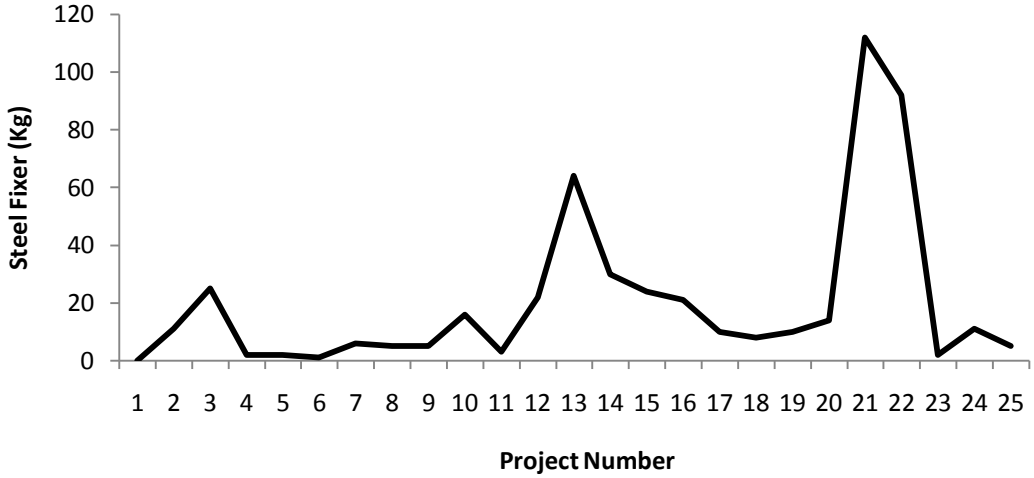

Figure 4.2. Average Variation in Productivity of Steel Fixer

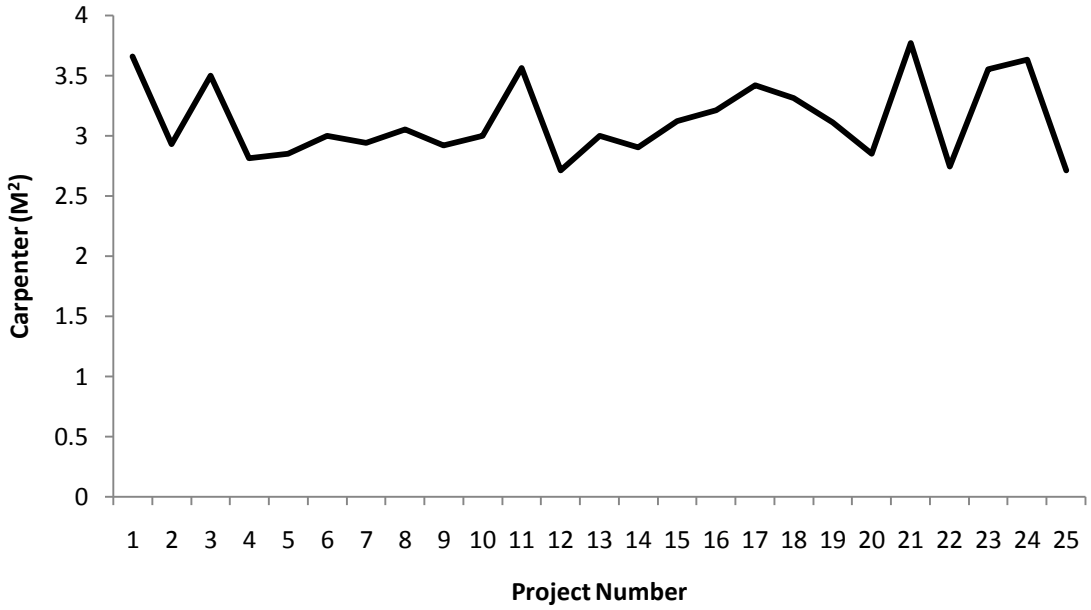

Figure 4.3. Average Productivity of Carpenter

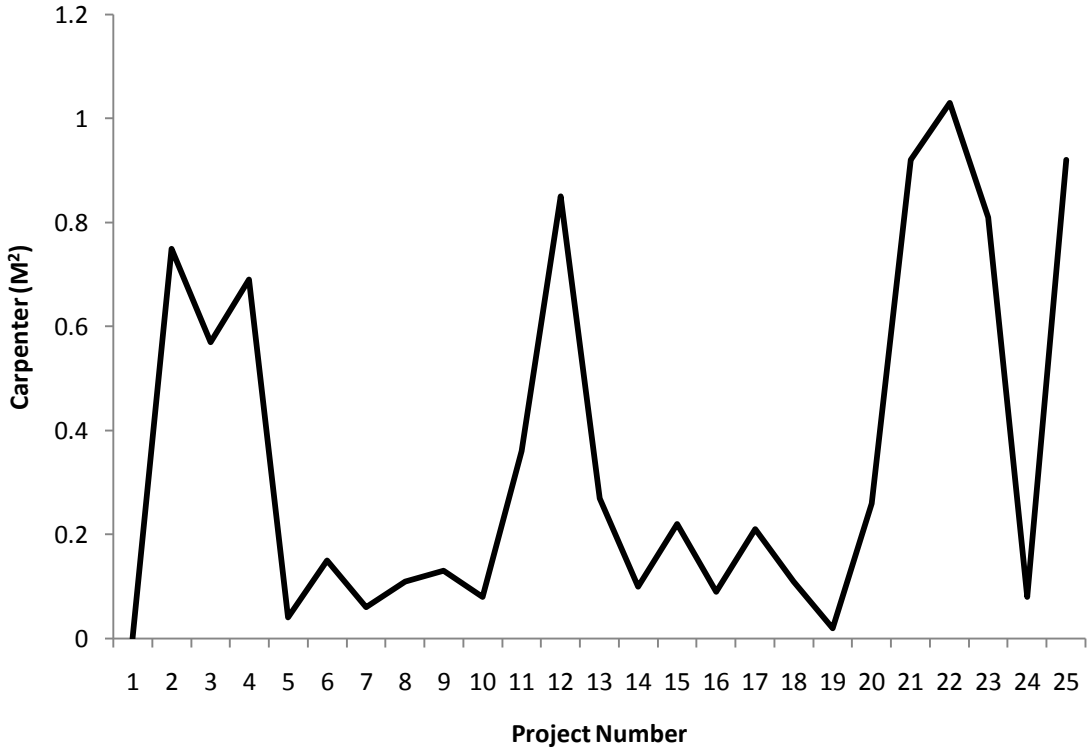

Figure 4.4. Average Variation in Productivity of Carpenter

5. Conclusion

The research draw the following conclusions based on its findings.

- The first ten influential factors that negatively affect the out put of steel fixers in North Central Nigeria were ranked as being very critical to their performance. On the other hand the carpenters ranked the first seven influential factors as being critical to their performance.
- The construction labour productivity of steel fixers in North Central Nigeria which was found to be 377.80kg an average which was slightly lower compared to the average established by Ayandele, (1997) in the South Western Nigerian which was 38.285kg. Similarly the average labour productivity of carpenter found in this study was 3.02m^2 which is slightly above 2.725m^2 establish by Ayandele in his study.
- All the findings of the study were similar to these in previous literatures surveyed. This proves the reliability of the data and the findings of the study.

6. Recommendation

In line with productivity improvement strategies going on almost all over the world particularly in the developing countries like Nigeria, the following recommendations were made.

- The study focus on timber form work and steel fixing in North Central Nigeria, further steps should be taken in carrying out similar research focusing on roof for carpenters and floor slab for fixers the same geopolitical region or other region of Nigeria.
- The study recommended further research on the identified critical factors with the objective to quantity their influence on the output of steel fixers and carpenters.

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