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ANALYSIS OF THE IMPACT OF ACTIVITY SAMPLING MEASUREMENT ON MASON'S PRODUCTIVITY IN NIGERIAN CONSTRUCTION SITES

By

ONYEAGAM, Onyealiam Peter. [1], AMKYES, Fwangwum Irmiya[2], MOHAMMAD, Gambo[2]. OYEKEYE, Olumide Israel [3]

[1]Department of Quantity Surveying, Federal Polytechnic, Nasarawa
[2]Department of Architectural Technology, Federal Polytechnic, Nasarawa
[3]Department of Surveying and Geoinformatics, Federal Polytechnic, Nasarawa

ABSTRACT

The dearth of information on activity performance of craftsmen on construction site leads to under-utilization of labour to the optimum level. The aim of this study is to analyze the impact of activity sampling measurement on mason's productivity in Nigerian construction sites, and the objectives were addressed to determine labour output and activity time spent by the block laying operatives per day on construction sites. Previous related literatures were reviewed to identify some of factors influencing production output and related block laying activities in construction sites. The study employed quantitative technique to conduct the research. 50 construction sites were identified in Abuja using purposive sampling technique, 254 masonry gang operatives were studied for 150 and 225mm size block wall and at different operational level (substructure and superstructure). Activity sampling technique adopted for data collection were through observation and structured time sheet questionnaires designed to record information relating to labour output and time spent on the activities involved in block laying operation. The activity sampling was grouped based on the level of commitment into three classes; productive time, contributory time and unproductive time. Descriptive statistics and percentile were used for determination of mean output and the time spent on per day on the related block laying activities. The study revealed that standard output of 150mm block laying operation at substructure and superstructure were 12.91 and 13.30 respectively while 150mm block laying operation at substructure and superstructure were 9.02 and 10.07 respectively indicating an impact of sizes and locational factor of block laying on the production output. In a gang of one skilled and one unskilled labour; the skilled labour spent 75.79% on productive, 11.68% on contributory and 11.38% being slothful while the unskilled labour spent10.85% on productive, 53.94% on contributory and 34.72% being slothful of the 7 hours per day. The study concludes that activity sampling measurement is an excellent technique to identify slothfulness in construction site and recommends that activity sampling measurement be adopted as a basis for proportioning gang size of skilled and unskilled labour.

KEYWORDS: Masonry, Productivity, Tradesmen, Activity sampling

1.0 Introduction

In construction site work measurement has been developed in various methods to meet specific objective of the construction stakeholders. The objective could be to serve as a reference point for future use, for determination of efficiency in construction site, for appropriation of an effective gang size, for determination of influencing motivation factor for enhancing operational performance, etc. Consequently, the dictionary of management, work measurement has defined as an integral part of work study process in which variety of subjective methods like work sampling are used to fix a standard time for acceptable performance of a given task by a trained worker (Hartzel, 2006); work measurement generally entails the determination of standard job which is used as a vital input towards improving organizational productivity. The determination of optimum output of the craftsmen on construction site is influenced by the output assessment at project and crew level which has both direct and lengthy term objectives. Employees need productivity data as a feedback on their

performance and may be used for pay bargaining and the same actions will lead to the provision of a performance database for planning and evaluating performance at this level (Enshassi, 2011), while performance at this level provides management with information that can influence their strategic actions (Lema, 1995).

Most of the outputs used for estimating and project planning and schedule were derived based on experience and guestimate, similarly, there have not been any basis or scientific evidence for proportioning gang size in the construction site and without reliable and accurate productivity estimates, it would be impossible to improve on existing operation and management or effective plan for new ones, decide on layout and routing considerations or design new work methods. (Onyeagm, 2022; Abdulrazaq *et al.,* 2010 and Olomolaiye and Ogunlana,1989). Construction production consists of a lot of activities and involves team work for efficiency to be achieved. Most often workers are under-utilized in the task assigned; in a study conducted by Enshassi, (2011) on labour productivity measurement for block work on building projects in the Gaza Strip using activity sampling revealed that the unskilled labour spent 36% of the operative hour per day being idle resulting to loss of productive hour. It is important to measure the mason's productivity in Nigeria construction site considering the significance of block work in building cost. Therefore, conducting a study on the analysis of the impact of activity sampling measurement on mason's productivity in Nigerian construction sites address the following objectives; to determine labour output and analyze the impact of the activities on the output of the block laying operatives on construction sites. It is expected the finding of this study will be explored for project planning and management, product design, work sequencing and workplace design.

2.0 Mason's Productivity

Masonry is the art of shaping and laying blocks of composite structure or stone to form walls. The most common and basic walling building unit in Nigeria are block sand crete block and clay brick of vary sizes. Masonry operations involve the activities of skilled and unskilled labour in the structure of labour force (Adegboyega et al.2019 and Griggs et' al. 2016) . Vollenhoven, (2016) stated that some of the attributes of skilled labour are; requisitely undertake apprenticeship programme, practice the trade by their cognitive knowledge and ingenuity, high level of expertise and capability in performing complicated tasks that require specific skill sets and exhibit vocational capacity and need lot of experience that involves different trades of specialization. Mason in its specialty is a segment of skilled labour of the work force that creates significant economic value through the work they perform (Bheemaiah and Smith, 2015; Ali, 2016). Skilled labour are of varying abilities ranging from physical attribute to cognitive attribute which influences its productivity. Husseini (2008) stated that skilled workers enhance training through schools, vocational training centres, workshops and on sites. Skilled labour can be described as those that spend more time being productive than contributory to the output production of a unit product. With the present innovative trend in construction, skilled labours are required to adapt to computer literate as many machines are computerized. Unskilled labour can be described as those that spend more time being contributory than productive to the output production of a product. Wahab (2011) defined unskilled workers as "those classes of workers that require special skills" and it is described as any way of making a living with little or no degree of security of income and employment and they require little or passive training to make them perform. Goswami *et al*., 2016) further stated that "unskilled workers are able-bodied men and women that perform manual activities, and their major asset therefore lies in their strength and healthy body which requires no special training".

Productivity

Many definitions have been evolved on productivity, with belief that every good definition of productivity contains three major elements, output, resources commitment and time. Single factor productivity has been considered as the most common labour productivity measurement due to its functioning efficiency. It does not imply that labour is the best input element for productivity measurement but simply reflects the difficulty or impossibility of obtaining numerical values for the other determinants of productivity. Therefore, productivity generally is defined as "the ratio of outputs to inputs" (Enshassi, 2007), and is given by any of the followings below:

Productivity = Output/ Input

$$P = \frac{units}{work\ hours}$$

$$P = \frac{total\ output}{total\ work\ hours}$$

Productivity is the extent of how well resources are brought together in organizations and utilized for achieving a set of results. Oforeh, (2006) states that, in construction industry, productivity is the measured by the ratio between the measured valued of construction, and the total cost of construction; given by $P = \frac{MV}{CC}$; where P = productivity; MV = measured valued of construction and CC = Construction Cost. Measured valued is for practical purposes, the tender amount or agreed price of the work between the client and the contractor. It can be seen that measured work is not the same thing as market value. The market value of products in the industry, or product generally refers to the price such products will attract when they are put up for sale in the open market. Oforeh, (2006) further, posited that cost of construction is the prime variable that affects productivity. The basic cost of construction is the aggregate of; materials, labour, plant and overhead costs:

CC = MC + LC + PC + OC

Where; MC = Material cost
LC = Labour cost
PC = Plant cost, and
OC = Overhead cost

Productivity is given as $\frac{Output}{Input} = \frac{Qty}{Time}$

To construct productivity indices, the efficiency equation is used, which is widely recognized as the measure of productivity; efficiency = $\frac{Output}{Time}$ (Olomolaiye, 1990).

It suffices to say that the productivity of walling unit is influenced by number of factors ranging from labour, material and design consideration. NIQS (2017), the measurement of masonry as stated in Section 14 of BESMM despite it involves three different components namely brick walling, block walling and glass walling and all having the same descriptive features and quantity procedure; the construction intricacies are quite different especially as the component composition varies significantly. This also implies that the productivity requirement varies. For instance, the size of sand crete block is not the same as well with brick and it requires more time to lay a larger size in a square metre. Also, the coverage rules 'C1' states that block work are deemed to include the following in the block laying operations, which are predetermined activities to adopt for completion of a task:

i. Extra materials for curved work;
ii. All rough and fair cutting;
iii. Forming rough and fair grooves, throats, mortises, chases, rebates and holes, stops and mitres;
iv. Raking and joints to form a key;
v. Labour in eaves filling;
vi. Labour in returns, ends and angles;
vii. Centering;

Item C1. (i) and (v) require significant variation in labour output due to the intricacy demanded in operations.

The following are specifically considered to have little or significant influence on block laying productivity;

S1. Kind/quality (either solid or hollow),
S1. Size of blocks (either 150 or 225mm any other size),
S2. Types of bond (stretcher bond commonly used),
S4. Types of pointing (commonly used for brick walling for its decorative features),
S5. Method of cutting blocks where not at the description of the contractor.

Other influencing factor requires specifying are location and dimensional consideration.

3.0 Activity Sampling Technique

Enshassi et al., (2011) and Tewodros, (2006) identified numbers of productivity measurement techniques commonly employed for measuring labour productivity in construction projects which includes direct time study, activity work sampling, craftsman questionnaire, foreman delay survey, technical estimates, and historical standards. The choice and application of any of the methods depend on the objectives of the user. However, for the purpose and objective of this study, emphasis is laid on activity sampling technique.

According to Tewodros (2006), activity sampling is defined as 'a technique in which a large number of instantaneous observations are made over a period of time of workers, machines, or processes'. Each instantaneous observation records what happens at every activity and the percentage of observation is recorded for a particular activity or delay as a measure of the percentage of time during which that activity or

delay occurs. It provides technique to collect data concerning the non-productive man hour operated on a large construction site. Activity sampling study provides the necessary information to decide on how time is being employed by the workforce, which workforce is at optimum production and also provides the relevant data to assist in establishing the use of time by the craftsmen, find out the problem area that cause the work delay, and established a base line measure for output improvement. Before starting the actual observation, the following was ensured: all persons involved in the activity were clearly identified and their specific roles should be defined and work completed prior to the start of the study is noted as accurately as possible. This enabled an accurate assessment of work accomplished during the observation interval.

Activity sampling has an advantage of allowing larger number of machines or men to be studied at same time which can be achieved using a continuous time study (Pilcher, 1997). As relate to block work where a lot of task involve in the vary activities, it is gainsaying to adopt activity technique which gives a broader view on the effectiveness of a specific operation

The process of producing unit product in construction industry are numerous ranging from elemental component, sectionalized trade, activity schedule to work items and the associated constituent cost of each of these components are also being influenced by the output of labour crew hence, the quality, appropriate quantity or the mix of the resources input influences the output, it becomes imperative to the contractor to understand the dynamics of productivity measurement so that it can be explored to estimating process for proposed project as well as to consider the possibility of aiming at appropriate number of crew for a specific task. To do that appropriate technique is employed; according to Oglesby *et al.,* (2002), the concept of activity sampling relied on two propositions which are as follows: the first proposition is based on working day and is classified into three major components, namely: productive, contributory, and unproductive time of the labour crew, so that optimum performance will be achieved.

Productive time is the basic time spent an operative or gang of operatives actually involved in developing component or element of constructed product per day; Contributory time is the time spent an operative or gang of operatives actually involved in supporting in the development of component or element of constructed product per day; while Unproductive time is the idle time or time spent for not being useful for the development of component or element of constructed product per day.

The second proposition is based on statistical principles and rules to obtain a proper representation of the studied operation. Thus it is a mathematical technique closely associated with statistics and the theory of probability (Olomolaiye *et al.,* 1998). Activity sampling must base on a sample of observations and adhere to certain statistical principles and rules in collecting and analysis small number of chance occurrences tends to form the same distribution pattern as the whole operation. The sampling conducted should be large enough to be statistically valid – can be used to predict the characteristics of studied operation with a desirable degree of accuracy. Therefore, the following steps are sequentially followed to establish activity sampling techniques: Definition of work; Determine sample size of observation; Making observation by designing appropriate formats; Determine the observed time, from the data collected; Determine normal and standard time respectively;

4.0 Research Method

The study employed quantitative research due to the nature of study; the activity productivity measurement on construction site was based on studying the time involved in various activities of block work operation in the FCT, Abuja using activity sampling. The main reasons for FCT and block work productivity measurements were:

- FCT, Abuja is the national capital where numerous construction activities take place to accommodate the inflow teeming settlement such estates as developers and ministerial houses.
- Block work contribute the significance cost compared with other building components
- There are varieties of influencing factor to be studied under block work
- Its input and output are easily evaluated
- Its activities are easily relatively easy to be observed and quantified

i. The construction sites constitute mainly of building projects such as residential, commercial and institutional buildings both of public and private owners.

ii. Specialized teams of gang of one mason and one unskilled labour were provided for all the equipment and tools for the task in construction sites.
iii. The contractor provided all materials; blocks, cement, sand and water and expected that the gang were provided with the working tools and equipment such as wheelbarrow, head pan, trowel, hammer, axe, hatchet, square angle and spirit level.
iv. The working duration for day work is usually 8.00 hours per day with an hour break commenced by 8.00AM to 12.00 noon for the morning section and an hour break, that is from 12.00 to 1.00pm and then commenced for the afternoon session and closed by 4.00 P.M., is expected to have an active operation of 7 hours per day.
v. Two types block sizes were common in the construction; 450 x 225 x 225mm and 450 x 150 x 225mm were studied.
vi. The study population involved the survey of 50 construction sites in Abuja with various gang of masonry operatives of two hundred and fifty-four (254), which not more than seven were observed in each site at different operational location consideration as presented in the Table 4.1.

Table 4.1: Sample size of the study

S/No	Locational factor	150mm thick	225mm thick
1	Substructure	68	62
2	Superstructure	62	62
	Total	130	124

Source: Author's field Survey (2022)

According to Lawal and Adeyeye, (2006), when the population is less than 100, the entire population is to be considered, therefore, the entire population was considered.

Vii The construction sites constitute mainly of building projects such as residential, commercial and institutional buildings both of public and private owners.

A purposive sampling activity measuring technique was adopted based on the concept that working operation was divided into three classification groups; therefore, the data collection and analysis of the 150mm and 225mm thick block work operation are divided into the following groups for a gang of one mason and one labourer:

I. First group is the productive activities which covered: mortar bedding, block laying, pressing and cutting of block to the required size, checking with spirit level for alignment of verticality and horizontality, filling in mortar into vertical gap between blocks and removing excess mortar.
II. Second group is the contributory activities which covered: mixing sand and cement mortar, distributing mortar and block to the productive point, assisting in alignment of blocks, setting angles and setting scaffolding, taking instructions from supervisors, and cleaning working tools.
III. Third group is the unproductive activities which covered: amendment of faulty work, slothful time; time spent for any work unconnected to block laying operation

Descriptive statistics was employed in analyzing the data collected for the purpose describing and interpreting the conditions regarding the activity productivity measurement on construction site.

1. Structured time sheet questionnaire containing all the relevant information to record block laying output and time spent the observed activities of the operatives on site, personally carried out by the author and by the help of well oriented trained research assistants where there were difficulties in special sites.
2. Observations of activities were made at instantaneous operation of every activity, except the block laying output was determined at two intervals; 12.00 noon and 4.00pm. At any instantaneous observation, a record of starting and stopping was made and summation of the

instantaneous observations of the various group component for the day were summed up for the time being observed for the activity and group component respectively

3. Additional information such as age, experience, method of payment, general level of supervision, tools and equipment used, gang sizes, and general site conditions were recorded relate to output performance based locational consideration and size.
4. The data were summarized in a separate sheet at the end of each observation period
5. The summation of the output was divided by the sample size of the respective block size in various locational factors to derive the mean production output.

5.0 RESULTS AND DISCUSSION

5.1 Distributions of Block Laying Operating Time

Table 5.1: Block Work Output and Time Observation on the Basis of 7 Hours per Day

Activity group classification	**150mm block work in substructure**			**225mm block work in substructure**		
	Mean G. output (M^2)	Skilled labour time (Hr)	Unskilled labour time (Hr)	Mean G. Output (M^2)	Skilled labour time (Hr)	Unskilled labour time (Hr)
Productive Time		5.41	0.66		5.33	0.74
Contributory Time	**12.91**	0.68	3.82	**9.02**	1.05	3.95
Unproductive Time		0.93	2.52		0.62	2.31
	150mm block work in superstructure			**225mm block work in superstructure**		
Productive Time		5.60	0.77		5.19	0.87
Contributory Time	**13.30**	0.66	3.69	**10.07**	0.88	3.65
Unproductive Time		0.74	2.54		0.93	2.50

6. Source: Author's field Survey (2022)

Table 5.1 shows the derived mean gang outputs square metre per day as well as the time spent on the basis of the activity classification grouping (productive time, contributory time and unproductive time) per day, collected through field observation for the 150mm and 225mm thick at different operational level (substructure and superstructure). However, from the observation, it revealed that the skilled labour spent more time on the productive than other activity group classification while unskilled labour spent more time on contributory than other activity group classification.

Table 2: Time Observations of Activity Distributions of Block Laying Operation

Activity group classification	Types activities	Skilled labour (hr)	Unskilled labour (hr)	Skilled labour (hr)	Unskilled labour (hr)
		150mm in Substructure		**225 mm in Substructure**	
Productive activities	Mortar bedding	1.52	0.08	1.50	0.10
	Laying/pressing/cutting	2.50	0.27	2.49	0.31
	Spirit level alignment	0.46	0.19	0.46	0.22
	Filling mortar & raking	0.93	0.12	0.88	0.11
Contributory activities	Mixing cement mortar	0.07	1.55	0.17	1.53
	Block & mortar distribution	0.29	0.73	0.34	0.85
	Ancillary work	0.22	1.39	0.42	1.43
	Cleaning working tools	0.10	0.15	0.12	0.14
Unproductive activities	Slothful time	0.82	2.49	0.57	2.27
	Amendment	0.11	0.03	0.05	0.04

		150mm in Superstructure		225 mm in Superstructure	
Productive activities	Mortar bedding	1.57	0.09	1.45	0.08
	Laying/pressing/cutting	2.58	0.32	2.45	0.38
	Spirit level alignment	0.54	0.22	0.47	0.25
	Filling mortar & raking	0.91	0.14	0.82	0.16
Contributory activities	Mixing cement mortar	0.07	1.50	0.11	1.45
	Block & mortar distribution	0.27	0.87	0.35	0.88
	Ancillary work	0.20	1.19	0.25	1.17
	Cleaning working tools	0.12	0.13	0.17	0.15
Unproductive activities	Slothful time	0.65	2.51	0.86	2.45
	Amendment	0.09	0.03	0.07	0.05

Source: Author's field Survey (2022)

Table 5.2 is the presentation of the time spent on the various activities identified in the preceding discussion of activity group classification for the two sizes of block thickness at different operational levels.

It also shows that under, productive time the skilled labour spent more time in laying, pressing and cutting blocks than any other activities while under contributory the unskilled labour spent more time on mixing cement mortar than any other activities

Table 5.3: Statistical Analysis of Block Work Basic Operating Hour

Mean parameter	Statistics	Skilled labour (%)	Unskilled labour (%)	Skilled labour (%)	Unskilled labour (%)
		150mm in Substructure		**225mm in Substructure**	
Productive Time	Mean	77.29	9.43	76.14	10.57
	Std Deviation	9.29	8.29	8.57	7.57
Contributory Time	Mean	9.71	54.57	15.00	56.43
	Std Deviation	6.57	18.57	6.29	12.57
Unproductive Time	Mean	13.29	36.00	8.86	33.00
	Std Deviation	6.71	14.00	7.43	9.71
		150mm in Superstructure		**225mm in Superstructure**	
Productive Time	Mean	80.00	11.00	69.71	12.43
	Std Deviation	10.29	9.57	9.27	8.29
Contributory Time	Mean	9.43	52.71	12.57	52.14
	Std Deviation	8.00	10.57	87.14	7.71
Unproductive Time	Mean	10.57	36.29	17.71	35.71
	Std Deviation	8.71	13.00	7.43	6.71

Table 5.3 shows the percentage analysis of activity time distribution of skilled and unskilled labour on the basis of activity group classifications of 150mm and 225mm thick block laying operation at different operational level. The table shows that productive time of skilled labour working on 150mm thick in substructure and superstructure are 77.29 % and 80% respectively while that of unskilled labour is 9.43 and 11.00% respectively. The contributory time for the skilled labour working on 150mm thick in substructure and superstructure are 9.71% and 9.43 respectively, while that of unskilled labour time are 54.57 and 52.71 respectively. Also the unproductive time of the skilled labour of the same size and location are 13.29 and 10.57% respectively, while that of unskilled labour time are 36.00 and 36.29 respectively.

Similarly, the 225mm thick block laying operation in substructure and superstructure has its

productive time of skilled labour to be 76.14% and 69.71% respectively while that of unskilled labour are 10.57% and 12.43% respectively. The contributory time for the skilled labour are 15.00% and 12.57% respectively, while that of unskilled labour time are 56.43 and 52.14 respectively. Also the unproductive time of the skilled labour of the same size and location are 8.86% and 17.71% respectively, while that of unskilled labour time are 33.00 and 35.71 respectively.

Table 5.4: Statistical Analysis of Activity Distributions of Block Laying Operation

Activity classification	Types activities	**150mm in substructure**		**225mm in substructure**	
		Skilled labour (%)	Unskilled labour (%)	Skilled labour (%)	Unskilled labour (%)
Productive activities	Mortar bedding	21.72	1.14	21.43	1.43
	Laying/pressing/cutting	35.72	3.86	35.57	4.43
	Spirit level alignment	6.57	2.72	6.57	3.14
	Filling mortar & raking	13.29	1.71	12.57	1.57
Contributory activities	Mixing cement mortar	1.00	22.14	2.43	21.86
	Block & mortar distribution	4.14	10.43	4.86	12.14
	Ancillary work	3.14	19.86	6.00	20.43
	Cleaning working tools	1.43	2.14	1.71	2.00
Unproductive activities	Slothful time	11.72	35.57	8.15	32.43
	Amendment	1.57	0.43	0.71	0.57
		150mm in superstructure		**225mm in superstructure**	
Productive activities	Mortar bedding	22.43	1.29	19.48	1.14
	Laying/pressing/cutting	36.86	4.57	32.91	5.43
	Spirit level alignment	7.71	3.14	6.31	3.57
	Filling mortar & raking	13.00	2.00	11.01	2.29
Contributory activities	Mixing cement mortar	1.00	21.42	1.57	20.70
	Block & mortar distribution	3.86	12.43	5.00	12.57
	Ancillary work	2.86	17.00	3.57	16.72
	Cleaning working tools	1.71	1.86	2.43	2.14
Unproductive activities	Slothful time	9.28	35.86	16.38	35.00
	Amendment	1.29	0.43	1.33	0.71

Table 5.4 is the percentage analysis of time distribution on the various activities of the activity group classification as indicated also in Table 5; the skilled labour in all the categorized operation, under productive time spent most of its time on laying/pressing /cutting of block ranges 32.91 - 36.86%, followed by mortar bedding ranges from 19.48 – 22.43% and least is amendment with 0.71-1.57, however, showing that the skilled labour observed were skillful and high experience to minimize rework; whereas the unskilled labour in all categorized operation, under contributory time, revealed high contributory performance in the production output, majorly in mixing cement mortar with percentage range of 20.70-22.14%, followed by ancillary work with percentage range of 17.00-20.43% and least is amendment with percentage range of 0.43- 0.71% this is depended on the skillfulness of the mason as indicated in Table 5.6.

However, on the basis of unskilled labour, slothful time rank highest ranges from 32.43 -35.86% thereby committing only 65% of the performance to production output which means the unskilled labour is under-utilized for the assigned work. Reference to Table, it shows that the active time for production of any output is the productive and contributory time.

Table 5.5: Activity Ranking of Skilled Labour on Block Laying Operation

Activity classification	Types activities	150mm block work		225mm block work		Average (%)	Rank
		Substr.	Supers.	Substr.	Supers		
Productive activities	Mortar bedding	21.72	22.43	21.43	19.48	21.26	2
	Laying/pressing/cutting	35.72	36.86	35.57	32.91	35.27	1
	Spirit level alignment	6.57	7.71	6.57	6.31	6.79	5
	Filling mortar & raking	13.29	13.00	12.57	11.01	12.47	3
Contributory activities	Mixing cement mortar	1.00	1.00	2.43	1.57	1.5	9
	Block & mortar distribution	4.14	3.86	4.86	5.00	4.47	6
	Ancillary work	3.14	2.86	6.00	3.57	3.89	7
	Cleaning working tools	1.43	1.71	1.71	2.43	1.82	8
Unproductive activities	Slothful time	11.72	9.28	8.15	16.38	11.38	4
	Amendment	1.57	1.29	0.71	1.33	1.23	10

Table 5.5 and 5.6 show activity ranking of skilled and unskilled labour derived from the average of the categorized block laying operation indicating the major time impacted activities in the production output.

Table 5.5 indicates that laying/pressing/cutting blocks rank first with percentage average of 35.27%, spreading of mortar for bedding block rank second with percentage average of 21.26% and filling mortar and raking rank third with percentage average of 12.47% of rank representing and these three activities are covered under productive time. However, the activities under contributory time rank between 6th to 9th position and are not committed much to the production output of block laying operation, having less than 5% time commitment.

Slothful time rank 4th position with percentage average of 11.38, however, the skilled labour spent 75.79% on productive time

Table 5.6: Activity Ranking of Unskilled Labour on Block Laying Operation

Activity classification	Types activities	150mm block work		225mm block work		Average (%)	Rank
		Substr.	Supers.	Substr.	Supers		
Productive activities	Mortar bedding	1.14	1.29	1.43	1.14	1.25	9
	Laying/pressing/cutting	3.86	4.57	4.43	5.43	4.57	5
	Spirit level alignment	2.72	3.14	3.14	3.57	3.14	6
	Filling mortar & raking	1.71	2.00	1.57	2.29	1.89	8
Contributory activities	Mixing cement mortar	22.14	21.42	21.86	20.70	21.53	2
	Block & mortar distribution	10.43	12.43	12.14	12.57	11.89	4
	Ancillary work	19.86	17.00	20.43	16.72	18.50	3
	Cleaning working tools	2.14	1.86	2.00	2.14	2.02	7
Unproductive activities	Slothful time	35.57	35.86	32.43	35.00	34.72	1
	Amendment	0.43	0.43	0.57	0.71	0.54	10

Similarly, Table 5.6 indicates that the unskilled labour, slothful time of the unproductive time ranks first with percentage average of 34.72%, followed by mixing cement mortar, ancillary work and block and mortar distributions of the contributory time rank 2nd (21.53%), 3rd (18.50%) and 4th (11.89%) respectively while all the activities of the productive time generate the least time ranges from 1.25 – 4.57%. Unskilled labour spent 53.94% on contributory time and 10.85% of the productive time indicating passive commitment in the output production of block laying operations.

Major Summary Findings of Activity Measurement

The study on activity measurement revealed the following major findings:

I. The standard output of block laying operation is influenced by the sizes and locational factor of block. This agreed with Adrian (1982), Abdullahi (2009), Abdulrazaq (2010) and Onyeagam (2014) that size of block and locational factor influenced output production of block laying operation.
II. In a gang of one skilled and one unskilled labour for block laying operation, the skilled labour spent 75.79% on productive, 11.68% on contributory of the 7 hours per day for standard output while the unskilled labour spent10.85% on productive time and 53.94% on contributory time of the 7 hours per day for standard output. This closely related to Enshassi (2011) that unskilled labour spent 54.66% of working time in contributory activities in block 10 and 20.
III. The skilled labour spent 11.38% on slothful time while the unskilled labour spent 34.72% and this implies that more than one third of the day work is spent on being idle, thereby being under-utilized in a gang of one skilled to one unskilled labour of block laying operation.

Conclusion

The complacency in adopting activity sampling techniques in construction sites has been considered as one of the reasons for the declining trend in construction productivity. The case of block laying operation replicates in all work sections and projects and it is imperative that activity sampling measurement is an excellent technique to identify slothfulness in construction site.

The production output in block laying operation is complementary between productive time and contributory time of gang of skilled and unskilled labour for production of optimum output. The production of block walls is guided by the productive impact by the skilled labour while the unskilled labour is to assist in contributing in the activities for the realization project. This study could be explored in the determination of the appropriate gang size so as to reduce slothfulness on construction sites which will have adverse financial effect on the stakeholders.

Recommandations

I. The slothfulness of the unskilled labour is depended on how engaged and relevant to the other activities of block work operation and therefore, the unskilled labour should be retrained to be relevant to the activities of the skilled labour especially where there is the tendency of inertness to the masonry operation
II. The result on the output production revealed that despite there have been supervision, percentage of slothful time for skilled labour is still significant which means if there is no supervision, it should be less than the recorded output and where the skilled labour work to the optimum time, the expected output should be plus 11. 38%; therefore, the output developed through work measurement should be used as standard.
III. Activity sampling measurement should be adopted as a basis for proportioning gang size of skilled and unskilled labour as in the case of block laying operation where the idle time is 34.72%. Relating to this result it should be recommended that the appropriate gang size for block laying operation be the ratio of 3: 2, that is, three skilled labour to two unskilled labour for the unskilled labour to be used to the optimum production.

REFERENCES

Abdullahi, M. (2009). Empirical Determination of Labour Outputs for Selected Trades in Kaduna State. An Unpublished B. Sc. Thesis, Department of Quantity Surveying, Faculty of Environmental Design, ABU Zaria.

Abdulrazaq, M., Muhammad, A. and Abba, I. (2010).Empirical Determination of Labour Outputs on Formwork for Construction Projects. *Construction Focus, Vol.3 No.1,pp 62-69.*

Adegboyega, A.A., Onyeagam, O.P., Eze, E.C. and Adamu, A.(2019). Effect of Tradesmen Demographic Information on Labour Output of Plastering and Rendering Operations in theNigerian Construction Industry. Elixir Org. Behaviour 126: p52474-52480

Adrian, J.J. (1982). Construction Estimating: An Accounting and Productivity Approach. First Edition, Reston Publishing Company, New York.Pp372-376

Ali, Z. A (2016). Improving Skilled Workers‟ Performance in Construction Projects in Nigeria. Published MSc. Thesis, Universiti Tun Hussein Onn Malaysia.

Bheemaiah, K. & Smith, M. J. (2015). Inequality, Technology and Job Polarization of the Youth Labour Market in Europe. (June 2, 2015).

Griggs, T. L., Eby, L. T., Maupin, C. K., Conley, K. M., Williamson, R. L., Griek, O. H. V., & Clauson, M. G. (2016). Who Are These Workers, Anyway? Industrial and Organizational Psychology, 9 (1), 114-121.

Goswami, A., Chaudhury, S., & Garg, T. (2016). Impact of green growth and development path for skilled and unskilled job creation and economic, social sustainability: Case study of India–A recursive. Economic Modelling, Analysis, and Policy for Sustainability, 29 (2), 29-35.

Hartzell, D. (2006); Dictionary of Management.Academic Publishers, New Delhi.

Husseini, A. A. (2008). The Importance of Manpower Training and Management to the construction industry. Proceedings of National Seminar on Effective Contract Management in the Construction Industry. Organised by the Nigeria Institute of Building, 22nd to 23rd August, 119-131.

Lawal, A and Adeyeye, V. A. (2006). Essentials of Research Methodology, Olas Ventures, Nigeria.

Lema N. M. (1995).Construction of labor productivity modeling, University of Dar Elsalaam,

NIQS, (2008). Building and Engineering Standard Method of Measurement; Third Edition.

Oforeh and Alufohai (2006). Management Estimating and Budgeting for Electrical Installation. 2nd Edition, Construction Cost and Management Book Series ,Lagos

Oglesby, C., Parker, H. and Howell, G. (2002).Productivity improvement in construction. McGraw-Hill, Inc, United States of America.

Olomolaiye, O.P. and Ogunlana, O.S. (1989). An Evaluation of Production Outputs in Key Building Trades in Nigeria. *Construction Management and Economics.* vol. 7: pp75- 86.

Olomolaiye P., Jayawardane A., and Harris F. (1998). Construction productivity management. Chartered Institute of Building, England.

Onyeagam, P. (2014). Empirical Determination of Labour Outputs for Block Laying in Nigerian Construction Industry. An Unpublished M.Sc. Thesis, Department of Quantity Surveying, Faculty of Environmental Design, ABU Zaria.

Onyeagam, O. P**.** , Oyekeye, O. I., Sanni, J. E. and Amkyes, F. I. (2022). Examining the Estimating techniques of Exploring Labour Productivity Standard for Construction Cost in Nigerian Projects. Fifth Annual National Engineering Conference Organized by School of Engineering Technology, Federal Polytechnic, Nasarawa.

Oglesby, C. H, Parker, H. W, and Howell, G. A. (2002). Productivity Improvement in Construction. McGraw-Hill, USA.

Tewodros, A. (2006), Measurement of Labour Productivity in Construction Projects. Published Thesis, Department of Civil Engineering, Faculty of Technology, Addis Ababa University.

Vollenhoven, G. (2016). Workplace Learning Experiences of TVET College Candidates in Apprenticeship Programmes: An Exploration of the Workplace Learning Environment.

Wahab, K. A. (2011). Satisfying the Training Needs of Management and Staff in the Construction Industry. Proceedings of National Seminar on Effective Contract Management in the Construction Industry, 98-107.