STUDY OF RELATIONSHIP BETWEEN TIME OVERRUN AND PRODUCTIVITY ON CONSTRUCTION SITES

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ABSTRACT

The history of the construction industry worldwide is full of projects that were completed with significant time and cost overruns. In an attempt to reverse this trend, this study aims at establishing the relationship between time overrun and labour productivity on construction sites in Lagos, Nigeria. 43 technical and management staff of some medium and large construction firms based in Lagos, Nigeria were sampled and administered a questionnaire survey. The questionnaire contained 18 causes of project time overrun and 14 causes of low labour productivity which had been identified from the literature reviewed. With these a relationship between project time overrun and low labour productivity was established. Both descriptive and inferential statistics were used in analyzing the data. Results indicate that inadequate funds for the project, inadequate planning before project takeoff, inadequate tools and equipment and delay in delivery of material top the list of major causes of time overrun while the use of wrong construction methods, inadequate construction materials and inaccurate drawing/specification are the key factors causing low labour productivity on construction sites. Significant negative relationship was found between time overrun and labour productivity in construction sites in Nigeria. The study concludes by recommending that early appointment of project managers could ensure proper management of both the human and material resources that could guarantee improved productivity and ultimately save projects from time overrun.

KEYWORDS: Construction site, Labour productivity, Time overrun, Nigeria.

INTRODUCTION

Mbachu and Olaoye (1999) opined that the Nigerian construction industry is bedevilled by projects that are completed much longer than mutually planned. This was buttressed by Odusami and Olusanya (2000) who concluded that most projects executed in the Lagos metropolis experienced an average time overrun of 51% on their planned duration. Volume of articles have been written in an attempt to eliminate or minimize construction time overrun along with its debilitating effects on project owners, contractors and consultants, but the issue remains unabated. Time overrun results in the growth of adversarial relationships, litigation, arbitration, cash flow problems and a general feeling of apprehension between project participants. Numerous studies relating to causes of time or cost overruns have been conducted worldwide in developed countries such as the USA and UK (Xiao & Proverbs, 2002), and developing countries such as Nigeria (Okpala & Aniekwu, 1988; Mansfield et al., 1994; Dlakwa & Culpin, 1990), Saudi Arabia (Assaf et al., 1995), Thailand (Ogunlana et al.1996), Malaysia (Wang, 1992) and Jordan (Al-Momani, 2000).

In most construction sites, best possible performance are unachievable with poor productivity resulting in time overrun and consequently cost escalation of the projects. According to Eldin and Egger (1990), construction productivity has been on a steady decline. The problem of low productivity is not limited to Nigeria. Proverbs et al. (1999) observed that construction productivity in the United Kingdom was lower than in many other European countries despite the encouraging signs observed in the 1980s boom. There is nothing as dangerous to an economy as a decrease in productivities because it creates inflationary pressure, social conflict and mutual suspicion (Drucker, 1980).

Previous research efforts have focussed on labour productivity measurement and the improvement of profitability through the working environment. Also in Nigeria, several research works have been undertaken to determine the causes and implication of time overrun on construction sites. However, the current study attempts to establish the relationship between time overrun and labour productivity on construction sites. The main objectives include: identifying the major causes of time overrun on construction project, determining the factors that affect labour productivity, examining the relationship between time overrun and labour productivity on construction sites and to develop a predictive model that will determine the impact of labour productivity on time overrun on construction sites.

BRIEF LITERATURE REVIEW

Time Overrun

The problem of project time overrun is of international concern. According to Kaming et al. (1997) and Trigunarsyah (2004), time overrun is the extension of time beyond planned completion dates usually traceable to contractors. Elinwa and Joshua (2001) defined it as the time lapse between the agreed estimation or completion date and the actual date of completion. Bramble and Callahan (1987) describe time overrun as the time during which some part of construction project is completed beyond the project completion date or not performed as planned due to an unanticipated circumstance. Al-Momani (2000) conducted a survey on 130 public projects in Jordan and found delays occurred in 106 (82%). Frimpong et al. (2003) observed that 33(70%) out of 47 projects in Ghana were delayed. Ogunlana et al.'s (1996) study in Thailand and Kaming et al.'s (1997) study in Indonesia found that the blame for most project delays were laid on the contractor. Abd. Majid and McCaffer (1998) found that 50% of the delays to construction projects can be categorized as non-excusable delays, for which the contractors were responsible. Time overrun affects the project owners, contractors and other project participants. Project owners may be affected through lost benefits that could have accrued from the completed facility, while contractors may have to spend more on labour and plant, pay penalties as per the contract or even lose other profitable contracts because resources for the next job are tied up on delayed projects.

Many researchers have highlighted the causes of project time and cost overrun. These studies established that the problem of project delays and cost overrun are caused by financing and payment for completed works (Frimpong et al. 2003, Alaghbari et al. 2007, Sweis et al. 2008, Fugar and Agyakwah-Baah, 2010), poor contract management (Ogunlana et al. 1996, Ojo et al. (1999), changes in site conditions **(**Mansfield et al., 1994, Al-Momani 2000), shortage of materials **(**Ogunlana et al., 1996), design changes **(**Mansfield et al. 1994, Xiao and Proverbs 2002), weather condition (Frimpong et al. 2003), among others.

Chalabi and Camp (1984) found that delays and cost overruns of construction projects occur entirely in the very early stages of the project i.e. during the planning stages of project development. The project owners may be responsible for the time overrun when delays, suspensions or interruptions to all or part of the work are caused by an act or failure to act by the owner resulting from breaches of owner's obligations, stated or implied in the contract. These include failure of the owner or his representative (consultants) to furnish the contractor with relevant information, details etc. for which the contractor has specifically requested in writing. Rowlinson (1988) referring to the finding of Bromilow (1974) says that project owners were responsible for delays in issuing approvals, signing contracts and allowing site access. The finding also indicated that owners were responsible for the largest proportions of variations, all of which have time and cost implications. Rowlinson further refers to Wearne and Ninos (1984) finding that effective control of construction was dependent on the promoter's decision on the authority vested in his project team. Whilst authority needs to be delegated to a member or members of the building team, it must not be forgotten that the client should provide an individual with authority to take decisions without reference back.

The contractor on the other hand bears the risk associated with time overrun on matters related to low labour productivity, inadequate scheduling or mismanagement, construction mistakes, weather, equipment breakdowns, staffing problems, etc. There are however, time overrun caused by events beyond the control of either the owner or the contractor. Such delays may rise as a result of force majeure, exceptionally inclement weather, civil commotion, industrial unrest, just to mention but a few.

Productivity on Construction Sites

Productivity is defined as a ratio between an output value and an input value used to produce the output (Borcherding et al., 1986). Output consists of products or services and input consists of materials, labour, capital, energy, etc. There is nothing as dangerous to an economy as a decrease in productivities because it creates inflationary pressure, social conflict, and mutual suspicion (Drucker, 1980).

Makulsawatudom et al. (2004) established 10 most significant factors affecting construction productivity in Thailand and they include lack of materials, incomplete drawings, incompetent supervisors, lack of tools and equipment, absenteeism, poor communication, instruction time, poor site layout, inspection delay and rework. Enshassi et al.'s (2007) study in the Gaza Strip identified the five most important factors that impact negatively on labour productivity as material shortages, lack of experience of labour, lack of labour surveillance, and alteration of drawings/specification during execution. Ameh and Odusami (2002) identified low wages, lack of materials and unfriendly working atmosphere as having key impact on productivity of craftsmen involved in in-situ concrete operation in single storey building projects in Nigeria.

RESEARCH METHODOLOGY

The aim of the study was to establish the relationship between time overrun and labour productivity on construction sites in Nigeria. To achieve this, the study collected data from medium to large construction firms that are based in Lagos, Nigeria. Lagos is located in the South-western part of Nigeria. Being a former federal capital and now the commercial nerve centre of the country, Lagos hosts many of the reputable construction companies operating in

Nigeria. Lagos is listed as one of the 25 megacities of the World with an estimated population of about 17million in 2007 and a growth rate (3.2%) which has an attendant pressure on its infrastructure. There are numerous construction projects in Lagos executed by both the private and public sector to meet the housing, economic and infrastructure requirements of the emerging megacity. The choice of Lagos benefits the study because it permits the sampling of a large population of technical and management staff of construction firms.

A structured questionnaire was the instrument used to collect primary data for the study. The target population include contractors registered with the Federation of Construction Industry (FOCI), formerly Federation of Building and Civil Engineering Contractors of Nigeria. The total number of contractors' registered is 65 and are mainly medium to large scale firms. Generally these companies have adequate on-going projects in Lagos State. A systematic random sample selection from the list of these registered contractors was undertaking, using non-replacement random selection method to ensure a representative sample of all the contractors.

Eighty (80) questionnaires were administered to the technical and management staff of the construction companies. Forty-three (43) of these completed questionnaires were used for the analysis. The number thinned down to 43 after the questionnaires were checked for completeness and omissions, including error of multiple answers. The data collected were analyzed using simple percentages, mean scores, mean item scores and regression analysis to develop a predictive model that will determine the impact of time overrun and labour productivity on construction sites. Also principal component analysis (Factor analysis) which is often preferred as a method for reducing the number of variables in a research study was used. Consequently, Eigen values are used to retain factors or drop them. Factors with Eigen values ≥ 1.0 are retained, meaning that the factors are significant to the study; conversely factors with Eigen values of less than 1.0 are insignificant.

RESULTS AND DISCUSSION

Respondents' Demographic Profile

A summary of the demographic information obtained from the survey respondents is given in Table 1. The first point of consideration is the organisational roles and responsibilities held by the respondents within their respective organisations. Majority of the respondents, 33% are Project Engineers, while 17% and 12% are Project Managers and Electrical Engineers respectively. Quantity Surveyors, Architects, and Land Surveyors are 10% apiece while 7% are Mechanical Engineers. Only 2% of the respondents perform Health Safety and Environment (HSE) roles. This distribution reflects the key roles of Project Engineers within the construction industry. HSE officers are few in the construction industry because there is currently little demand for their services in the industry.

Breakdown of the nature of business that respondents are involved in shows that, the largest proportion of them, (77%) are in actual construction work. Also 12% and 7% of the respondents are into engineering consultancy and the provision of architectural services respectively.

Table 1: Demographic profile of research participants

Descriptor	Participants	Percentages
Organisational Role	Project Engineer	33
	Project Manager	17
	Electrical Engineer	12
	Quantity Surveyor	10
	Architects	10
	Land Surveyor	10
	Mechanical Engineer	7
	Health Safety and Environment (HSE)	2
Nature of Business	Construction	77
	Engineering consultancy	12
	Architectural services	7
	Facilities Management	2
	Cost Consultancy	2
Highest Qualification	Postgraduate	12
	Degree	45
	Diploma	33
	Others	10
Work Experience	Less than 5 years	35
	6-10 years	35
	11-15 years	16
	16-20 years	7
	21 years and above	7
Age Classification	20 - 29 years	9
	30 - 39 years	70
	40 - 49 years	21

The respondents are largely degree and diploma certificate holders, with those having postgraduate qualifications accounting for only 12% of the total. In general, this distribution depicts a cumulative of about 77% of construction industry professionals with first degree or its equivalent. Further the respondents' years of experience shows a predominance of professionals with less than 10 years working experience. As observed, 70% of the respondents fall in this group. The remaining 30% have years of experience of above 10 years. Finally, it was interesting to see that 70% of the respondents fall within 30 and 39 years age category, followed by 21% in the 40 to 49 years category, and the remaining 9% of the respondents are within the 20 - 29 years age bracket. A cumulative total of 86% of the survey respondents have less than 15 years working experience. The propensity to be promoted to management position with more responsibility on strategic and policies issues than site daily operation, may account for this early career attainment amongst the respondents.

Causes of Time Overrun on Construction Sites

The study had identified 18 factors from literature which were chief among the causes of time overrun on construction sites. The study respondents were required to rank these 18 factors according to their influence on time overrun on construction sites. The ranking was therefore based on the perception of the respondents which are grouped into two: consultants and contractors. The result is presented in Table 2.

As indicated in Table 2, inadequate fund for projects, inadequate planning of projects before their commencement, inadequate tools and equipment, delay in delivery of materials, and design changes during project execution were ranked overall as the top 18 factors causing time overrun on construction sites. These same factors were ranked (in that order) by the

contractor. Sub-contractor incompetency was ranked first followed by inadequate funds for the project by the consultants.

The result of this study is consistent with earlier studies in Nigeria. Aibinu and Jagboro (2006) identified contractors' financial difficulties, the project owners' cash flow problems, incomplete drawings, subcontractors' incompetency, equipment breakdown, late delivery of materials, planning problems, price escalation and subcontractor's financial problems, in that order as leading causes of project time overruns.

Table 2: Consultants and contractors perception of causes of time overrun in construction site

Time Overrun Factor	Consultants		Contractor		Overall	
	Mean	Rank	Mean	Rank	Mean	Rank
Inadequate fund for the project	4.40	2nd	4.16	1st	4.21	1st
Inadequate planning of project before commencement	4.10	3rd	4.03	2nd	4.05	2nd
Inadequate tools and equipment	3.60	8th	3.94	3rd	3.86	3rd
Delay in delivery of materials	3.70	5th	3.84	4th	3.83	4th
Design changes during project execution	3.70	5th	3.55	5th	3.70	5th
Subcontractor incompetency	4.50	1st	3.46	7th	3.70	5th
Delay in response to decision taking	3.40	12th	3.49	6th	3.58	7th
Incompleteness of technical documentation	3.60	8th	3.33	8th	3.40	8th
Variations	4.00	4th	3.30	9th	3.40	8th
Labour dispute in form of strike or lock-out	3.70	5th	3.27	10th	3.37	10th
Unexpected subsoil/ground condition	3.50	10th	3.21	11th	3.28	11th
Community issues	3.50	10th	3.06	12th	3.16	12th
Unclear or inadequate instructions to operators	3.40	12th	3.00	14th	3.10	13th
Temporary work stoppages due to adverse weather	3.40	12th	2.94	15th	3.05	14th
Delay in inspection and testing of completed work	3.00	16th	2.94	15th	2.95	15th
Political instability or change in government policies	2.50	18th	3.06	12th	2.93	16th
Accidents	3.00	16th	2.81	18th	2.88	17th
Obtaining building permit and approvals	2.80	17th	2.94	15th	2.84	18th

This finding also agrees with similar studies in other developing countries. For example, Frimpong *et al*. (2003) found that financial problems are the main factors that cause delay in the construction of groundwater projects in Ghana. Alaghbari *et al*. (2007) study in Malaysia indicated that from a list of thirty-one (31) factors, clients, contractors and consultants agreed that financial problems were the main factors causing delay. The inability of clients (building owners) to honour payments on time was determined as the first major factor that causes delays in building construction projects in Ghana (Fugar & Agyakwah-Baah, 2010). Sweis *et al*. (2008) studied the causes of delay in residential projects in Jordan and concluded that financial difficulties faced by the contractor and too many change orders by the owner are the leading causes of construction delay. Abd El-Razek *et al*. (2008) in a similar study in Egypt found that the most important cause of delay is financing irregularity by contractor during construction.

Factors that affect Labour Productivity

Respondents were asked to rank the effect of 14 factors identified from literature on labour productivity using a 6-point Likert scale ranging from extremely high effect (5) to I don't know (0). The breakdown of the survey analysis is presented in Table 3.

There are however some minor disagreements in the responses of the consultants and the contractor. For example the use of wrong construction methods which was ranked first by the contractor was ranked second by the consultants. In Nigeria, construction projects are highly labour intensive. In most cases, simple hand tools and manually operated equipments are used on sites. The use of wrong methods for construction can reduce the productivity of workers on site. Most importantly more time will be spent on an item of work with little outcome. The wrong use of construction methods aside from slowing down productivity of workers could gravitate to rework with the attendant waste of material and human resources. Similarly, inadequate construction materials which ranked second by the contractor, was ranked fifth by the consultants. Inaccurate drawing/specification which was ranked first by the consultants was ranked fourth by the contractor.

Table 3: Rankings of causes of low productivity in construction site by organisation

Productivity Factor	Consultants		Contractor		Overall	
	Mean	Rank	Mean	Rank	Mean	Rank
Use of Wrong Construction Method	4.10	2nd	4.09	1st	4.09	1st
Inadequate Construction Materials	3.80	5th	3.97	2nd	3.93	2nd
Inaccurate Drawings/Specification	4.30	1st	3.82	4th	3.93	2nd
Inadequate Tools and Equipment	4.00	3rd	3.84	3rd	3.88	4th
Poor Supervision of Operatives	3.90	4th	3.67	5th	3.72	5th
Lack of Skills from the Workers	3.80	5th	3.64	6th	3.67	6th
Tools/Equipment Breakdown	3.67	8th	3.41	7th	3.46	7th
Delay Due to Unclear or Inadequate Instructions	3.40	11th	3.39	8th	3.40	8th
Unfriendly Working Atmosphere or Weather Condition	3.70	7th	3.18	9th	3.30	9th
Unbalanced Distribution of Resources	3.56	9th	3.09	11th	3.20	10th
Correctional Work to Improve Poor or Bad Work	3.50	10th	3.00	12th	3.12	11th
Political Insecurity or Change in Government Policies	2.60	14th	3.13	10th	3.00	12th
Injury or Accident Involving a Worker	3.00	12th	2.82	13th	2.86	13th
Wages	3.00	12th	2.78	14th	2.78	14th

Unexpectedly, wages, injury or accidents involving workers and political insecurity or change in government policies, were unanimously ranked as factors that have the least effect on labour productivity on construction sites.

Principal-component factoring and orthogonal varimax rotation yielded only three key factors out of the fourteen identified low productivity factors. The identified three main factors ranked according to the order of their effect on labour productivity are use of wrong construction method, inadequate construction materials and inaccurate drawings/ specification. These factors accounted for a cumulative variance of 64.97% and had Eigen values ≥ 1.0.

Time Overrun and Labour Productivity

Six factors that culminated in time overrun were selected for consideration of their effect on labour productivity. The selection was done using principal component analysis (factor analysis as previously explained) on the 18 factors identified from literature to be among the causes of time overrun on construction sites. The analysis revealed six (6) key factors ranked according to the order of their contribution to time overrun. These factors accounted for a cumulative variance of 73.20% and had Eigen values ≥ 1.0 which signifies reasonable contribution to time overrun in construction sites. The first key factor had a Eigen value of 5.156 while the last one had 1.004.

The outcome is given in Table 4 which gives the effect of time overrun factors on labour productivity on construction sites in relative ranks. According to this analysis, subcontractor incompetence is found to result in the lowest labour productivity on construction site. A total of about 58% of the respondents rated sub-contractor incompetence as major cause of low or no labour productivity on construction sites in Nigeria. This is followed by inadequacy of tools and equipment, which about 56% of the respondents confirmed affect low labour productivity on construction sites. In the same vein, inadequate planning of project before commencement received 55% response on account of low labour productivity. This proves that inadequate planning like other key factors does not only affect time overrun but could in turn lead to low labour productivity.

Table 4: Relationship between time overrun and labour productivity

	No Productivity	Low Productivity	Moderate Productivity	High Productivity	Extremely High Productivity	Relative Index
Subcontractor incompetence	7	51.2	16.3	14	11.6	0.453
Inadequate tools and equipment	-	55.8	20.9	9.3	14	0.469
Inadequate planning of project before commencement	2.4	54.8	14.3	9.5	19	0.48
Inadequate fund for the project	11.6	41.9	9.3	14	23.3	0.492
Delay in delivery of materials	-	42.9	26.2	19	11.9	0.5
Design changes during project execution	-	27.9	41.9	16.3	14	0.527

From Table 4, other key time overrun factors that respondents show to contribute to low labour productivity include inadequate fund for project (42%), delay in delivery of materials (43%) and design changes during project execution (28%). The most important thing noted among the six key time overrun factors is that respondents' responses on them highly concentrate on the low labour productivity side. This implies that such factors reduce labour output on construction sites and should be managed to guarantee timely completion of projects.

Predictive Model of Labour Productivity Impact on Time Overrun on Construction Sites in Nigeria

One of the study objectives is to construct a predictive model that will determine the impact of labour productivity on time overrun on construction site in Nigeria. To achieve the above

objective, a linear regression model was specified using labour productivity as independent variable and time overrun as dependent variable. Total score for eighteen time overrun factors was computed for consultants and contractors together to give us time overrun, which is used here as dependent variable. While labour productivity were derived from the fourteen factors that constitute labour productivity. The transformation gives a perfect score for labour productivity which is now taken in this aspect of the analysis as the independent variable. The mathematical model in Equation (1) follows the standard equation form for straight lines with provision for stochastic error:

$$T = \alpha + \beta P_L + \varepsilon \quad \text{..... Equation (1)}$$

Where:

P_L = labour productivity
T = time overrun
α = intercept
β = coefficient of labour productivity
ε = stochastic error term

Table 5: Regression analysis of time overruns

Model		Unstandardized Coefficients		Standardized Coefficients	t	Significance
		B	Standard Error	Beta		
1	(Constant)	93.460	3.361	-0.859	27.809	0.000
	Productivity	-1.031	0.102		-10.081	0.000

The result from the regression analysis is presented as follows:

$R^2 = 0.74$
Adjusted $R^2 = 0.73$
Durbin-Watson = 1.82
$F_{(1,32)} = 101.635$, p = 0.000

From the result obtained after the regression analysis (outlined in Table 5), it was observed that the mathematical model expressed in Equation (1) can well predict the impact of labour productivity on time overrun. Therefore $F_{(1,32)} = 101.635$, p = 0.000**.** The coefficient of labour productivity gives the magnitude of change in time overrun due to change that occurred in labour productivity which in this case is -1.031. This implies that a unit increase in labour productivity results in about 1.03 units' reduction in time overrun and vice versa, while the intercept (constant) is 93.46. The estimated model is presented in Equation (2).

$$T = 93.460 - 1.031P_L \quad \text{..... Equation (2)}$$

On this basis, it was concluded that a significant predictive impact of labour productivity exists on time overrun on construction site in Nigeria, such predictive impact is 1.03 units' reduction (or increase) in time overrun for a unit increase (or decrease) in labour productivity.

CONCLUSION

This study has established that among the various factors that causes time overrun, inadequate fund for the project, inadequate planning of project before take-off, inadequate tools and equipment, delay in delivery of materials, subcontractors' incompetency and design changes during project execution top the list. Adequate funding guarantees reasonable cash flow while good planning ensures uninterrupted progress of work and these are basic ingredients for the realisation of key objectives of any project. The project owner and project manager should keep their eyes on these key factors during project execution as these factors could result in reasonable time overrun on projects.

Among several factors that affect productivity in the construction sites, use of wrong construction method, inadequate construction materials and inaccurate drawings/specification were the most significant. Availability of construction materials in the required quantity and quality will avert production delay, while accurate drawings/specification will prevent rework, and good construction method enhances the production process in any construction site.

The predictive model emanating from the current study indicates that significant relationship exists between time overrun and labour productivity in construction sites in Nigeria. Equally, the nature of the relationship is inversely proportional i.e. the higher the time overrun the lower the labour productivity and conversely the lower the time overrun the higher the labour productivity. More precisely the study concludes that a 1.03 units' reduction (or increase) in time overrun causes 1.0 unit increase (or decrease) in labour productivity.

Based on the outcome of the study, the following recommendations are made towards improved productivity in the construction industry and to reduce time overrun on projects in Nigeria.

a) There should be effective funding of project by project owners to avoid unnecessary time overrun with its attendant effect on cost. To guarantee achievement of the construction programme, the project owner could engage the service of a project manager to manage the project from the design stage through tendering to completion.

b) Contractors and subcontractors should provide adequate and functional working tools/equipment for their workers to enable timely completion of projects. Equally, in every medium to large scale projects, the project team composition should include a dedicated staff trained on materials management and store keeping to ensure effective and efficient management of construction materials. The contractor or sub-contractor could establish a maintenance department that is managed by experienced technician on construction sites to ensure prompt repair of any damaged tools/equipment.

c) The project manager should ensure that both nominated and domestic sub-contractors on any project have the requisite experience and work plan to meet the requirements of the main contractor. Pre-qualification of these sub-contractors would ensure that the ones engaged have sufficient experience, proficiency and capacity to deliver not only quality work but on time. The project owner (or project manager) must ensure completion of all design documentation with any associated value engineering analysis and buildability reports before tendering, so that design changes during project execution is minimised.

d) The project manager should ensure the submission of method statements by the contractors in the course of bidding for any construction project. This to a large extent would determine the contractor's understanding of the work and the application of good construction method and technology that will guarantee prompt realisation of project objectives.

e) Government should encourage skill acquisition especially among the teaming unemployed youth through development of technical colleges for training of workers in various construction trades. Good skills within and among the workers would exert reasonable quantum of positive influence on labour productivity more especially when backed by adequate supervision of operatives. Contractors and sub-contractors should as a matter of policy train and retrain skilled and semi-skilled workers to enhance their skills which will eventually improve on the labour productivity.

f) Contractors and subcontractors should ensure adequate training and supervision of the operatives on construction sites as it would improve on the quality of output as well as minimize the chances of doing wrong work or even application of wrong construction method by the workers. Equally, supervisors should be well grounded in any aspect of work they are in charge as it would not only earn them respect but add value to quality of the completed work.

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