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Efficiency Losses in Construction Sites; who is Responsible?

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Abstract: *Claim in the construction industry is becoming spurious and worrisome particularly to clients and consultants. In many of such claim circumstances, labour continues to be a contentious issue. Inefficient use of labour in construction sites arising from disruption, work acceleration and brief's extension where identified in this study to result in efficiency losses in terms of Man – hour loss. This paper responded to the inquiry of efficiency losses in construction projects by a survey design using the Likert scale questionnaire. Stratified and systematic sampling techniques where adopted for this purpose with a target population of registered professionals in the three Niger-Delta states of Bayelsa, Delta and Rivers of Nigeria where the survey was conducted. Data collected was analyzed with mean items score. The study revealed that engineers on the basis of their frequent issuance of change orders are highly responsible for the occurrence of efficiency losses or productivity decline in construction projects.*

Keywords: *Efficiency losses, productivity decline, claims, efficiency losses estimation, change order, cost impact.*

1. INTRODUCTION

One of the most contentious areas in construction claims is the calculation or estimation of efficiency losses. Unlike direct costs, efficiency losses is often not tracked or cannot be discerned separately and instantaneously (Association for the Advancement of cost Engineering, AACE 2004). As a result, both causation and entitlement concerning the recovery of efficiency losses are difficult to establish. To compound this situation Construction Industry Institute (CII) (1996), stated that there is no uniform agreement within the construction industry as to a preferred methodology of calculating efficiency losses. There are, in fact, numerous ways to calculate efficiency losses, but within the ambit of limitation CII (1995) observed that many methods of calculation are open to challenge with respect to reliability and applicability to particular case(s) – thus making settlement and award of claim for efficiency losses on a particular project problematic. The major outcome of efficiency losses is usually decline in productivity, arising from efficiency losses. Dieterle and Gaines (2010) observed that virtually every project in which a contractor makes a claim for delay, acceleration or disruption includes damages associated with loss of labour efficiency. Often times, loss of efficiency claims represent a significant component of damages. Consequently construction companies are constantly searching for ways to improve labour output, (Orth, Welty and Jenkins, 2006). In view of the evolving nature of efficiency losses in construction contracts in respect of estimation, ascertaining cause, evaluation of claims and award of entitlement, Gulezian and Samelian (2003) averred that efficiency losses that resulted in the increase of a contractor's cost arising from acts of an owner or its agents has been recognized by arbitration panels, courts and construction boards to be recoverable by the contractor. However, this paper seeks to find who is responsible for efficiency losses in Construction projects with the specific objective of ascertaining the professional responsible for efficiency losses in construction projects.

2. LITERATURE SURVEY

2.1. An Overview of Efficiency Losses in Construction Projects

As all construction industry professionals know, there are few, if any project that do not involve unanticipated events that impact the cost of the project (As worth and Hogg 2008). Unanticipated course of construction events typically result in contract change order requests for the cost incurred as a result of the additional work, delay and/or acceleration. Efficiency losses occasioned by inefficient use of labour, leads to the reduction in productivity arising from unanticipated conditions (Sykes

2009). Such conditions may include adverse weather, scheduled overtime, change orders and material delivery problems (Halligan and Demsetz 2004). According to AACE (2004) efficiency losses is the increased cost of performance caused by a change in the contractor's anticipated or planned resource, working conditions or method of work. Due to the very nature of a disruption chain (alteration of job sequence), it is difficult to timely identify a disruption claim, document the chain and prove the specific costs of a disruption claim. According to Last (2009) on many occasions, the long term effect of these unanticipated events cannot be assessed or calculated until the project is completed. The general cause(s) of efficiency losses may be easy to speculate upon, the contractor seeking to be compensated for a cost increase must first demonstrate entitlement, that is, a contractual right to recover damages to a level of certainty, i.e. the nexus between entitlement and damages (Chen 2010). The resulting damage (cost) from efficiency losses are an outgrowth of the change in output/input been the difference between baseline productivity and that actually achieved. i.e.

$$Efficiency\ losses = productivity_{Baseline} - productivity_{Actual}$$

Baseline productivity can be determined by measurements of input and output in unimpacted or the least impacted periods of time on the project. This makes, efficiency losses the difference between the productivity actually observed and the productivity that might reasonably have been expected if not for the unanticipated condition. According to Dieterle and Gaines (2010) efficiency losses claims are prevalent in many construction disputes. They are of the opinion that efficiency lossess are not well understood and often difficult to quantify. Ironically, they often represent the largest component of a claim for disruption to intended productivity levels arising from contractor's inability to perform at its historical or estimated level of progress (Hanna, Jeffrey, Detwiler and Pehr 2009). In many instances, contractors fail to provide a causal link between the alleged impacts that affected its productivity levels and the resultant damages (Chen 2010). Arising from this, clients are generally reluctant to acknowledge that a contractor has suffered a compensable loss. However, the nature and theory behind efficiency losses claims should remind clients continuously that the methodology for determination of efficiency losses need not be a laboratory science (Seals and Josette 2006). From existing literature and particularly Halligan and Demsetz (2004), two steps are required to evaluate efficiency losses. First, it must be demonstrated that a loss occurred. Several techniques exist for demonstrating such losses.

2.2. The Nature of Claims in the Construction Industry

It is evident, from society in general, that individuals are becoming more claims conscious. Firms of lawyers are now touting their services, often on a contingency fee basis, although this is more the exception than the rule in construction cases (Borcherding and Alarcon 1991). The term claim is a request by a contractor for recompense arising from some loss of expense which he has suffered or is an attempt to avoid the requirement to pay Liquidated and Ascertained Damages (L.A.D) or a request, supported by full detail and particular, for which one party believes he is entitled to (usually time or money or both) by virtue of a term or terms in a valid contract with another party, but which there is yet no agreement (Singh 2010). Contractual claims arise where contractors assess that they are entitled to additional payments over and above that paid within the general terms and conditions of the contract for payment of work done (Ashworth and Hoggs 2008). The contractors may seek reimbursement for some alleged loss that has been suffered, for reasons beyond their control. Claims may arise for several different reasons, such as Extension of time, Changes to the nature of the project, Disruption to the regular progress of the works by the client or designer and Variations to the contract. A claim can only occur when a contract is breached or under one of the specified clauses in the contract which allows for extra payment over and above normal valuation (Federle 1993). Provisions relating to loss and expense remain largely unaltered except that the new JCT 2005 Contract refers to it as "Relevant Matters" rather than the "list of matters" in the 1998 Edition. The Relevant Matters in the new 2005 Edition have equally been reduced from the ten matters that are referred to in the 1998 Edition to five matters. It is fairly easy to cross-reference the Relevant Matters with the Relevant Events to see those events for which the Employer is responsible that gives rise to loss and expense. However grounds for contractual claims have been extracted from the JCT (1980) and the ICE (1979) as revised in JCT (2005) and ICE (2001) schedule as highlighted hereunder;-

Clauses in JCT on which claims are based are;

Table1. *Claim clauses*

Serial Number	Clause Reference	Claim Heading
1.	4(2)	Fees based claim
2.	6(1)	Specification based claim
3.	7	Patent based claim
4.	11(6)	Variation based claim
5.	15(2) and (3)	Return to good based claim
6.	20(B) and (C)	Insurance and premium based claim
7.	24	Efficiency losses based claim
8.	26(B)	Direct loss based claim
9.	31	Fluctuation based claim
10.	34(3)	Loss associated with dealing with antiquities based claim

Clauses in ICE on which claims are based are; Clause 12 adverse physical site condition and artificial obstruction leading to efficiency losses claim, clause 52(4) showcases procedure for preparation of claims by contractor's loss claim. According to Alli (1997) contractual claims are means whereby a contractor can be compensated for the loss that he would suffer where the obligation that he under took in the contract agreement has become more onerous than he anticipated through no fault of his own. Claims are not payable in all circumstances that may cause the contractor loss but those circumstances which do give rise to a right to compensation are identified in the contract documents (Ward and Thomas 2004). Contract condition of engagement clause relating to the contractors entitlement to claim compensation for loss are necessarily introduced into building contracts because of the uncertainty that may surround the conditions under which the contractor is to carry out the works at the time when he prepares his tender. The contributions to the completion of a construction project are made by a number of diverse parties any of whom may disrupt or interfere with the progress of the contractor in completing the works as noted by Randolph and Oloufa (2005). The conditions under which a project is to be carried out are usually uncertain with respect to weather, availability of resources, and site conditions, which makes it difficult for the contractor to predict the costs of completing the works. Because of the variations in circumstance that may arise from these varied and uncertain conditions which will directly affect the contractor's efficiency, contract conditions are introduced to compensate the contractor for unpredictable losses that may subsequently arise (Hester, Kuprenas and Chiang 1999). The possibility of paying the contractor these costs outside the contract sum requires the contractor to price the known factors of completing the works at the time of tender, without having to provide for unknown factors. According to Jones (2001) the principle of contractual claims is that the contractor shall be paid for a change of condition affecting the circumstance under which he has to carry out the works (whether arising naturally – relating to matters over which he has no control over or through the fault of the client, his Agents or his consultants) that causes him loss.

Emphatically clause 24 and clause 26B of the JCT form is scheduled for payment of such a claim to include reimbursement for loss suffered in respect of disruption of the progress of works, the introduction of uneconomic working,/ standard time or schedule, the cost of returning resources to the site, or the cost of a prolonged contract period arising from variation of the works instructed by the Architect or the Engineer.. Jones (2001) on the same issue of efficiency losses noted that disruption or acceleration of construction project work schedule always leads to lost of labour man-hour. It is not easy to speculate such losses in anticipation for claim. That is why Jensen and Albert (1995) stated that in practice, contractors do not always identify an occurrence which gives rise to a claim situation on an instantaneous basis. This is because it is difficult at the time of the occurrence to identify the disruption chain and identifying that it is of claim consequence or alternatively it may not be possible to identify the disruptive effect of the occurrence until sometime after its occurrence (Dieterle and Gains, 2010). Singh (2001) advised that it is important that once a contractor feels that a claim might be appropriate he should file a notice to the Architect or Engineer of his observations and intention to claim for disruption of planned work activity and by extension labour. AACE (2004) had proposed a framework for identification of claim items noting that, to facilitate the identification of occurrences which gives rise to claims, and to enable an evaluation of the delay and cost effect of disruptions which occured during the contract to be made, it is important that the contractor maintains an earned value system and monitoring process well known to field staffers that will alert him when claim situations arise and will record the effect of such disruptions once they are identified (AACE 2004). Efficiency losses is rooted in disruption to man-hours where the contractor wishes to claim for the financial effect of labour inefficiency that was introduced into the project due to occurrences arising from circumstances wherein the contractor's method of work become less efficient against his historical or base line productivity estimate (Halligan and Demsetz 2004).

Secondly it may arise from acceleration of work schedule, where the contractor is required to accelerate the progress of works to accommodate a claim situation, thus introducing additional expenditure on resources. Thirdly it may arise from out of sequencing of job where a claim occurrence affects the contractor's efficiency due to consequential sequencing difficulties. Finally it may be an offshoot of climatic weather conditions were labour may be disrupted and cost incurred as a result of work having to be carried out at a less favourable time of the year (AACE 2004). These provisions are contained in Section 4 of the Contracts conditions, which deals with payment, and no longer sit side by side with "extension of time" provisions Needham-Laing (2005). There is, within the industry, a misconception that an adjustment to the Completion Date and loss and expense go hand in hand and it is necessary to prove an adjustment to the Completion Date in order to obtain loss and expense (Ashworth and Hoggs 2008). In legal terms, while the two are connected, they are in fact mutually exclusively remedies and it is not necessary to obtain an extension of time in order to gain loss and expense. Whether divorcing the two provisions so that they are in separate sections of the Contract conditions will alter the Industry's misconception remains to be seen. The circumstances of the claims, reasons for the liability and the relevant clauses in the contract condition must be explored by the contractor before making his presentation (Thomas and Oloufa 1995). Claims may arise in respect of additional payments that cannot be recouped in the normal way, through measurement and valuation. They are based on the assumption that the works, or part of the works, are considerably different from or executed under different conditions than those envisaged at the time of tender (Singh 2001). The differences may have revised the contract's intended and preferred method of working, and this in turn may have altered or influenced the costs involved.

Under this circumstance, the rates inserted by the contractor in the contract bills do not now represent fair recompense for the work that has been executed (Dieterle and Gains 2010). Discussion of the principle of the claim informally with the client representative first to establish some bases for its validity, is of utmost importance; accompanied by proof of claims and claim document, detail records of all site activities and other document like correspondence, site meeting minutes, architect instructions, daily labour and location sheet, site diary, daily weather report, receipt of drawing schedules (Alli 1997). Correspondence with the subcontractors, build up of tender extension of time claims and allowances, plant record, day work records and variation sheet are somewhat considered as prerequisites (Sanvido et al 2007). Of all the claim items enumerated above, the most direct claim function to this research is the claim associated with inefficiency occasioned by the inefficient use of labour and plant. A situation were men and plant, stand idle or working at reduced or below optimal level of output. It will be necessary for the contractor in substantiating a claim to produce evidence of the estimated level of output used in preparing his tender and records of the actual output during the disruption period (CII 2001).

2.3. Why the Study?

Thomas and Gary (1995) stated that measurement and allocation of responsibility for efficiency losses can be difficult in a construction project and compounded by the fact that there is no unified method of measuring efficiency losses amongst cost experts. Accordingly, AACE (2004) affirmed that, efficiency losses resulting from some actions of the client may not easily be detected or observed at the outset. Unless a contractor has a good labour monitoring plan, well known to field officers, all that may be known at the outset of a project is that gangs are not completing work activities as planned, (Dieterle and Gains 2010, AACE, 2004). On identification, appropriate written notice to the client are often not promptly filed, resulting to discrete and tension soaked project monitoring efforts. As noted by Singh (2010), efficiency losses is frequently not discretely tracked on construction projects in an instantaneous manner. Unless a contractor uses some sort of structured earned value system for tracking output units and input units, there is no way to measure efficiency losses instantaneously (CII 2001, AACE, 2004). Thus, productivity losses can be difficult to prove with the degree of certainty demanded by many clients. Because of the volatility of this concept, Thomas and Gary (1995) pointed further that there is no unified standard amongst cost experts as to how such lost hours should be calculated. Subject to these assertions, there is a general agreement among experts that a comparison to un-impacted work on the project is generally preferred when sufficient data is available, (CII 1995).

The quality of some of the methods' results is not always repeatable, leading to low confidence in the resulting analysis. Often two methods are used to compare results as a check with seemingly wide variances that cannot be easily understood or reconciled, as (Chen 2010). Once efficiency losses is calculated, it is still difficult to establish causation. Contractors tend to blame such losses on clients and ask to be compensated. Client, on the other hand, often blame a bad bid or poor project management and thus deny additional compensation for lost productivity. Given this situation, the root cause of efficiency losses is frequently a matter in dispute between clients, contactors and consultants (Griffith 2007). The need to document productivity information in support of a efficiency losses claim is a novelty or a new phenomenon amongst contractors in the construction industry. According to Singh (2001), it is important the contractor gets labour information from the very start of the project by establishing a uniform system of capturing and recording field labour information on a contemplating basis. The novelty of the concept was reinforced by Singh (2001) that contemporaneous project documentation is not always available to one tasked with estimating efficiency losses. In preference, estimated costs are, adopted, as a legitimate way to calculate damages once entitlements and causation are sufficiently proven. According to AACE (2004) North American legal systems admits the fact that damages cannot always be calculated with mathematical certainty.

In the Nigerian scenario, contractors are indifferent to the concept of claim arising from efficiency losses as their claim headings are frequently tied to fluctuation and variation. The proof that it is completely alien to them is resonate in the fact that there is a dearth of a celebrated arbitration case or indigenous literature cited in support of this concept. It is indicative of the fact that it is a complete departure of contractors' regular claims and point to the fact that their profit or loss margins are not absolute with the absence of productivity check. CII (2001) noted that claimants of efficiency losses are not careful to consider whether Efficiency losses can be recast as an impact of specifically definable extra work, so as to incorporate it into the estimate of the extra work and resolved in that manner. Myer (2004) was of the view that courts, Boards of contract appeals and other legal for a within the ambit of the US and Canadian Case Law are more favourably impressed by damage calculations related directly to the project in dispute and supported by instantaneous lost documentation. The opinion of Myer (ibid) is that contractors are living with high level under estimation of damages as a result of mathematical uncertainty associated with efficiency losses calculation. AACE (2004) agreed that in the absence of other proof of damages, the legal system should allow estimate to establish damages, since contractors have to prepare and live with cost approximations for damages. Cass (2002) berated the incongruous manner under which claims cannot be established in a uniform and parallel circumstances associated with non-standardization of efficiency losses computation methods. This is owing to the fact that some methodologies are specifically tied to some claim circumstances which are themselves non-repeatable to the same circumstance of other projects (Jones 2001). A validation of these methodologies is exigent in face of industrial and academic confrontation. However, in the absence of more reliable techniques, claimants are vulnerable to the use of the routine methodologies cited in the literature review of this study once entitlement and causation have been sufficiently proven. According to Jansen and Albert (1995), estimation of efficiency losses cost is frequently recurring in the calculation of the percentage change on a project cost, rather than labour hour cost basis. Further gap identified by Emir (2009) were applying calculated efficiency losses factors to bid labour hours rather than actual labour hours and applying calculated factors to all hours on the project rather than the hours during a certain impacted period. Further, most contractors fail to account for typical learning curve labour factors when calculating efficiency losses, failing to deduct the additional labour hours already paid for in change orders or extra work orders, before applying the efficiency losses factor(s) estimated and by extension failing to take into account and deduct other factors, which impacted on productivity but which are not recoverable under the terms of the contract (Daytrer and Randolph 2005). As noted earlier, a validation of the existing estimating methodologies will in this research standardize the application of a method to the situation being analyzed to off-set these gaps enumerated above, so that likelihood of cost recovery, will almost be certain

3. METHODOLOGY

This section clearly outlines the methodology used to provide data in response to the research questions foretasted in this study. It further will provide the assurance that appropriate procedures were followed in the course of the study. According to Dixon (1994), Adeyanju, Tuku and Oyedeji (2008) and Adamu (2004) the concept of research design is aimed at addressing the planning of scientific inquiry or design strategy for finding out something. Atsar (2008) pointed that the concept should not only be concerned with what is being sought after but the best way of getting it done. The study adopted the use of case studies and well structured questionnaire administered on contractors, consultants and corporate clients. According to Rogers (1991), Alli (1997) and Akintoye and Fitzerald (2000) the set of individuals or items available to be sampled from which a sample is drawn and must be adequate to show that such sample represent the whole population of participants from which it is drawn is the sample frame. In order to achieve this, list of relevant professionals in the three (3) states where obtained from ministerial gazette and professional bodies namely Nigerian Institute of Architects (NIA) for the architects, Nigerian Institute of Quantity Surveyors (NIQS) for Quantity Surveyors, Nigerian Society of Engineers (NSE) for Engineers and Nigerian Institute of Builders (NIOB) for builders both in public, private and multinational contracting practice.

Table2. *Sampling Frame of Respondents*

Serial No.	Respondent	Population		
		Bayelsa	**Delta**	**Rivers**
1.	Architect	33	56	87
2.	Quantity Surveyors	40	51	62
3.	Engineers	32	73	122
4.	Builders	25	33	34
5.	Contractors	18	29	36
6.	Organised Clients	10	24	29
	Total	**158**	**266**	**370**

Source: *Field Survey 2015*

3.1. Sample Size

Adeyanju, Tuku and Oyedeji (eds.) (2008) were of the view that in sampling process, larger samples are in general better than smaller samples and that even very large sample can also lead to erroneous conclusion. Accordingly, this study determined it sample size from:

$S = \chi^2 N\rho\,(1-\rho) \div \partial^2 (N-1) + \chi^2\ \rho\,(1-\rho)$

Where; S = Sample size being sought

χ^2 = Table value for chi-square at 1 degree of freedom at the desired alpha level

(0.05 = 3.841; 0.01 =6.64)

N = Population size

ρ = The population proportion (Usually .05 as this provides the maximum sample size)

∂ = Degree of accuracy desired, expressed as a proportion (Usually .05)

Substituting the pre – determined variables, the sample size for each of the study population and their respective locations are as shown in Table 3.

Table3. *Sample Size for the category of respondents*

S/No.	Respondent	Population	Sample Size
1.	Architect	176	54
2.	Quantity Surveyors	153	51
3.	Engineers	227	58
4.	Builders	92	37
5.	Contractors	83	33
6.	Organised Clients	63	28
	Total	**794**	**261**

Source: *Field Survey 2015*

According to Adamu (2004) Atsar (2008), and Halligan and Demsetz (2004) adoption of appropriate sampling process that will be suitable for analysis is necessary having identified the target population. A combination of two probabilistic sampling techniques i.e. stratified and systematic sampling techniques was adopted for this research work. Stratified method in classifying the study population into grounds that mutually exclusive from which the desired sample size selected for the research. The science behind this method has been shown in the works of keeping (1998) Singh (2001), Wong

(2004) and Haverton (2009) such that if an unbiased population of size M is divided into strata of sizes $M_1, M_2, \ldots M_k$ and a simple random sample N_i *is* taken from the i^{th} stratum, if $X_{i\sigma}$ is the measured characteristics of the $\propto^{th}$ item in the i^{th} stratum then the i^{th} stratum mean for the population is;

$$\mu_i = \frac{I}{M} \sum_{i=1}^{k} X_{i\sigma} \ldots$$

where $\sum M_i = M$. So that the overall mean for the population is given as: $\mu = \sum_{i=1}^{k} M_i \mu_i$

The stratified sampling technique was adopted to effectively reduce the variability in population Adeyanju, Tuku and Oyedeji (2008). Since the population is heterogeneous this sampling techniques will obtain a more efficient result of the population mean Roger (1991), Atsar (2008) and (Adamu 2004). The systematic sampling method was also adopted since there is a complete and up to date list of the sampling unit being available and arranged in some systematic order requiring them to be ordered in such a way that each item in the population is uniquely identified by the it order. As Reported in Aje (2008), there are numerous methods available to a researcher to enable them collect their data. Data used for the study have been generated by a questionnaire survey for primary data and from archival materials for secondary data as case studies.

3.2. Method of Data Analysis

Mean Score

This method of analysis usually represents the average value of all factors associated to a cause; Usually arithmetic mean is employed, unless otherwise a condition for application is giving, a specification is giving from the several types of Arithmetic mean, Geometric mean, Harmonic mean and weighted mean. Atsar (2008) and Ogunsemi (2002) has shown that mean score has been prevalent amongst construction management researchers, where the works of Kulularga et.al. (2001), Wong (2004); Ling et. al (2003) and Akintoye (2000) were reported. This study applied the weighted mean score which involves assigning numerical value to respondents' ratings of factors with respect to their severity e.g. very High, 5 points, High, 4 points, Moderate, 3 points, Low, 2 points and very low 1 point. In each case, assessment was carried out from the factors which have been weighted on a 5 point

Likert scale to adduce the level of importance attached to each factor. The weighted mean was computed from;

Weighted mean $= \frac{W_1X_1 + W_2X_2 + \ldots\ldots + W_nX_n}{W_1 + W_2 + \ldots\ldots + W_n}$

$X_1, X_2, \ldots\ldots X_n$ represents the factors under evaluation

$W_1, W_2 \ldots\ldots W_n$ represents the weightings of the factors that translate to;

W_1 = number of respondents who answered very low

W_2 = number of respondents who answered low

W_3 = number of respondents who answered moderate

W_4 = number of respondents who answered high

W_5 = number of respondents who answered very high

Table4. *Summary of Demographic Information of Respondents*

Categories	Classification	No.	%
Academic Qualification	ND	60	31.30
	HND	54	28.10
	B.Sc	50	26.00
	M.Sc	25	13.00
	Ph.D	3	1.60
Professional Qualification	NSE	70	36.56
	NIQS	60	31.30
	NIOB	35	18.20

	NIA	27	14.10
Type of Organization	Contracting Consulting Government Office Corporate Client	67 55 50 20	34.90 28.60 26.00 10.00
Number of projects executed over the last 10 years	0 – 5 6 – 10 11 – 15 16 – 20 Above 20	53 47 34 31 27	27.60 24.50 17.70 16.10 14.10
Construction Experience of Respondents	0 – 5 6 – 10 11 – 16 16 – 20 Above 20	50 45 35 34 28	26.00 23.40 18.20 17.70 14.60
Age of Establishment	5 – 15 16 – 20 21 – 25 26 – 30 Above 30	153 18 9 7 5	79.70 9.40 4.70 3.60 2.60

Source: *Field survey from respondents. 2015*

4. RESULTS AND DISCUSSIONS

This section is dedicated to the presentation of the field results and the analysis of the data obtained through the questionnaire administered. It also discusses and interprets the relationship of the results presented with a view to assess the cross correlation with previous outcomes of other studies. This is with a view to show the significance of the results of this study with a view to draw up evaluations and conclusions. It is important to avoid speculation on who is frequently associated with efficiency losses. A clear cut responsibility is attached to a person or an individual in his professional capacity for the causation of efficiency losses in spite of the obvious causes, enumerated in this literature survey. This requires a distinction from the routine lumping so as to indemnify the person on professional ground.

Table5. *Assessment of the Extent of Contribution of Principal Actors Responsible for Occurrence of Efficiency losses.*

Actors	Highly Responsible	Mostly Responsible	Somewhat Responsible	Fairly Responsible	Least Responsible	Mean Value	Rank
Client **Contractor** **Prime consultant** **Project Q/S** **Project Engineers** **Project Architect**	37 80 85 35 75 67	40 25 25 29 41 35	45 35 12 54 35 23	70 30 38 25 28 47	32 22 32 49 13 20	3.40 3.58 3.48 2.88 3.71 3.43	5 2 3 6 1 4

Source: *Field survey from respondents. 2015*

This study showed considerable assessment in the satisfaction of the pre-requisite for the classification of efficiency loss causes and their methods of estimation. The researcher itemized the actors by way of their affiliation to the project and respondents assessed their level of causation of efficiency losses in construction project by way of their extent of involvement. The study showed that all the actors are not equally responsible for the occurrence of efficiency losses in construction sites. Hence some are highly responsible with a weight value of 5, other are mostly responsible with a weight value of 4, somewhat responsible with a weight value of 3, fairly responsible with a weight value of 2 and least responsible with a weight value of 1. From table 5, it is obvious by way of mean ranking from the responses of the respondents that Engineers are highly responsible for the occurrence of efficiency losses, followed by contractors, followed by prime consultants, then by project Architects, then client and finally by Project Quantity surveyor. This trend shows some high degree of experimental concodance that the least person responsible for the occurrence of efficiency losses is the project cost adviser (Quantity Surveyor). This must be borne by the fact that the Quantity Surveyor knows the financial implications of causing a disruption chain. For others, the tendency of not minding the financial implications of change orders, extensive procedure and arbitrary use of office unknowingly incur claims for efficiency losses.

5. SUMMARY OF FINDINGS

This study did an assessment of the principal actors responsible for the occurrence of efficiency losses in construction projects if it is proved with certainty that any professional in the construction site is traceable to the occurrence of efficiency losses, such professional should be made to share the cost of the claim from the losses. Arising from this finding, the engineers and architects are most frequently attributed to efficiency losses occurrence.

6. RECOMMENDATIONS

In the absence of appropriate documentation in agreement for efficiency losses, Contractors should set up an earned value system on mobilization to site to keep records of historical productivity level to show the baseline and the actual productivity attained since efficiency losses can be iterated from the difference. It is therefore recommended that engineer's instruction or orders on changes should firstly be evaluated on the basis of cost implication by the Quantity Surveyor before such orders are consented to.

REFERENCES

Adamu, M. (2004). *An Appraisal of Cost Planning in the Construction Process in* South Western *Nigeria.* An Unpublished M. Tech Thesis Submitted to the Department of Quantity Surveying, Federal University of Technology, Akure, Nigeria.

Akintoye, A. (2000) Analysis of Factors influencing project cost estimating practice. *Construction Management and Economics 18(1), 77 – 89.*

Akintoye, A. and Fitzgerald, E. (2000) A survey of current cost estimating practices in the UK. *Construction Management and Economics,* 18(2), 161 – 172

Alli, R.O (1997) *The Effects of Contractual Claims on the delivery of building projects in Nigeria*: Unpublished M.Sc Thesis, Submitted to Department of Quantify Surveying, Obafemi Awolowo University, Ile – Ife.

Ashworth, A. E., and Hogg, K. (2008). Willis's Practice and Procedure for the Quantity Surveyor. London: Blackwell Science.

Association for the Advancement of Cost Engineering (AACE). (2004). *Forensic assessment of efficiency losses claims.* Retrieved on 20th March, 2012 from http://www.AACE.com

Borcherding, J. D., and Alarcon L. F. (1991). *Quantitative Effects on Productivity. Journal of the Construction Lawyer,* II (1), 19-24.

Cass, D. J. (2002). *Labour Productivity Impact of Varying Crew Levels.* C.2.1, AACEI Transactions.

Chen, M. T. (2010). *Change Control and Tracking, U.2.1.* AACEI Transactions.

Construction Industry Institute. (1995). *Quantitative Impacts of Project*. Texas.

Construction Industry Institute. (1996). *Compressing the Learning Curve*. Texas.

Construction Industry Institute. (2001). *Engineers Productivity Measurement, CII Research Summary*. Texas:

Daytner, A. D., and Randolph, H. T. (2005). An Analysis of the Interaction between the Effect of Learning and Efficiency Losses Caused by Weather. *Construction Management Research Series, Report*, 21.

Dieterle, R. A., and Gaines, T. A. (2010). Practical issues in loss of efficiency claims. *AACE International Transactions,* 7, 1-11.

Dixon, T. (1994). The Benefits of property research. *Chartered Surveyor Monthly* November/ December 4(2).

Emir, Z. (2009). Learning Curve in Construction. *Revay Reports*, 18(3).

Federle, M. O. (2003). Predictive Model of Cost Overruns. *AACEI Transactions.*

Griffith, A. (2007). An Investigation of the Factors Influencing Build ability and Levels of Productivity for Application to Selecting Alternative Design Solutions. *A Preliminary Report, Managing Construction Worldwide*, 2.

Gulezian, R. and Samelian, F. (2003). Baseline Determination in construction labour productivity loss claims. *Journal of Management in Engineering*, 19(4), 160-165.

Halligan, D. W., and Demsetz, L. A. (2004). Action-Response Model and Loss of Productivity in Construction. *Journal of Construction Engineering and Management*, 120 (1), 1-13.

Hanna, A. S., Jeffrey, S. R., Detwiler, J., and Pehr, P. (2009a). Quantifying the Cumulative Impact of Change Orders. *Preliminary Report,* 34.

Haverton, J. (2009). Do You Know the Hidden Costs of Overtime?. *Journal of Qualified Contractors,* 23(2), 23-34.

Hester, W. T., Kuprenas, J. A., and Chang, P. C. (1999). Construction Changes and Change Orders: Their Magnitude and Impact. *Journal of Construction Industry Institute*, 12(2), 13-15.

Jensen, D. A., and Albert, P. (10th April, 1995). *Construction Acceleration: Recognising the Necessary Legal Elements for a successful Claim by the Contractor.* ASC Proceedings of the 31st Annual Conference, Arizona State University.

Jones, R. M. (2001). Lost Productivity: Claims for the cumulative impact of multiple change orders". *Journal of Public Contract Law*. 31(1), 1 – 46.

Keeping, E. S. (1998). Introduction to statistical inference (3rd Edition). New York: Van No strand publishing.

Kululanga, G. K., Kuotcha, W., McCaffer, R and Edun–Fotwe, A. (2001) Construction Contractors' claim process framework *Journal of construction Engineering and Management, 127(4),* 303 – 314.

Last, W. C. (2009). Are you including a loss of productivity cost component in your change order? Techniques for Establishing a lost productivity claim. Last and Faoro Associates, Retrieved on 5th July, 2011 from Goggle Scholar @ http://www.lf.com.

Myers, C. W. (2004). *Understanding Process Plant Schedule Slippage and Start-Up Cost.* New York: Rand Corporation Study.

Needham-Laing, M. (2005). *Mastering Contracts: JCT 2005.* Fenwick Elliott Associates, Uk.

Randolph, T. H., and Oloufa, A. (2005). December, Labour Productivity, Disruptions and the Ripple Effect. *Cost Engineering,* 37(12), 106-112.

Roger, P. (1991). *The Harper Collins Dictionary of Statistics* (2nd edition). New York: Zaibra.

Sanvido, V. E. and Thomas, H. R., Riley, D. R., (1987). Loss of Labour Productivity Due to Delivery Methods and Weather. *Journal of Construction Engineering and Management,* 113(4), 23.

Singh, A. (2001). Claim Evaluation for Combined Effect of Multiple Claim Factors. *Journal of Cost Engineering,* 43(12), 19-13.

Thomas, H. R., and Gary, R. S. (1990). Loss of Construction Labour Productivity Due to Inefficiencies and Disruption: The Weight of Expert Opinion. *Journal of the Pennsylvania Transportation Institute,* 15(6), 22-28.

Thomas, H. R., and Oloufa, A. A. (1995). Labour Productivity, Disruptions and the Ripple Effect. *Journal of Cost Engineering*, 37(12), 23.

Ward, J. G., and Thomas, H. R. (2004). A Validation of Learning Curve Models Available to the Construction Industry. *Journal of Construction Management Research Series,* 20.

Wong, C. H. (2004). Contractor performance prediction model for the United Regression Approach. *Journal of Construction Engineering and Management,* 130(5), 6990 – 697.