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Relationship between workplace accidents and project success in construction industry in Enugu State.

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Abstract
Accidents have been the challenge encountered by the construction industry from its inception; and its impact on construction workers, the industry and the economy are of great concern to the nation. Due to the number of accidents occurrence in construction industry which have been regarded high compared to other industries less prone to accidents. Bearing in mind that success of a project are usually tied to performance and quality, budget and completion of time. Therefore, this study focused on the impact of accidents on construction project success. Questionnaires were administered to professionals working with selected construction firms around Enugu state. The firms were selected based on their valid registration with CAC, the State Government, the firms' years of experience and frequency of construction activities in the last five years. Data were analyzed using Econometrics views software (Eviews v.8.0) for percentage, mean score and standard deviation. Ordinary least square techniques (OLS) were used to test the hypothesis. The result revealed that, as workplace accident is increasing the project cost and project time increases while project quality decreases. A unit in increase in workplace accident will lead to 2.104095 increase in project success cost on the average. It was recommended that safety practices should be implemented and enforced.

Keywords: *Workplace accident, Project success, Construction industry, Project duration, Project Cost.*

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I. Introduction

There is a persistent occurrence of accident on the building construction site in Nigeria. Stakeholders are less concerned about safety, as cost, timely delivery and quality are prioritized, while safety is compromised (Williams, 2018).Accidents and health hazards do not only represent terrible human tragedies but also substantial social and economic impacts on society. The social impact of site accidents touches the human side of the society, while the economic impact relates to the financial aspects of the society. All society members such as employees, families, employers, economy and resources will be affected somehow by the occurrence of accidents and health hazards (Mthalane, Othman and Pearl, 2017).

Orji, Enebe and Onoh. (2016) reported that Nigeria is classed among countries with no adaptive health and safety regulations. Organizations typically allocate little or no resources to health and safety management does not keep accurate and reliable records of health and safety related incidents, all of which leads to poor health and safety performance.

The overall aim of any construction project is the design and eventual construction of a structure to meet the specific requirements of the client which according to Onwusonye (2005) are usually tied to performance and quality, budget and completion of time. This factors when achieved, will automatically lead to project delivery. Therefore, this research work was embarked on with focus of assessing the impact of accidents that are accrued on building construction projects, which can hinder the successful delivery of projects in Nigeria. At the end of this research work, it will be clear why accidents should be mitigated.

II. Review Of Literature

Construction Project Success

Success is an undeniably vital issue, achievement of which is sought in all sectors. A project success is a multi-dimensional construct that inevitably means different things to different people. It is better expressed at the beginning of a project in terms of key and measurable criteria upon which the relative success or failure of the project may be judged. In the construction sector, success is still broadly measured by the degree of achieving the project objectives and expectations of stakeholders in terms of the traditional norms of the iron triangle of time, cost, and quality. However, it is variable depending on the situation and observer (owner, planner, consultant, engineer, contractor, operator, supplier), and is defined by each depending on individual goals and expectations.

Construction project success is influenced by a set of factors. Cheung, Wong, Fung and Coffey (2006) also pointed out that the successful accomplishment of cost, time, and quality objectives were regarded as project management success. Various researchers focused on new dimensions of project success (Carvalho&Rabechini, 2015). Carvalho and Rabechini (2015) noted that project success is a multidimensional construct, and different stakeholder groups have a personal understanding of project success (Davis, 2014). In recent years, customer satisfaction and client relationships have emerged as additional criteria for assessing project success (Williams, Ashill, Naumann, & Jackson, 2015). This is very important because this criterion turns the eyes of the company outside the organization and towards the customer. Furthermore, it enhances the specific role of the marketplace in a successful project.

In addition, Agarwal &Rathod (2006) propose four basic criteria for the evaluation of a project: cost, time, quality and functionality. Their definition goes as follows: "A software project's ability to meet the scope that encompasses the software specifications in terms of functionality and quality, within budget and schedule, by adopting proper process and techniques". Once again, the triple constraint seems to be an indispensable part of project success. Some experts have suggested that customer satisfaction is a critical dimension of project success (Davis, 2014; Serrador& Turner, 2015).

The approach to assessing project success has evolved substantially over the past three decades (Davis, 2014) from the primary iron triangle of cost, time, and scope/quality (PMI, 2013). Ebbesen and Hope (2013) argued that although the iron triangle is a traditional method, it is still important in evaluating project success. Therefore,the project success will be measured using the iron triangle of time, cost, and quality.

Accidents at the construction sites

The construction industry is one of the most labour intensive industries and the largest employer in most countries worldwide. The types of activity performed on site and the nature of the tasks carried out on the site make the profession a hazardous one.According to International LabourOrganisation (ILO), there are at least 60,000 fatal accidents yearly on construction sites around the world with one fatal accident every ten minutes, approximately 270 million workers suffer occupational accidents yearly that leads to absence from work for 3 days or more, and approximately 4% of the world‟s gross domestic product (GDP) is lost with the cost of injury, death and disease through absence from work, sickness treatment, disability and survivor benefits (Somavia,2005).

The increasing competition among construction companies brings out the need to pay attention to construction productivity issues. The main objective of any construction project are to avoid any negative environmental impact, to build with quality (avoid defects), to ensure safety and health (avoiding occupational accidents and diseases), to meet the deadline and minimize costs (Lius, 2009). Achieving these five objectives is very complex.

Classification of workplace accidents

There are various classification of work place accident. However, International LabourOrganisation (ILO, 1997) classifies accident into five different groups, following a resolution adopted at the Tenth International Conference of Labourstatiscians in October 1962. This classification includes:

Classification According to the Degree of Injury: Herewe have fatal accident, major accident and minor accident.

Classification According to the Type of Event Causing the Injury. ILO identifies nine main categories of events capable of causing injury on site. These are described as follows:

Fall of person, Struck by falling object, Stepping on, striking against or struck by object including falling objects, Caught in or between objects, Over exertion or strenuous movement, Exposure to or contact with electric current, Exposure to or contact with extreme temperature, Exposure to or contact with harmful substance or radiation and Other types of accident.

Classification According to the Agency:The presence of an agent in a task is an indication of the probability of the occurrence of the associated accident in the performance of the task. Some of the agents include means of transport,machines and flying fragments.

Classification According to the Bodily Location of Injuries: Someof the injuries include fractures, dislocations, etc. Most construction injuries fall under three types, namely; fracture, contusions, and sprains and strains.

Classification According to the Nature of Injury: There are seven main headings under this group such as head, neck, trunk, hand and leg. Each of them has several sub-heading relating to parts of the seven main parts of the body.

III. Methodology, Data Analysis And Result

Hypothesis

Ho1: There is no significant relationship between workplace accident and total cost of construction.
Ho2: There is no significant relationship between workplace accident and duration of construction.
Ho3: There is no significant relationship between workplace accident and quality of construction.

To gather the data we conducted a survey. The targeted population in this study was the building construction firms that have CAC, registered with Enugu state government and frequency of construction activities in the last five years. The researcher established the population to be seventy five (75) from the Ministry of Enugu state contractors registration board, and considered this to be adequate in providing data for the study. From each firm, three persons were chosen, making it a total of 3 persons per firm (3 x 75 = 225). Using Taro Yamane's formula,the sample size of 144 was adopted for this study.

Primary data for the study were gathered using self-administered questionnaires. The Data collected were analyzed both qualitatively and quantitatively using Econometrics views software (Eviews v.8.0) and results presented in tables as percentages and frequencies, mean score, standard deviation. Ordinary least square techniques (OLS) were used to validate the hypothesis. Decision Rule: Reject the null hypothesis if p-value is less than or equal to 0.05 [Level of significance (α)]; otherwise do not reject. This technique was chosen because it possesses some optimal properties; its computational procedure is simple and it is essential component of most other techniques.

IV. Results and Analysis

In order to ensure reliability of the data collection instruments, the researcher carried out pre- test by randomly selecting a few building construction firms 10 in number, administered the questionnaire and observed the response to note if the questions were understood, and if the answers given were relevant to the study. To ensure validity of the data collection instruments the researcher formulated simple easy to understand questions whose answers have a critical bearing to the variables under investigation in other to guide the study achieve its purpose. This presents the responses obtained from the completed questionnaires.

A total number of one hundred and forty four copies of questionnaires were distributed but one hundred and thirty two were retrieved and one hundred and twenty nine were completed which represents the response rate of 90%. However, the percentage analyzed had the highest margin, which is good enough to sample the general opinion on this study

Table no 1 - Percentage Distribution of Designation of Respondents

Profession	Frequency	Percentage (%)
Architect	24	19.05
Builder	49	37.98
Civil Engineer	35	27.13
Project manager	7	5.43
Quantity Surveyor	14	10.85
Total	**126**	**100**

Source: Researcher's field work (2020)

Table no 1 illustrates that Builder has the highest percentage of 37.98% (49 persons) of the respondent's years of experiences, and followed Civil Engineer by with 27.13% (35 persons). Besides that, Architect has 19.05% (24 persons), Quantity Surveyor has 10.85% (14 persons) and Project Manager has 5.43% (7 persons). This reveals that all the professionals are well represented at the site and they are knowledgeable of the work.

Table no 2 - Percentage of Respondent's Years of Experience in Construction

Years of experience	Frequency	Percentage (%)
1-5 yrs	18	14.29
6-10 yrs	37	29.37
11-20 yrs	63	48.84
21 and above	12	9.30
Total	36	**100**

Source: Researcher's field work (2020)

It can be deducted from Table no 2 that respondents with 11 – 20 years of experience has the highest percentage of 48.84% (63 persons). Respondents with 6 – 10 years of experience have 29.37% (37 persons), respondents with 1 – 5 years have 14.29% (18 persons) and respondents with 21 – 30 years of experience have only 9.30% (12 persons). This shows that more professionals were recruited into the industry eleven to twelve years ago. It also indicates that generally the respondents have wealth of experience to answer the questions.

Table no 3 - Percentage Distribution of Academic Qualification

Respondent's Academic Qualification	Frequency	Percentage (%)
HND	35	27.13
B.SC	45	34.88
M.Sc	21	16.28
M.Tech	28	21.71
Total		**100**

Source: Researcher's field work (2020)

Referring to Table no 3, respondents with B.sc holders has the highest percentage of 34.88% (45 persons), respondents with HND holders have 27.13% (35 persons), respondents with M.tech holders have 21.71% (28 persons) and respondents with M.sc holders have only 16.28% (21 persons). This gives an indication that respondents with B.sc holders are recruited more than other academic holders. However every one of them has qualification.

Table no 4 Accidents and Health Related Problems on Projects.

	Frequency	Percentage (%)
Yes	122	94.57
No	7	5.43
Total	129	**100**

Source: Researcher's field work (2020)

Table no 4 reveals that 94.57% of the respondents have encountered accidents and health related problems on projects while 5.43% of the respondents have not encounter the aforementioned problems. This gives an indication that construction projects are highly prone to accidents and health related problems.

Accident related questions

Tableno 5 - Number of Accidents Occurrence on Construction Projects.

Occurrence	Frequency	Percentage (%)
Two	9	6.98
Three	11	8.53
Four	53	41.09
Five	42	32.56
Greater than five	14	10.85
Total	**129**	**100**

Source: Researcher's field work (2020)

Table no 5 on accidents occurrence on projects shows that 6.98% have two, 8.53% have three, 41.09% have four, 32.56% have five and 10.85% have the number of occurrence greater than five. This reveals that accidents occurrence number of four (4) have the highest frequency

To evaluate the relationship between workplace accident and project success in construction, the respondents were provided with a table that had a list of effects of workplace accidents on cost, time and quality. They were told to rate the extent to which they agree on a five point Likert-type scale (1=Don't Know, 2= Disagree, 3=Strongly Disagree, 4=Agree, and 5= Strongly Agree). Participants' responses were analysed using mean and standard deviation. Results are presented in Table no 6:

Table no 6: Relationship between workplace accident and project success.

	Project Cost	Mean	SDev
1	Additional cost for treatment of the injured workman	3.7921	1.38093
2	Increase in overhead cost as a result of extension of time	3.5908	1.30873
3	Cost for replacement of damaged plant and equipment	3.5347	1.36584
4	Costs of workman's compensation	3.9406	1.31984
5	Legal fees for defense against claims	3.3333	1.47083
6	Increased insurance costs	3.5875	1.38276
	Project Duration (Time)		
7	Lesser workers will have to complete the work leading in delay	3.9736	1.26044
8	Slowdown in operations while accident causes are determined	4.0000	1.30206
9	Slowdown of work as a result of corrective actions to prevent reoccurrence of accident	3.8317	1.19660
10	Additional time will be spent in training a temporary or permanent	3.5743	1.28791

	replacement		
	Quality of Services		
11	Different workers(experts) on the same work might affect the quality	4.0759	1.19499
12	Degradation of efficiency of operation due to loss co-worker	4.0000	1.30206
13	Not minding engaging any other worker to complete the work	3.8086	1.19449

Test of Hypothesis

H_{o1}: There is no significant relationship between workplace accident and total cost of construction.
H_{o2}: There is no significant relationship between workplace accident and duration of construction.
H_{o3}: There is no significant relationship between workplace accident and quality of construction.
Data Used: Table no 6
Statistical tool: Ordinary least square techniques (OLS)
Data analysis software used: Econometrics views (Eviews v.8.0)
Decision Rule: Reject the null hypothesis if p-value is less than or equal to 0.05 [Level of significance (α)]; otherwise do not reject.
Note:
Workplace accident = (independent variable)
Project success (cost, time and quality) = (dependent variable)
Model specification
Model one
Cost = F(wrkpaccid)
$Cost = \beta_o + \beta_1 wrkpaccid$
$Cost = \beta_o + \beta_1 wrkpaccid + \mu$
Where,
Wrkpaccid = workplace accident
Model Two
Time = F(wrkpaccid)
$Time = \beta_o + \beta_1 wrkpaccid$
$Time = \beta_o + \beta_1 wrkpaccid + \mu$
Model Three
Quality = F(wrkpaccid)
$Quality = \beta_o + \beta_1 wrkpaccid$
$Quality = \beta_o + \beta_1 wrkpaccid + \mu$

ANALYSIS FOR MODEL ONE

Dependent Variable: D(Cost)
Method: Least Squares
Date: 02/04/20 Time: 11:22
Sample (adjusted): 2000 2018
Included observations: 17 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-197.3651	621.5632	-0.317530	0.7528
D(wrkpaccid)	2.104095	0.587774	3.579768	0.0011
ECM(-1)	-0.135274	0.030988	-4.365333	0.0001

R-squared	0.685607	Mean dependent var	1474.379
Adjusted R-squared	0.657025	S.D. dependent var	1506.158
S.E. of regression	882.0669	Akaike info criterion	16.50422
Sum squared resid	25675388	Schwarz criterion	16.67837
Log likelihood	-301.3280	Hannan-Quinn criter.	16.56562
F-statistic	23.98802	Durbin-Watson stat	1.754012
Prob(F-statistic)	0.000000		

The regression result above shows that workplace accident has positive and significant relationship on cost of project success, hence, as the workplace accident is increasing the project success cost simultaneously increases alongside. More so, the result further indicates that a unit increase in workplace accident will lead to 2.104095 increase in the project success cost on the average. Hence, you reject the hypothesis and state that there is a significant relationship between workplace accident and total cost of construction.

ANALYSIS OF MODEL TWO

Dependent Variable: D(Time)
Method: Least Squares
Date: 03/04/20 Time: 13:59
Sample (adjusted): 2000 2018
Included observations: 17 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(wrkpaccid)	5.213292	14488.40	0.359825	0.0213
ECT(-1)	0.096672	0.199534	0.484490	0.6313

R-squared	-0.005805	Mean dependent var	218322.7
Adjusted R-squared	-0.068668	S.D. dependent var	1172669.
S.E. of regression	1212263.	Akaike info criterion	30.93569
Sum squared resid	4.70E+13	Schwarz criterion	31.06901
Log likelihood	-538.3746	Hannan-Quinn criter.	30.98171
Durbin-Watson stat	1.999604		

The result of the regression above shows that workplace accident have positive and significant relationship on the project success time, an increase in workplace accident will lead to an increase in project success time. The result further reveals that a unit increase in workplace accident will lead to 5.213292 increase in project success time on the average. . Hence, you reject the hypothesis and state that there is a significant relationship between workplace accident and duration of construction.

ANALYSIS OF MODEL THREE

Dependent Variable: D(Quality)
Method: Least Squares
Date: 03/04/20 Time: 04:53
Sample (adjusted): 2000 2018
Included observations: 17 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	663.5935	282.0378	2.352853	0.0254
D(wrkpaccid)	-1.203568	0.410682	-2.930654	0.0064
ECT(-1)	-0.546444	0.225117	-2.427381	0.0214

R-squared	0.544414	Mean dependent var	1557.240
Adjusted R-squared	0.498855	S.D. dependent var	1532.667
S.E. of regression	1084.999	Akaike info criterion	16.92668
Sum squared resid	35316700	Schwarz criterion	17.10625
Log likelihood	-283.7535	Hannan-Quinn criter.	16.98792
F-statistic	11.94973	Durbin-Watson stat	1.360710
Prob(F-statistic)	0.000026		

The result reveals that workplace accident has negative and significant impact on project success quality such that an increase in workplace accident will lead to decrease in the project success quality. More so, a unit increase in workplace accident will lead to 1.203568 decrease in project success quality on the average. Hence, you reject the hypothesis and state that there is a significant relationship between workplace accident and quality of construction.

V. Conclusion

In all the three models formulated, it shows that workplace accidents have negative and significant impact on project cost, time and quality of service.Accidents Impacts on Construction Projects Delivery This research assessed the impacts of accidents on construction projects delivery process. The result analyzed from questionnaires revealed that workplace accident has an impact on the delivery of a construction project either in terms of cost, time or quality. As the workplace accident is increasing the project time (duration) increases. Production delay, slowdown in operations while accidents causes are determined and loss of productivity are impacts on construction projects delivery. Sharma (2010) asserted that production delay is among the economic effects of accidents in construction industry. According to Mthalane*et. al* (as cited by Ajasa, 2012), the economic impacts of site accidents on Construction Company are enormous which includes slowdowns in operations while accident causes are determined and loss of productivity.

Cost Implication of Accidents on Construction Projects. This research investigated the cost implications of accidents on construction projects. The result analyzed via questionnaires revealed that as the workplace accident is increasing the project cost increases. These include increment in insurance premium, costs of rescue operations and equipment, medical payment, payments for settlements of injury or death claims, legal fees for defense against claims, costs of workman's compensation insurance and increased insurance costs are cost implications of accidents on construction projects. In a research finding of Mthalane et.al (as cited by Ajasa, 2012), it was found that payments for settlements of injury or death claims, legal fees for defense against claims, costs of rescue operations and equipment, increased insurance costs and loss of productivity are the economic impacts of site accidents on Construction Company. Finally, the improvement of health and safety should be a major and continual concern to achieve projects' objectives.

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