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Impact of variation on project delivery in Oyo state, Nigeria

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ABSTRACT

Variation in construction projects are very common and likely to occur from different sources, by various causes, at any stage of a project, and may have considerable negative impacts on items such as costs and schedule delays. This study is aimed to assess the causes of variation on construction project, the factors influencing the occurrence of variation on project and to determine the impacts of variation on project delivery in relation to cost and time. Questionnaire survey was used; out of 80 questionnaires that were sent out 78 questionnaires were retrieved from respondents in the contracting firm, consulting firms and government parastatals in Oyo state. The findings showed that; owner's financial problem, change in specification by owner, change in scope of the project, care the most important causes of variation. The presence of specialist works, unforeseen conditions, and incompleteness of design are the top factors influencing the occurrence of variation. The most important impacts of variation on project delivery in relation to cost are quality degradation, increase in project cost, delay in completion and logistics delays while the most important impacts of variation on project delivery in relation to time are logistics delays, delay in completion and quality degradation.

***Keywords*:** Variation, Project delivery, Time, Cost

1. INTRODUCTION

The construction industry plays an essential role in the socio economic development of a country. The activities of the industry have a lot of significance to the achievement of

national socio-economic development goals of providing infrastructure, sanctuary and employment (European Centre for Research Training and Development UK, 2013). This industry in both developed and developing countries is viewed as that sector of the economy which, through planning, design, construction, maintenance and repair, and operation, transforms various resources into constructed facilities, (Isa, Jimoh & Acheunu, 2013). The construction industry plays a major role in satisfying a wide range of physical, economic and social needs and contributes significantly to the fulfilment of various major national goals, (Ibironke, 2004; Shittu & Shehu 2010 cited in Isa *et al.,* 2013).

The importance of the construction industry in the development of any nation cannot be under emphasized (Oshodi, 2012). These roles are played by providing employment for the teeming unemployed or underemployed youth, provision of shelters and Infrastructure such a houses, offices, schools, hospitals, road, banks, railway, highways, ports, and airports to mention but a few.

The industry has been performing these roles for long, not until recently when it was marred by some problems making the public criticize the input of the industry to the economy. Variation means the alteration, change or modification of design, quality or quantity of work omission, addition or substitution of the work Variation in the construction industry has become one of the common and serious issues (Aftab *et al*., 2014). Ala'a 2012 pointed that it has long been identified to have a negative impact on construction productivity, leading to a decline in labour efficiency and, in some cases, sizeable loss of man hours. Variation in construction projects are very common and likely to occur from different sources, by various causes, at any stage of a project, and may have considerable negative impacts on items such as costs and schedule delays (Hao *et al.*, 2008). Though there have been cases where variation costs accounted for as much as 100 percent of the budgeted funds, the industry norm has been determined to be about 10 percent (Arain & Pheng, 2005b).

Aibinu and Jaboro (2002) studied the significance of forty-four sources of delay in project delivery, finding show 44 sources of project failure, among which are Clients' cash flow problems, contractors' financial difficulties, incomplete drawings, equipment problems, late instructions, poor supervision, material shortages, variation/change orders, planning and scheduling problems and price escalations were believed to be among the top significant sources of the problem. Nwuba (2004), observed that variation as one of the major cost variables that affects final cost of building projects in Nigeria and results to delays and abandonment of some projects in Nigeria. In this research, the causes of variation in construction project, the factors influencing its occurrence and its impacts on project delivery will be discussed.

2. SIGNIFICANT OF STUDY

Variation in the construction industry has become one of the common and serious issues (Aftab *et al*., 2014). Various authors intimate that variation orders are common to all types of projects (Thomas *et al.*, 2002; Oladapo, 2007). Ssegava *et al.* (2002) asserted that the presence of variation clauses in contracts amounts to admitting that no project can be completed without changes. Even if carefully planned, it is likely that there will be changes to the scope of the contract as the work progresses (Harbans, 2003). Arguably, variation cannot be avoided completely (Mohamed, 2010). Ssegawa *et al.* (2002) added that it is hardly

possible to complete a construction project without changes to the plans or the construction process itself due to the complexity of construction activities.

Variation has long been identified to have a negative impact on construction productivity, leading to a decline in labour efficiency and, in some cases, sizeable loss of man hours (Ala'a, 2012). Variation in construction projects are very common and likely to occur from different sources, by various causes, at any stage of a project, and may have considerable negative impacts on items such as costs and schedule delays (Hao *et al.*, 2008). The magnitude of variation varies from one project to another. Though there have been cases where variation costs accounted for as much as 100 percent of the budgeted funds, the industry norm has been determined to be about 10 percent (Arain & Pheng, 2005b). The study by Charoenngam *et al.* (2003) of variation orders on construction projects found that the average cost escalation was 7% of the original project cost with an average time extension of 30% more than the original project duration. Studies have revealed the significant reduction in both cost increase and time delay as a result of a complete design before commencement of works on site resulting in the prevention of variation orders (Koushki *et al.*, 2005). Arguably, the more the occurrence of variation, the greater the likelihood that unnecessary costs could accrue impacting on the overall project cost. Whenever a variation order is issued, whether leading to additions, alterations, omissions or substitutions, unnecessary costs are likely to be incurred.

From the aforementioned, we realized that this cost variable has been a common phenomenon in construction project, and it impact on the cost and time duration of project cannot be underemphasized with regards to its tremendous contribution to the growth of construction industry as a whole and little has been done on the study of impacts of variation on project delivery. In this regard, a major aspect of this study is to assess the impact of variation on project delivery in Oyo state.

3. RELATED LITERATURE

The nature of a variation can be determined by referring to both the reasons for their occurrence and subsequent effects. Arain and Pheng (2005) distinguished two types of variation namely: beneficial and detrimental variation.

3. 1. Beneficial Variation

A beneficial variation is one issued to improve the quality standard, reduce cost, schedule, or degree of difficulty in a project. It is a variation order initiated for value analysis purposes to realise a balance between the cost, functionality and durability aspects of a project to the satisfaction of clients (Ruben, 2008). Value analysis is an organised approach to the identification and elimination of unnecessary costs which are defined as costs which provide neither use, nor life, nor quality, nor appearance, nor customer features (Kelly & Male, 2002). Therefore, a variation order is beneficial if it is initiated to enhance the client's value. Among others, the client's value system elements include time, capital cost, operating cost, environment, exchange or resale, aesthetic/esteem and fitness for the purpose (Kelly & Duerk, 2002).

A beneficial variation eliminates unnecessary costs from a project as a result; it optimizes the client's benefits against the resource input by eliminating unnecessary costs

(Arain & Pheng 2005). A beneficial variation order, therefore, seeks to optimise the client's benefits against the resource input by eliminating unnecessary costs (Ruben, 2008). These benefits are understood to be the satisfaction of perceived needs for the development project that include social, economic and commercial aspects. Impliedly, a beneficial variation is initiated in the spirit of adding value to the project. However, it should be noted that regardless of how beneficial a variation order might be non-value-adding costs are likely to accrue as a result. For example a variation order to solve the discrepancies between contract documents involves the abortion of works that have already been executed. Cost for aborted works should not have been incurred if discrepancies were not found between contract documents.

3. 2. Detrimental Variation

A detrimental variation is one that negatively impacts the client's value or project performance (Arain & Pheng, 2005). Arguably, a detrimental variation order compromises the client's value system (Ruben, 2008). A client who is experiencing financial problems may require the substitution of quality standard expensive materials to substandard cheap materials. For example, on a construction project situated in a salty environment, steel window frames result in steel oxidation if selected in lieu of timber or aluminium frames.

3. 3. Causes of variation

Variation arises for a variety of causes, of which some causes are foreseeable and others are not. The enormity of the various causes of variations identified over the years by various author shows that variation has come to stay as part of the construction projects and it cut across various stakeholders. It has been categorized into consultant related, owner related, contractor related variation and the other variations.

a) Change in scope of the project: Change of plan or scope of the project is a common issue faced by construction industry and is reported for affecting project time and cost performance (Memon *et al.,* 2011). It is one of the extremely severe factors of variation in construction projects. Insufficient planning during the conceptualization stage and lack of owner's participations during design activities are major reasons for causing change in scope (Arain *et al.,* 2004).

b) Change in project schedule: Almost every construction project in the world is facing problem of change of schedule during the executions (Aftab *et al*., 2014). In the case of change in schedule, the contractors have either to endow with extra resources or also may cause keeping some of resources inactive. In both cases, additional cost is incurred. Thus, it affects severely the performance of the project (Memon *et al.,* 2011).

c) Owner's financial problems: Financial problems of the owner affect severely the quality and progress of the project. This problem can lead to change in work schedules and specifications, affecting the quality of the construction (Aftab *et al*., 2014).

d) Impediment to prompt decision-making process: Prompt decision making is an important factor for project success (Gray & Hughes, 2001). Failure to make the decision efficiently may result in the delay, causing the need for variation due to cost increments.

e) Obstinate nature of the owner: A building project is the result of the combined efforts of the professionals involved, which have to work at the various interfaces of a project (Wang, 2000). If the owner is obstinate then this could cause major variations at the later stages of a project.

f) Change in Specifications by the Owner: Construction projects often experience the issue of changes in specification (Aftab *et al.,* 2014). If the owner changes the specification of the design or requirement, then this may lead to variations in the construction phase

g) Change in design: A change in design improvement by the consultant is a norm in contemporary professional practice (Arain *et al*., 2004). Changes in design were frequent in projects where construction starts before the design is finalized (Aftab *et al*., 2014). Such changes affect the project in various ways depending on the timing of the change (Alaghbari *et al*., 2007).

h) Conflicts between contract documents: Conflicts among contract documents: Conflict between contract documents can result in misinterpretation of the actual requirement of a project. It is essential that the contract documents are clear and precise. Insufficient details in the contract documents may result in delays to the project completion or cause variations in cost (Aftab *et al*., 2014).

i) Design complexity: Design complexity: Design complexity highlights the need of exclusive expertise and special construction methods (Arain *et al*., 2004). Complexity encroaches on the flow of construction activities while simpler and linear construction activities easy to handle. In other words, if the complexity of the design increases this will create more opportunities of variations in the project (Aftab et al 2014).

j) Inadequate working drawing details: To convey a complete concept of the project design, the working drawings must be clear and concise (Geok, 2002). Inadequate working drawing details can result in misinterpretation of the actual requirements for the project (Arain *et al.,* 2004), causing variations in the project.

k) Change in specification by the consultants: Changes in specification are observed frequently in construction projects (Aftab *et al*., 2014). Changes in specification results in variations to the project, leading to delay and increased overall cost.

l) Unavailability of equipment: Unavailability of equipment is a procurement problem that can affect the project completion (Aftab *et al*., 2014).

m) Shortage of skilled manpower: Skilled manpower is one of the major resources required for technological projects (Arain *et al*., 2004). Variations and delays may occur due to shortages of skilled labour (Aftab *et al*., 2014).

n) Contractor's financial difficulties: Construction is a labour intensive industry. If a contractor experiences financial difficulties during the course of a project, it may result in lacking of resource availability. Consequently, the progress of the project is affected which may require variation and extension of time (Aftab *et al*., 2014).

o) Poor workmanship: Defective workmanship may lead to demolition and rework in construction projects (Aftab *et al*., 2014). This results in delay and increased cost.

p) Poor procurement process: Procurement delays have various adverse effects on other processes in the construction cycle (Aftab *et al*., 2014). Other processes in the construction cycle are affected by poor procurement processes. Consequently, variations are required.

q) Lack of strategic planning: Proper strategic planning is an important factor for successful completion of a building project (Aftab *et al*., 2014). The lack of strategic planning is a common cause of variations in projects where construction starts before the design is finalized (e.g., in concurrent design and construction contracts).

r) Inadequate design: Inadequate design can be a frequent cause of variations in construction projects (Aftab *et al*., 2014).

3. 4. Impacts of Variation on project delivery in relation to cost and time.

According to Arain and Pheng (2005b) variations are an unwanted but inevitable reality of any construction project. Further, Hanna *et al*. (2002) found that projects with many variations cause the contractor to achieve lower productivity levels than planned. Variation adversely impact project delivery in terms of increase in project cost, quality degradation, cause reworks and demolition, delay in completion, logistic delays, health and safety issues and professional relations.

3. 4. 1. Increase in project cost

Increase in project cost is regarded as the most common effect of variations (Ruben, 2008). Any alteration or addition is the design during execution of the project may results in demolition or rework of any project component and eventually increase the project cost. Hence, in order to keep overall project cost unchanged; normally in every construction project a contingency sum is allocated which caters possible variations in the project. Further, variations require processing procedures, paper work and reviews before they can even be implemented. The process and implementation of variations in construction projects would increase the overhead expenses for all the participants concerned. Normally these overhead charges are provided for from the contingency fund allocated for the construction project.

3. 4. 2. Quality Degradation

Variations affect the quality of work adversely. It was reported that the quality of work is frequently affected by frequent variations because contractors have to compensate for the losses by cutting corners. Ruben (2008) indicated that contracts with a significant degree of risk for unknown variables such for example, lump sum, contractors may cut corners on quality and quantity to maximise profits. If variations are frequent, they may potentially affect the quality of works. Quality may be compromised as contractors try to compensate for losses they are not optimistic about recovering.

3. 4. 3. Causes reworks and demolition

Variations in construction often results in rework and demolition (Ruben, 2008) if the variations are occurred during the construction is underway or even completed. This effect is to be expected due to variations during the construction phase while variations during the design phase do not require any rework or demolition on construction sites.

3. 4. 4. Delay in completion

Variations often hinder the project progress, leading to delay in achieving the targeted milestones during construction. Variations may (but do not necessarily) delay the progress of the whole of the works or some part of it. The mere ordering of extra work as a variation of itself does not import delay and consequent entitlement to an extension of time but rather delay an activity or activities. Variations may be on or off the critical path of the performance of the works. In these circumstances the Contractor may or may not be entitled to an extension of time. Nevertheless, if there is a delay caused by the variation it may cause the Contractor to incur costs which would otherwise not be incurred. The variation may delay the completion of the works as a whole and, not only delay certain activities, but cause the Contractor to be on the site longer than would otherwise have been the case. The impact of one or more variations on the Contractor's orderly and economic progress of the works is sometimes difficult to show. The consequences of several individual variations may be cumulative. Multiple variations in succession may have a total effect greater than the sum of the effects of individual variations.

3. 4. 5. Logistics delay

Variation may cause requirement of new or additional amount of material and equipment which results in logistics delays (Ruben, 2008). Logistics delays are among the significant effects of variations in construction projects.

3. 4. 6. Health and safety

Variation occurrence can lead to revision of health and safety considerations. The OHS (2003) clause 5.3 (e) stipulates that where changes are brought about, sufficient health and safety information and appropriate resources are to be made available to the contractor to execute the work safely. This is because change in construction methods, materials and equipment may require additional health and safety measures (Arain & Pheng, 2005). Furthermore, the OHS (2003) clause 5.14 requires the contractor to provide the principal contractor with any information which might lead to health and safety of any person at work carrying out construction work or any person who might be affected by the work of such a person at work or which might justify a review of the health and safety plan.

3. 4. 7. Professional relations

A construction project is not merely brick and mortar brought together. Rather, it creates professional relationships between parties to the contract. Each project successfully completed constitutes an added experience to participants and their reputation builds up. But disputes may arise between parties to the contract due to variation. Misunderstandings may arise when contractors are not satisfied with the determination of the valuation of variation by the client’s consultant. Parties to a contract are left to argue over the cost, time effects and due compensation of a variation (Bower, 2000). Possibly because contractors are not confident about the outcome of such negotiations, they usually request higher values for variation than the actual cost incurred. Bower (2000) opined that consequently there is tension between parties as the contractor continually pushes the client to settle claims for additional costs while invariably feeling that the reimbursement has been insufficient. This can be very damaging to the relationship between the representatives of all parties (Bower, 2000).

Charoenngam *et al*. (2003) remarked that disputes between the client and the contractor can occur if variation orders are not managed carefully. Harbans (2003) warned that unless a mutually acceptable solution is agreed by the parties, valuation of variations will continue to remain at the forefront of disputes and claims making their way ultimately to arbitral tribunals or the corridors of justice. Finsec (2005) found that a large proportion of current arbitrations were on claims for additional time and additional expenses. Ssegawa *et al*. (2002) reported that more than one-third of disputes pertained to how to determine losses that stem from variation orders. The excessive occurrence of variation due to design errors or omission may undermine the professionalism of the designer. Workers are demoralised when they have to demolish a portion work that they had already completed.

4. RESEARCH METHODOLOGY

The design involve the use of questionnaire survey to collect data needed to assess the impact of variation on project delivery. The questionnaire was self- administered to various categories of respondents within the target population, which are then analysed by frequency distribution and percentage and mean item score. The category of population for this research included the professionals in Ibadan, Oyo state because they are all contributed towards the occurrence of variation on projects and also feel the effect of variation on project delivery on building project within Ibadan, Oyo state, Nigeria. Sampling frame consisted of consultants who have represented the client in various building construction projects (such as quantity surveyors, architects, civil engineers) and contractors involved in execution of the projects selected for this study within Ibadan, Oyo state. The questionnaire is in four sections, each section in the questionnaire was designed to measure a specific aspect of the set objectives. Section one was designed to collect demographic information about the respondents, such as official designation, gender, age, types of organization, academic qualification, years of working experience, membership of professional bodies and number of projects executed. This is to check for the quality of the data that were acquired from the field before embarking on statistical analysis. Section two asked the question on the possible causes of variations on construction projects, section three was on the factors influencing the occurrence of variation and the last section, asked the questions on the impacts of variations on project delivery in relation to cost and time. The question was rated on a 5-points likert scale ranging from extremely important to not at all important depending on the type of rating.

4. 1. Method of Data Analysis

Mean item score was the technique used in analysing the objectives of this study with the aid of statistical package for social sciences (SPSS), which is to assess the causes of variation on construction project, the factors influencing the occurrence of variation on project and to examine the effects of variation on project delivery in relation to cost and time. Mean item score is the sum of all items in the set of data. It can be used in calculating both the grouped and ungrouped data. It is mathematically represented as;

$$Mean\ Score = \frac{\sum(F \times S)}{\sum F}$$

$1 \leq MS \leq 5$
S = score given to each factor by the respondent and ranges depending on the ordinal scale (1-5)
F = frequency of respondent to each rating (1-5) for each factor.

The sample size of 140 was used, 78 questionnaires were retrieved and found suitable for analysis (representing 56% of sample size). The statistical analysis of data was carried out with the aid of statistical package for social sciences (SPSS). The data collected was presented using tabular form while mean item score was applied appropriately and result was later discussed.

5. RESULT AND DISCUSSION

Table 1 showed the official designation of respondents contacted for this study, 35.9% are Quantity Surveyors, 33.3% of the respondents are Builders, 16.1% are Architects while the remaining 14.1% are Civil Engineers. The types of organisation where various respondents worked; 42.3% of the respondents worked with a contracting organisation, 37.2% worked in a consulting organisation and 19.2% of the respondents are civil servants. Academic qualification of respondents; 55.1% of the respondents are Higher National Diploma Holders, 33.3% are holders of Bachelor in Degree and 10.3% are Master's degree holder. It also revealed the years of experience of respondents, 33.3% of the respondents have between 1-5years working experience, 25.6% have between 6-10years working experience, the same percentage goes for those within the range of 11-15years working experience. 6.4% of the respondents have 16-20years of experience and 21-30years of experience and 1.3% of the respondents have between 31 and above years of experience. 15.4% of the respondents have executed project ranging from 0-5, 24.4% of the respondents have executed 6-10 projects, 11-15 projects were executed by 20.5%, 16-20 projects were executed by 12.8% of the respondents and 24.4% of the respondents have executed project that are more than 20 in number. This shows that the respondents are qualified to give their opinion on this area of study.

Table 1. Respondents demographics.

	Demographic Information		
A	**Designation**	**Frequency**	**Percentage**
	Quantity Surveyor	28	35.9
	Architect	13	16.7
	Builder	26	33.3
	Civil Engineer	11	14.1

B	**Nature of organization**		
	Contracting	33	42.3
	Consulting	29	37.2
	Government	15	19.2
C	**Academic Qualification**		
	HND	43	55.1
	B.Sc/B.Tech	26	33.3
	M.Sc/M.Tech	8	10.3
D	**Years of experience**		
	1-5	26	33.3
	6-10	20	25.6
	11-15	20	25.6
	16-20	5	6.4
	Above 30	6	7.7
E	**Numbers of projects executed**		
	0-5	12	15.4
	6-10	19	24.4
	11-15	16	20.5
	16-20	10	12.8
	above 20	19	24.4

5. 1. Causes of variation on construction projects

Table 2 showed the causes of variation on construction projects, all the causes listed are found to be important because they are found above the mean score. It also revealed that the most importance cause of variation on construction projects included, owner's financial problem with the mean score of 4.09 followed by change in specification by owner with mean

scored of 4.08, change in scope of the project with mean score of 3.94, inadequate working drawing details with mean score of 3.89, change in design by consultants with the mean score of 3.88, others followed in descending order. Complex design and technology with mean score of 3.35, Contractor's desired profitability with mean score of 3.34, Contractor's financial difficulties with mean score of 3.29, Contractor's obstinate nature with mean score of 3.13 and Poor procurement process with mean score of 3.01 were ranked very low among the causes of variation on construction projects.

Table 2. Identification of the Causes of Variation on Construction Projects

CAUSES OF VARIATION	MEAN	RANK
Owner's Financial problems	4.09	1
Change in specification by owner	4.08	2
Change in Scope of the project	3.94	3
Inadequate working drawing details	3.89	4
Change in design by the consultants	3.88	5
Change in project schedule	3.85	6
Error and Omission in design	3.83	7
Change in Specification by the Consultants	3.83	7
Unavailability of Equipment	3.81	9
Safety Consideration	3.73	10
Conflicts among contract documents	3.57	11
Change in economic conditions	3.55	12
Poor workmanship	3.45	13
Design Complexity	3.44	14
Shortage of Skilled Manpower	3.42	15
Obstinate nature of Consultant	3.42	15
Change in Government regulations	3.40	17
Impediment to prompt decision making process	3.39	18
Complex design and technology	3.35	19
Contractor's desired profitability	3.34	20

Contractor's Financial Difficulties	3.29	21
Contractor's obstinate nature	3.13	22
Poor procurement process	3.01	23

5. 2. Factors influencing the occurrence of variation

Table 3 showed the factors influencing the occurrence of variation, all the factors are important as they are all above mean score. Presence of specialist works with mean score of 3.94 ranked first among the factors influencing the occurrence of variation, this is followed by Unforeseen conditions with mean score of 3.87, Incompleteness of design with mean score 3.82 is ranked third, Insufficient money and time during the design phase with mean score of 3.77, Continuous demand for project with mean score of 3.74, Weather Condition with mean score of 3.72, Lack of pre-design with mean score of 3.71 are ranked fourth, fifth, sixth and seventh respectively. Non Involvement of contractor at early stage with mean score of 3.62, technical complexity with mean score of 3.56 and management complexity with mean score of 3.36 were ranked very low among the factors influencing the occurrence of variation, taking the eighth, ninth and tenth position in the ranking.

Table 3. Identification of the Factors Influencing the Occurrence of Variation

FACTORS INFLUENCING VARIATION	MEAN	RANK
Presence of specialist works	3.94	1
Unforeseen Conditions	3.87	2
Incompleteness of design	3.82	3
Insufficient money and time during the design phase	3.77	4
Continuous demand for project	3.74	5
Weather Condition	3.72	6
Lack of pre-design	3.71	7
Non-Involvement of contractor at early stage	3.62	8
Technical complexity	3.56	9
Management complexity	3.36	10

5. 3. Impacts of variation on project delivery in relation to cost and time

In Table 4, the impacts of variation in relation to cost were examined, all of them are found to be important because they are above the mean score. Quality degradation with mean score of 4.19 ranked 1st among the most important impacts of variation in relation to cost, this is closely followed by Increase in cost with mean score of 4.13, then delay in completion with mean score of 3.96. Logistics delays with mean score of 3.84, health and safety with mean score of 3.55, causes reworks and demolition with mean score of 3.47 are ranked fourth, fifth and sixth respectively. Loss of productivity with mean score of 3.29, Procurement delay with mean score of 3.13 and Professional relation with mean score of 3.04 were ranked low among the important impacts of variation in relation to cost.

Table 4. Determination of the Impacts of Variation on project delivery in Relation to Cost

IMPACTS OF VARIATION IN RELATION TO COST	MEAN	RANK
Quality degradation	4.19	1
Increase in project cost	4.13	2
Delay in completion	3.96	3
Logistics delays	3.84	4
Health and Safety	3.55	5
Causes reworks and demolition	3.47	6
Loss of productivity	3.29	7
Procurement delay	3.13	8
Professional relation	3.04	9

5. 4. Impacts of Variation on project delivery in Relation to Time

Table 5 above shows the examination of the impacts of variation in relation to time, all of them are found to be important because they are above the mean score. Logistics delays with mean score of 4.02 is ranked high among the impacts of variation in relation to time, this is followed by delay in completion with mean score of 3.85, then Quality degradation with mean score of 3.78. Health and safety with mean score of 3.56, procurement delay with mean score of 3.45 and increase in project cost with mean score of 3.38 are ranked fourth, fifth and sixth respectively. Causes reworks and demolition with mean score of 3.32, loss of productivity with mean score of 3.25 and Professional relation with mean score of 3.16 were ranked low among the important impacts of variation in relation to time.

Table 5. Determination of the Impacts of Variation on project delivery in relation to time

IMPACTS OF VARIATION IN RELATION TO TIME	MEAN	RANK
Logistics delays	4.04	1
Delay in completion	3.85	2
Quality degradation	3.78	3
Health and Safety	3.56	4
Procurement delay	3.45	5
Increase in project cost	3.38	6
Causes reworks and demolition	3.32	7
Loss of productivity	3.25	8
Professional relation	3.16	9

6. CONCLUSIONS

The main aim of the client is to get their project completed without any delay or additional cost which should also be the focus of consultant who is representing the client in achieving the objective of project in term of cost, time and quality.

Based on outcome of this research, it was concluded that;

1) Financial problems of the owner affect severely the quality and progress of the project, therefore adequate funding should be guaranteed by the client before the commencement of any project.
2) Change in specification by owner, change in scope of the project, inadequate working drawing details and change in design by the consultants are major changes affecting the quality and cost of the construction.
3) The nature of the work which has to do with the complexity of the work, environmental conditions and the type of procurement methods used play a major role in influencing the occurrence of variation, thus affecting the rate of project delivery.
4) Delays in the project as a result of reworks, demolition, procurement of material, health and safety have the most predominant impacts of completion of the project.

7. RECOMMENDATIONS

After the extensive research on this topic from introduction to conclusion, the following recommendations will serve as means of minimizing the impacts of variation on project delivery in Ibadan, Oyo state, Nigeria. Generally minimizing variation is not easy. Some

situations are avoidable and some may be unavoidable, but there are strategy actions that can be taken in order to minimize variation at different stages as:

1) Clients should provide a clear brief of the scope of works, Clear and thorough project brief would assist in eliminating variations arising because of the unclear scope of work for the contractor it will also help to reduce the miscommunications between the parties.
2) Enhance communication, and co-ordination is required at the design stage and all parties should be proactive all times. Direct communication and continuous coordination will provide professionals an opportunity to review the contract documents thoroughly that would help in eliminating the variations arising because of conflicts in contract documents and also eliminate design discrepancies and errors as well as omissions in design.
3) Consultant should ensure that the design/specifications fall within the approved budget and the budget team should be appointed and participate during the design phase;
4) Most variation orders can be traced back to reduced time spent on project planning and design stages due to consultant accepting unreasonable time frame from clients. More time for thorough detailing in design should be given to reduce variation in future. Contract document and adequate time for the Quantity Surveying to prepare the document is important in order to avoid problem in future.
5) The building design should be comprehensive enough and local building materials should be specified for the work.
6) Based on the prevailing economic climate in Nigeria, the pricing, opening of tenders and award of contract should not exceed 28 days.
7) Project managers should study the materials that have irregular trends of inflation and carefully prepare their inventory management so that they can reduce the menace of inflation. They should also get accurate information and research with regard to procurement procedure, material and plant.
8) Design and Build form and other similar forms of contracts, should be operated for major projects. This reduces the risk of variations
9) All expenses of prime cost provisional sums and others by the contractor should be under the approval of the clients or his representative on site.
10) The clients should release fund whenever it is due to the contractors so that to avoid delays and subsequent cost overrun.
11) An advance payment to cover cost of materials on site should be made to contractors on time

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