

Causes of variation in building projects in Akanu Ibiam Federal Polytechnic Unwana (2010-2020)

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ABSTRACT

Variations which occur on given projects are unique and can be linked to the extent of time and money made available for planning. with Ebonyi state sitting on the last position among south-east states in terms of federal allocation, the study examined the causes of variation in building projects in Akanu Ibiam Federal Polytechnic, Unwana. Historical research design was adopted. Primary data was used for carrying out the research. 35 questionnaires were administered and 28 was fully filled and returned. Simple percentage, mean, descriptive statistics and SPSS version 20 software were used to analyse the data. The result of the analysis shows that among the causes of urgent and emergency projects in construction, Poor planning ranked 1st with mean score of 4.48, disaster is ranked 2nd with a mean score of 4.28. It was recommended that it is important that detailed costing of a project should be carried out right from the inception of the project to the demise or practical completion of the project; Stakeholders and Contractors should be involved at planning and scheduling process helps in developing better plans and schedules, major variations which would otherwise be severe will be ultimately prevented in the later stages of the project; Timely advance payment for procurement of materials, specialist equipment and machinery should be made.

Keywords: Variation, building projects, payment, specialist equipment and machinery.

INTRODUCTION

[1], indicated that variations which occur on given projects are unique and can be linked to the extent of time and money made available for planning. [2] posted increase in scope and changes in work condition have great impact on productivity. [3], added that increase in scope and changes in work conditions can result in labour efficiency decline. This change in work conditions as stated by [4] was defined as any modification to the contractual guidance provided to the contractor by the owner, owner's agent or design engineer [5]. New standards, advance technologies and changes in the owner have made projects become more and more complex. In any

construction project, significant additional costs can be experienced by the contractor and the client due to increases/reductions in taxes, general economic trend as well as alteration or modification of design. Every construction project starts with an idea, a deep concept that could transform into reality. This reality demands an early extensive planning and cost control starting from clients brief through design stages which will culminate into feasibility and viability studies, preparing engineering designs from which the cost of the proposed structure or Over the years, Ebonyi State has been the state in South East with the least allocation, this was captured by National

Bureau for Statistics [6]. Many building projects initiated by government and state institutions usually exceed their completion time and cost [7]. This is why it is important to address the issue of causes of variation in

order to help the state institution maximize their resources and reduce their effects in their public projects especially in Akanu Ibiam Federal Polytechnic, Unwana.

LITERATURE REVIEW

General Concept of Variation in Construction Project

Variation is the alteration or modification of the design, quality or quantity of the works as shown on the contract drawings described by or referred to in the contract bills. Variations are perhaps the most vexatious area of contractual relationship in the construction industry today. In contractual agreement, variation is limited to the correction of an inconsistency, but if there is no contractual requirement for variation, whether expressed or implied it would not be practicable for the contractor to execute the variation order within the contract period. The contractor is entitled to an extension of time if any variation attracts delay to the contract and eventually the contract period and the cost which will obviously attract time extension. Variation is generally inevitable [8] and it occurs to all type of projects [9]. Such changes can occur at either design or construction stage. Many other researchers have confirmed this and

thus, hardly can a project proceed from beginning to the completion stage without having some changes, either at the level of planning or construction phase [10]. According to [11], variation is an alteration, addition omission and substitution in terms of quantity, quality and schedule of work. In the contract document by the Joint Building Council clause 26, deals with variations and it defines term "variation" to mean the alteration or modification of the design, quality or quantity of the works. These provisions contain detailed arrangements how the changes are to be made but also who will be vested with the power to decide the changes. The parties are thus able to adjust to future contingencies thus secure performance and continuation of the contract. The response has been to come up with ways to prevent or limit the occurrence of variations.

Provision for Variations in JCT Standard form of Contract.

It is common to find incorporated in most building contracts today a clause concerning variations. The condition which allows for such changes as defined in clause 13.1.1 of the JCT standard form of building contracts "definition of variations" is usually termed "variation clause". Without such a provision the contractor would have to agree to erect the building shown on the drawings and represented in the contract bill for the stipulated contract sum and any minor alterations that the employer or his Architect

wishes to make, later in the cause of the project would mean that the contract will become void and a new one drawn up covering all the new features of the projects. This could lay the employer open to breach of contract each time, a change is made to the original design from which the contract bills were prepared and later the procedure of drawing up a new contract each time a change is made will not only be expensive and tedious but also ethical [12].

Nature of Variations

There are variations in all types of construction projects [13] various factors determine how the frequency and nature of variations vary from a project to the other [14]. In the event of variations in the construction project either total direct and indirect cost, adjustment to the contract

duration or both are experienced. Therefore in order to minimize adverse effects of variations on projects, teams must possess capability to efficiently react to variations. The impact of variations on individual construction projects has been subject of great concern in recent years. Variations are

common in construction projects and because considerable changes to the cost and quality and to the project time. The task of variation management is hard for most clients because of how the diverse the causes of variation orders tend to be. However if a mechanism for handling variation orders and making better informed

decisions with the help of past projects can be built into project management then this unfavorable situation can be alleviated whether there is variation orders it should not be the litmus test for successful management, but rather, if variation orders were resolved on time for the benefit of all the parties in the project [15].

Nature of variation orders

The nature of variation orders can be determined by referring to both the reasons for their occurrence and subsequent effects.

[16], distinguished two types of variation orders, namely: beneficial and detrimental variation orders.

Beneficial variation orders

A beneficial variation order is one issued to improve the quality standard, reduce cost, schedule, or degree of difficulty in a project [17]. 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.

Detrimental variation orders

A detrimental variation order is one that negatively impacts the client's value or project performance [18]. Arguably, a detrimental variation order compromises the client's value system. 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.

Causes of Variation

Changes in the construction projects have been classified according to sources, and factors responsible for these causes by many researchers [19] are as follows:

- i. Client related variation
- ii. Consultant related variation
- iii. Contractor related variation

Client Related Variation

The client as the project initiator plays a major role in the construction project from the inception to the completion phases. As a result, clients influence the likelihood of the occurrence of variation. Clients anticipate the needs and objectives of projects, establish the scope of works and the required quality standards. During the

construction stage, clients initiate variation orders due to various reasons.[20] remarked that the principal reason for the client to initiate variation order is a change in requirements. For example, rethinking of the needs or change of the use of the anticipated future utilization of finished works.

Consultant Related Variations

The consultant may directly initiate a variation if the consultant had a failure to capture some details initially. [6] have also cited that change in design for improvement purposes is a norm in professional practice. Change in design is a common practice in projects where construction starts before

design changes affect a project adversely depending on the timing of the changes. Design errors and omissions of design are major causes of project delays. [8] and this leads to loss in productivity and project schedule delay hence adversely affecting the project.

Contractor Related Variations

In some cases, the contractor may suggest variations on a project or the variation may

be required to enable the contractor fulfill certain requirements for carrying out the

project. Involving the contractor at the design may assist in developing a better design by accommodating his creative and practical ideas [9]. In the traditional building projects set up, there is not contractor involvement at design phase and this is a potential or variations of this form. Lack of

these practical ideas in design may eventually affect the project adversely. There are many causes of variation orders. Table 1 shows causes of variation orders stemming from the above discussed origin agents [9].

Table 1: Causes of variation orders

S/N	Causes of variation	Client	Consultant	Contractor	Others
1	Change of plans or scope	•			
2	Change of schedule	•			
3	Clients financial problem	•		•	
4	Inadequate project objectives	•			
5	Replacement of materials or procedures	•			
6	Impediment in prompt decision making process	•			
7	Obstinate nature of the client	•	•	•	
8	Change in specifications	•	•		
9	Change in design by the consultant		•		
10	Error and omission in design		•		
11	Conflict between contract documents		•		
12	Inadequate scope of work for contractor		•		
13	Technology change		•		
14	Value engineering		•		
15	Lack of coordination		•		
16	Design complexity		•	•	

17	Inadequate working drawing details		•		
18	Inadequate shop drawing details		•		
19	Consultants lack of judgment and experience		•	•	
20	Lack of consultants knowledge of available materials and equipment		•		
21	Honest wrong beliefs of consultant		•		
22	Consultants lack of required data		•		
23	Ambiguous design details		•		
24	Design discrepancies		•		
25	Non-compliant design with government regulations		•		
26	Non-compliant design with owners requirement		•		
27	Lack of contractors involvement in design			•	
28	Unavailability of equipment				
29	Unavailability of skills			•	
30	Contractors desired profitability			•	
31	Differing site conditions			•	
32	Defective workmanship			•	
33	Unfamiliarity with local conditions			•	
34	Lack of a specialised construction manager			•	
35	Fast track construction			•	
36	Poor procurement process			•	
37	Lack of communication			•	

38	Long lead procurement			•	
39	Honest wrong beliefs of contractor			•	
40	Lack of strategic planning			•	
41	Contractor's lack of required data			•	
42	Weather conditions				•
43	Health and safety considerations				•
44	Change in government regulations				•
45	Change in economic conditions				•
46	Socio-cultural factors				•
47	Unforeseen problems				•

Source: Adapted from [2].

Effects of Variation

Much analysis and review has been done on construction projects by several authors such as [9]. Despite being affected =, sometimes there is no delay in the progress but then variations in the project. The followings are effects of variation.

Quality Degradation: In case the frequent, they may adversely affect the standard of work [11]. The standard of work was normally poor since frequent variations by contractors to make up for the losses by cutting corners.

Completion Time: As much as the professional team attempts to maintain the project complete schedule intact, time has an equal monetary value. Nonetheless, just main variations during the project may have a direct effect on the completion time of the project. The contractor in most cases, try hard to accommodate the several variations through maximizing on the free floats in the schedules of construction time.

Increase in Project Cost: Increase in the project cost is the most common influence of variation in the construction stage of a project. Major amendments to the project in

terms of design would ultimately increase the cost of the project. A contingency sum is in most cases at the time of maintaining the whole project intact.

Hiring New Professionals: There can be adverse effects on the project because of variations especially in complex technological projects. Highly experienced human resource serves as one of the significantly important resources needed for complex projects. The variations may at times need hiring new specialists or change the entire project team depending on the nature.

Delay in Payment: Payment delays that take place occasionally because of variation in construction project. The variations may block the project progress resulting in delays in the targeted milestones in construction; this may have an effect on payment to contractors.

Increase in Overhead Expenses: Variations need processing procedures, paper work and review prior to implementation [8], both the implementation and processing of variations in construction projects would in turn

increase the overhead charges for all the

participants in question.

Control of Variation

Many researchers have suggested several controls for variations as well as variation order [11]. The control measures can be

categorized into three stages namely, design stage, construction stage and design-construction interface stage.

Design Stage Controls for Variation

Contract documents are the major source of info for projects and balanced as well as variation clause would assist in improving the quality of communication and co-ordination conflicts in contract documents may lead to misinterpretation of the actual requirement of projects.

For that matter, freezing design is a strong control measure. Most owners freeze the design as well as close the door for variation after the completion of the drawing.

Value Engineering at Conceptual Phase: During the phase, value engineering can be a cost saving exercise, as at this stage, variation in any design element would not need rework or demolition at the site. This activity can help clarify project objectives as well as reducing design in balance.

Involvement of Professionals at Initial Stage of Projects: This may help develop better designs by accommodating practical and creative ideas [13]. Participation of professionals help to develop a well detailed design with minimum inconsistency.

Freezing Design: Variations in design may have an impact on projects depending on the timing of the happening of the changes.

Involvement of Contractor at Planning and Scheduling Process: Contractors bring to the table practical ideas which when incorporated at planning and scheduling helps in developing better plans and schedule.

Constructions Stage Controls for Variation

Variation Order Scope: A comprehensive scope goes a long way in helping professional teams to reduce negative effects of variation through appropriate planning [7]. In order to create a distinction between a variation of scope and a variation due to design development, the original scope should be clear and well defined.

Owner's Involvement during Construction Phase: Owner's participation will help to defect noncompliance with the requirements and in prompt approval of the variations [14]. This also serves to keep the owner aware of ongoing activities and assist in quick decision making.

Written Approvals: The owners should approve in writing any variation involving a change in the original price to execution of a variation order. When there is not authorization from the owner, it is difficult to prove the right for compensation thus it is necessary for any party signing on behalf of the owner to have written authorization.

Clarity of Variation Procedure: For effective management of variation orders, clarity of variation is key [15]. Procedures should be identified and clarified to all parties in the early stages of the projects. This will assist to minimize processing time and other mishandling issues.

Design - Construction Interface Stage Controls for Variation

Prompt Approval Procedures: The period between the times when proposed is contract modification is first announced and when the matter is finally rejected or approved as a variation order is very aggravating. Prompt approval procedures help to minimize adverse effects of variations such as costly changes resulting

from long periods between recognition and implementation.

Ability to Negotiate Variation: A key factor for effective control of variation orders is the ability to negotiate variation [9]. This helps the professional team to curtail the negative effects of variation.

Utilize Work Breakdown Structure: this refer to a management tool for identifying

work. The WBS should be used particularly for large projects as an evaluation tool. A variation that involves work not previously included in WBS can be added and its relationship with other WBS element can be easily checked.

Control the Potential for Variation Orders to Arise Through Contractual: Effective

RESEARCH METHODOLOGY

The research design employed in this research was a historical research design. The population has been drawn from projects executed by Akanu Ibiam Federal Polytechnic, unwana in Afikpo LGA, in Ebonyi State from 2010-2020. A total number of ten (10) completed projects executed within the stated period, funded from internal generated revenue (IGR) of the

management of variation orders requires selection of the appropriate contract form with essential and explicitly variation clauses. Well prepared variation clauses lead to shifting risks as well as enhanced communication channels.

polytechnic. The Purposive Sampling (PS) was adopted for this research where each element of the frame has an equal probability of selection. The source of data a collection used by the researcher herein is the primary and secondary source. Data generated was subjected to descriptive statistical analysis and inferential analysis.

FINDINGS AND DISCUSSION

Table 2: Ten (10) highest ranking causes of variation in building projects in Akanu Ibiam Federal polytechnic, unwana.

S/N	Causes	W	VI-----LI					ΣFX	\bar{X}	RANK
			54	3	2	1				
1	Increase in cost of building materials (fluctuation)	F	27	1	-	-	-	28		1 ST
		WF	135	4	0	0	0	139	4.96	
2	Change in specification	F	25	3	-	-	-	28		2 nd
		WF	125	12	0	0	0	137	4.89	
3	Inadequate working drawing detail	F	22	5	1	-	-	28		3 rd
		WF	110	20	3	0	0	133	4.75	
4	Payment delay	F	21	5	2	-	-	28		4 th
		WF	105	20	6	0	0	131	4.67	
5	Change in economic conditions	F	20	5	2	1	-	28		5 th
		WF	100	20	6	2	0	128	4.57	
6	Change of scope	F	19	4	3	2	-	28		6 th
		WF	95	16	9	4	0	124	4.42	
7	Unavailability of skill	F	20	1	4	3	-	28		7 th
		WF	100	4	12	6	0	122	4.35	
8	Lack of proper communication	F	19	1	3	4	1	28		8 th
		WF	95	4	9	8	1	117	4.17	
9	Lack of contractors involvement in design	F	17	2	2	4	3	28		9 th
		WF	85	8	6	8	3	110	3.92	
10	Clients financial problem	F	17	1	1	5	4	28		10 th
		WF	85	4	3	10	4	106	3.78	
Grand Mean										

SOURCE: Researchers field survey, 2021

Table 2 above shows the 10 highest ranked factors affecting cost of building projects. Increase in cost of materials ranked 1st with mean score of 4.96, change in specification, inadequate working drawing details, payment delay ranked and change in economic condition

ranked 2nd 3rd 4th and 5th respectively with RII of 4.89, 4.75, 4.67, 4.57 respectively. This is in line with [3] who mentioned most of these factors as causes of cost increase in building projects.

Conclusion and recommendations

The effect of variation have already been established in earlier chapters and there is specific need for all concerned to channel attention towards reducing or where possible eliminating the causes of variation in building projects. Based on this study, some recommendations are given as follows in order to reduce variations in building contract.

1. It is important that detailed costing of a project should be carried out right from the inception of the project to the demise or practical completion of the project.
2. Stakeholders and Contractors should be involved at planning and scheduling

process helps in developing better plans and schedules, major variations which would otherwise be severe will be ultimately prevented in the later stages of the project.

3. Timely advance payment for procurement of materials, specialist equipment and machinery should be made.
4. Reduce Prime cost and provisional sum items to the barest minimum and assessed realistically after which they may be expanded without further recourse of the client, provided that the initial estimates are not exceeded.

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**APPENDIX A
QUESTIONNAIRE**

Factors affecting cost of building projects

S/N	Factors	VI (5)	I (4)	SI (3)	LI (2)	NI (1)
1	Increase in cost of building materials (fluctuation)					
2	Change in specification					

3	Inadequate working drawing detail					
4	Payment delay					
5	Change in economic conditions					
6	Change of scope					
7	Unavailability of skill					
8	Lack of proper communication					
9	Lack of contractors involvement in design					
10	Clients financial problem					
11	Long period between design and tending time					
12	Supplier manipulation					
13	Conflict between contract document					
14	Inadequate project objectives					
15	Poor strategic planning					
16	Change in government regulations					
17	Unforeseen problem					
18	Weather conditions					
19	Technology change					
20	Consultants lack of judgment and experience					

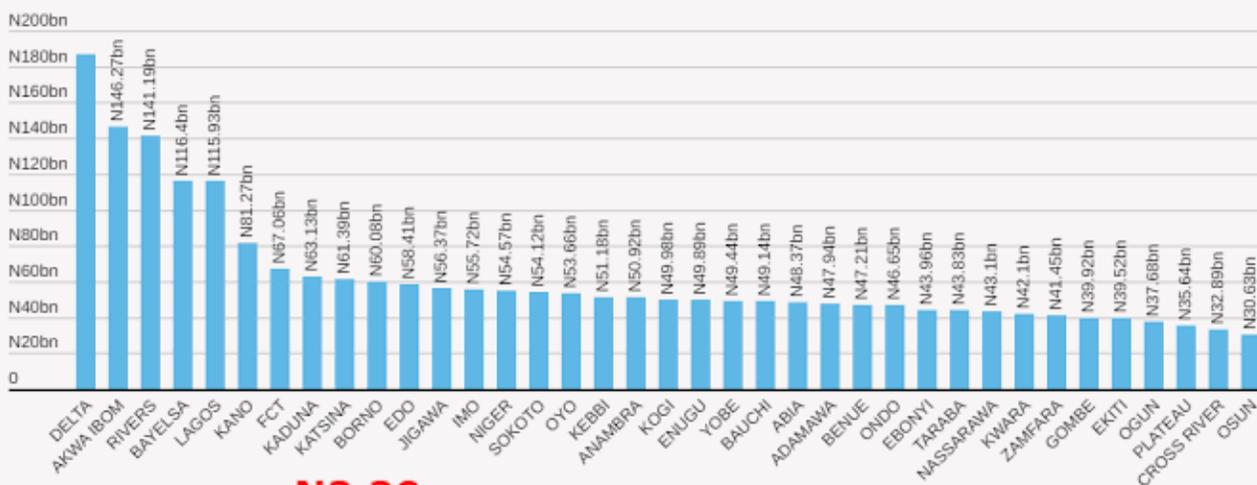
Other factors affecting cost of building projects

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- VI = Very important
- I = Important
- SI = slightly important
- LI = Less important
- NI = Not important

APPENDIX B

Federal allocation to the 36 states and the FCT in 2020



N2.29 trillion total allocation in 2020 was shared among the 36 states and the FCT

By Isah Abdul-Azeez



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Source: NBS
14-Feb-21