

IDENTIFYING FACTORS CAUSING VARIATIONS IN PRIVATE RESIDENTIAL BUILDING PROJECTS IN LAGOS STATE, NIGERIA

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Abstract: Variations occur in almost every building projects in Nigeria. The main purpose of this study is to identify and rank the significant factors causing variation in building project with focus on Lagos State. 230 structured questionnaires were sent to clients, consultants and contractors in Lagos State. Based on 131 valid responses, the data collected were analysed using Relative Importance Index. Analytical result revealed that change in plans or scope by owner's, change in specifications by owners, financial difficulties of owners, poor design and delay in detailed design, lack of detailed and well defined brief, inaccurate or poor estimation of original cost. Poor schedule planning & management, poor site management and supervision, poor project management and contract management, unavailability of building materials, change in economic conditions are major factors contributing to the causes of variations in private residential building projects in Lagos State. The study recommended that building owners must adhere to original plans or scope, adequate financial planning, detailed and well defined brief, detailed designs, accurate cost estimate, employment of skilled personnel to carry out project and contract administration of works in progress.

Keywords: Causes, variations, private, residential, building projects.

1.0 INTRODUCTION

The incidence of Variations has been one of the major problems in the building Industry. According to Wambeke, Hsiang and Liu (2011) Variation almost always exists in the construction work process, and can have significant impact on labour productivity. The Joint Contracts Tribunal Limited (1998) standard form of contract defined variation as:

1 The alteration or modification of the design, quality or quantity of the Works including

1 .1 The addition, omission or substitution of any work

1 .2 The alteration of the kind or standard of any of the materials or goods to be used in the Work

1 .3 The removal from the site of any work executed or materials or goods brought thereon by the Contractor for the purposes of the Works other than work materials or goods which are not in accordance with this Contract;

1 .4 Access to the site or use of any specific parts of the site;

1 .5 Limitations of working space;

1 .6 Limitations of working hours;

1 .7 The execution or completion of the work in any specific order;

The complexity of construction works means that it is hardly possible to complete a project without changes to the plans or construction process itself Jasper, Abdul and Abdelnasses (2010). They further stated that construction plans exist in form of designs, drawings, quantities and specifications earmarked for a specific construction site. Changes to the plans are effected by means of a variation order initiated by a consultant on behalf of the client or as raised by the contractor. The degree of the occurrences of Variation vary from the type of client involved in the project. Variation order contains a set of instructions which allows changes or modifications to be made to an earlier agreement in terms of volume or nature of task to be carried out, O' Brien (1988).

It must be noted and understood that Variations during the post Contract stage of the project. In essence, items that constitute Variations occur after the award of the contract, that is during the construction stage of the project.

The objective of this study is to identify the critical factors causing Variations in private residential building projects in Lagos State, Nigeria.

2.0 LITERATURE REVIEW

Building projects comprises of various and complex inter related sequence of activities. It also involves that the participation of professionals such as Architects, Structural Engineers, Mechanical and Electrical Engineers. The role and activities these professionals and Client can bring changes into the concept, scope of what has been originally intended at the onset.

Construction industry due to its compartmentalization has made Variation almost an inevitable element and has become so prevalent that it is hardly possible to complete a project without changes to the plans or the construction process itself (Kwakye, 1997; Ssegawa et al 2002; Ojo; 2010).

CAUSES OF VARIATION

The causes of Variation in building projects have been discussed extensively in previous Literatures with several factors identified as the causal agents.

In Nigeria Ubani, Nwachukwu and Nwokonkwo (2010) stated that the critical project risk potentials and possible source of concern to lenders, apart from inadequate scope descriptions and documentations are the ever present possibility that the project might not be executed as planned or projected. They further identified the project plan as very important in the successful execution of building projects.

The planning defines the activities and actions time, and cost targets and performance milestone which will result in successful project implementation and achievement of project objectives (Telsang 2004; Ubani Nwachukwu and Nwokonkwo, 2010).

Remon (2012) list 52 factors that cause construction waste water project cost Variation as follows:

There are 52 factors that causes construction wastewater project cost variation, which are used in the paper, and grouped by category in (Table 1) as follows (1) Inadequate planning; (2) Inflation; (3) Incessant variation order; (4) Change in project design; (5) Project complexity; (6) Shortening in project period; (7) Fraudulent practices, Kickbacks and corruption; (8) Fluctuation in prices of raw materials; (9) Unstable cost of manufactured materials; (10) Mode of financing and payment for completed work; (11) High cost of machineries; (12) High interest rates charged by bankers on loans received by contractors; (13) Long period between design and time of bidding/tendering; (14) Lack of coordination between design team and general contractor; (15) Lack of coordination between general contractors and subcontractors; (16) High machineries maintenance costs; (17) High cost of skilled labors; (18) High transportation costs; (19) Domination of construction industry by foreign firms and aids; (20) Poor contract management; (21) Inadequate production of raw material in the country; (22) Conflict between design consultants and implementation consultants; (23) Inappropriate government policies; (24) Poor financial control on site; (25) Absence of construction cost data; (26) Inappropriate contractual procedure; (27) Additional work; (28) Wrong method of cost estimation; (29) Inaccurate cost estimation; (30) Poor relationship between manager and labors; (31) Stealing and waste on site; (32) Inadequate labor/skill availability; (33) Disputes on site; (34) Adverse effect of weather; (35) Bureaucracy in bidding/tendering method; (36) Lowest bidding procurement method; (37) Litigation; (38) Numerous construction activities going on at the same time; (39) Scope changes occasioned by inadequate pre-contract study; (40) Scope changes arising from redesign and extensive variation occasioned by change in brief; (41) Inadequate site investigation; (42) Inappropriate preconstruction study; (43) Work suspensions owing to

conflicts; (44) Inadequate quality/ambiguity of contract documents; (45) Inappropriate contractor's policies; (46) Poor project (site) management/poor cost control; (47) Unexpected ground conditions; (48) Land acquisition costs; (49) Force majeure; (50) Inappropriate contractors; (51) Funding problems; and (52) Shortage of material and plant.

Arain and Pheng (2006) cited by Mohammed et al (2010) identified four origin agents of Variation orders. These included Client, Consultant, Contractor and other changes see Figure 1.

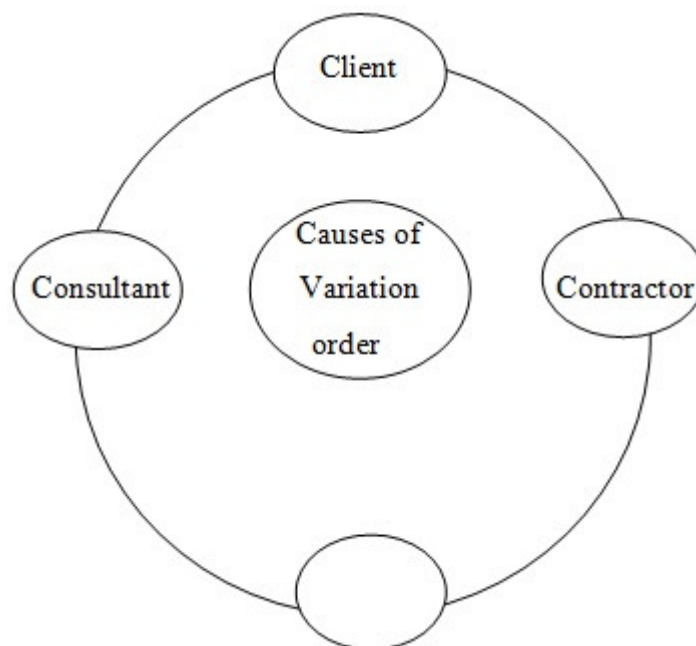


Figure 1: Causes of variation order

Source: Mohammad, Ohe Ani, Rakmal and Yusuf (2010)

Client related changes

Client related changes the causes of variations that were initiated by the owner. In some cases, the owner directly initiates variations or the variations are required because the owner fails to fulfill certain requirements for carrying out the project. The changes initiate by client are:

- Change of scope
- Change of project schedule
- Owner's financial problems
- Inadequate project objectives
- Replacement of materials
- Change in specifications

Consultant related changes

In some cases, the consultant directly initiates variations or the variations are required because the consultant fails to fulfill certain requirements for carrying out the project. The changes initiate by consultant are as follows:

- Change in design
- Errors and omissions in design
- Conflicts between contract documents
- Inadequate scope of work for contractor
- Design complexity
- Inadequate shop drawing details
- Lack of consultant's knowledge of available materials and equipment

Contractor related changes

In some cases, the contractor may suggest variations to the project or the variations may be required because the contractor fails to fulfill certain requirements for carrying out the project. The contractor related changes are as follows:

- Lack of contractor's Involvement in design
- Unavailability of equipment
- Unavailability of skills manpower
- Contractor's financial difficulties
- Defective workmanship

Other changes

Other changes refer to the causes of variations that were not directly related to the participants. These changes are as follows:

- Change in government regulations
- Weather changes
- Change in economic conditions
- Unforeseen problems

Halwatawa and Ranasingbe (2013) identified poor estimation as the major cause of Variation in road construction industry in Sri Lanka. Consultants do not carry out adequate investigations at the initial investigation and design state.

Memon, A.H, Rahman, I.A and Hasan, F.A. (2014) identified unavailability of equipment, poor workmanship and design complexity as the major causes of variations. They identified the effects of variations as increased project cost, delay in completion and logistic delays.

Memon et al (2014) review previous studies as follows:

Variation order is the deviation experienced in any project from base contract or work scope mutually agreed at contracting time (Keane *et al.*, 2010). It is written agreement between the contracting parties that represent an addition, deletion, or revision to the contract documents, identifies the change in price and time and describes the nature of the work involved (CMAA, 1993). Variation orders arise for a variety of causes, of which some causes are foreseeable and others are not. Many researchers have identified various causes of variation orders (CII, 1990a; Thomas and Napolitan, 1995; Clough and Sears, 1994; Fisk, 1997; Ibbs *et al.*, 1998; O'Brien, 1998; Mokhtar *et al.*, 2000; Gray and Hughes, 2001; Arain *et al.*, 2004). As a results of literature review, a total of 18 causes were identified as discussed below.

Change of schedule: A change of schedule during the project construction phase may result in major reallocation of resources. A change in schedule means that the contractor will either be required to provide additional resources or keep some resources idle. In both cases, additional cost is incurred (Fisk, 1997; O'Brien, 1998).

Change in scope: Change of plan or scope of the project is one of the most significant causes of variation in construction projects (CII, 1990b). It is usually the result of inadequate planning at the project definition stage or because of lack of involvement of the owner in the design phase (Arain *et al.*, 2004).

Owner's financial problems: The owner's financial problems can affect project progress (Clough and Sears, 1994; O'Brien, 1998). This problem often leads to change in work schedules and specifications, affecting the quality of the construction.

Change in specifications by the owner: Changes in specification is a common phenomenon in construction projects with inadequate project objectives (O'Brien, 1998). If these changes in the specification of the design or requirement are carried out, this leads to variations in the construction phase.

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. **Change in specification by the consultant:** Changes in specification are observed frequently in construction projects (O'Brien, 1998).

Changes in specification results in variations to the project, leading to delay and increased overall cost. **Unavailability of equipment:** Unavailability of equipment is a procurement problem that can affect the project completion (O'Brien, 1998).

Contractor's financial difficulties: Construction is a labor intensive industry. Whether the contractor has been paid or not, the wages of the worker must still be paid (Thomas and Napolitan, 1995). 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.

Poor workmanship: Defective workmanship may lead to demolition and rework in construction projects (Fisk, 1997; O'Brien, 1998). This results in delay and increased cost.

3.0. METHODOLOGY

A survey of experts on Causes of Variations in Private Residential Building Projects in Lagos State, Nigeria was conducted. A well structured questionnaire was designed and administered to construction stakeholders comprising, Clients, Contractors and Consultants.

These groups comprise, Building Owners, Contractors and Consultants on building projects (Architects, Structural Engineers, Mechanical Engineers, Electrical Engineers and Quantity Surveyors). The questionnaires were distributed to a random sample of 50 Building Owners, 70 Contractors and 110 Consultants located in Lagos State, Nigeria.

3.1. Data Analysis Procedure

Of the 230 questionnaires that had been sent out to targeted groups, 131 questionnaires were returned which yield an overall response rate of 56.96% which is 50 from Building Owners, 70 from Contractors 110 from Consultants located in Lagos State, Nigeria.

Most of the questions in the questionnaire involved assessing some of the effects of delays on building construction projects on a five (5) point Likert's Scale. The data analysis therefore employed the following steps:

- (a) Computation of Relative Importance Index using weighted average formula.

$$RII = \frac{5n_1 + 4n_2 + 3n_3 + 2n_4 + 1n_5}{5N}$$

Where n_1 = frequency of respondent for very high, n_2 = frequency of respondents for high, n_3 = frequency of respondent for moderate, n_4 = frequency of respondents for low, while n_5 = frequency of respondent for not relevant.

3.2. Data Presentation and Analysis

Data from expert opinion survey are as presented in the following tables:

Table 1: Respondent too questionnaire survey.

Professional Group	Sent No.	Received No.	%
Clients	50	30	60.0
Contractors	70	45	64.29
Consultants	110	58	52.73
Total	230	131	56.96%

Source: Field survey (2015)

Table 1a: RII and R of Factors contributing to Variation in Residential Building Projects

1= Not Important, 2= Slightly Important, 3= Moderately Important 4= Important, 5= Very Important

RII= Relative Importance, R=Rank

	Percentage of respondents scoring					RII	Rank
	1	2	3	4	5		
Owner Related Factors							
Change of plans or scope by owner	3.7	3.7	7.4	22.2	63.0	874	1
Change in specifications by owner	3.7	3.7	14.8	37.0	40.7	815	2
Financial Difficulties of owners	3.7	7.4	11.1	48.1	29.6	785	3
Owner's Financial problems	7.4	3.7	14.8	40.7	33.3	778	4
Change of schedule by owner	7.4	3.7	18.5	33.3	37.0	778	4
Replacement of materials/procedures	3.7	3.7	33.3	29.6	29.6	756	6
Inadequate project objectives	3.7	11.1	18.5	40.7	25.9	748	7
Impediment in prompt decision making process	3.7	11.1	22.2	40.7	22.2	733	8
Obstinate nature of owner	7.4	3.7	29.6	44.4	14.8	711	9

Table 1b: RII and R of Factors contributing to Variation in Residential Building Projects

	Percentage of respondents scoring					RII	Rank
	1	2	3	4	5		
Consultants Related Factors							
Poor design and/or delay in detailed design							
Lack of detailed and well defined design brief							
Inaccurate or poor estimation of original cost							
Incomplete design information when estimating							
Change in design by consultants							
Lack of competence among consultants & project managers	1	2	3	4	5	RII	Rank
Design discrepancies (inadequate design)							
Lack of experience among Consultants & project managers							
Lack of experience among Consultants & project managers	0.0	7.4	11.1	33.3	48.1	844	1
Error and omissions in design	0.0	7.4	22.2	14.8	55.6	837	2
Insufficient time (for pre-tender stage)	0.0	3.7	18.5	37.0	40.7	830	3
Lack of coordination at design phase	0.0	7.4	25.9	22.2	44.4	807	4
Consultant's lack of required data	3.7	7.4	18.5	25.9	44.4	800	5
Poor planning and coordination at construction stage	0.0	7.4	14.8	51.9	25.9	793	6
Non-compliance design with owner's requirement	0.0	14.8	11.1	40.7	33.3	785	7
Conflicts between contract documents	0.0	7.4	22.2	44.4	25.9	778	8
Change in specifications by consultant	0.0	7.4	22.2	44.4	25.9	778	8
Project complexity	3.7	14.8	22.2	14.8	44.4	763	9

Non-compliance design with govt. regulations	0.0	7.4	25.9	48.1	18.5	756	11
Technology change	3.7	3.7	25.9	44.4	22.2	756	11
	3.7	3.7	25.9	44.4	22.2	756	11
	0.0	11.1	22.2	48.1	18.5	748	13
	0.0	11.1	18.5	55.6	14.8	748	13
	0.0	14.8	22.2	48.1	14.8	726	16
	7.4	11.1	25.9	29.6	25.9	711	17
	0.0	7.4	40.7	51.9	0.0	689	19
	3.7	14.8	25.9	48.1	7.4	681	21
	7.4	0.0	44.4	44.4	3.7	674	22

Source: Field work (2015).

Table 1c: RII and R of Factors contributing to Variation in Residential Building Projects.

1= Not Important, 2= Strictly Important, 3= Moderately Important 4= Important, 5= Very Important

RII= Relative Importance Index, R=Rank

	Percentage of respondents scoring					RII	Rank
	1	2	3	4	5		
Contractors Related Factors							
Unavailability of local materials	3.7	3.7	44.4	29.6	18.5	711	1
Poor Projected management and contract administration	0.0	11.1	25.9	33.3	29.6	763	2
Poor site management and supervision	0.0	14.8	22.2	29.6	33.3	763	2
Poor schedule planning & management	0.0	14.8	18.5	37.0	29.6	763	2
Change in economic conditions	3.7	14.8	29.6	37.0	14.8	689	2
Lack of communication between construction team	0.0	3.7	29.6	51.9	14.8	756	4
Contractor's lack of judgement & experience	0.0	11.1	25.9	48.1	14.8	733	5
Safety considerations	7.4	14.8	29.6	40.7	7.4	652	5
Inappropriate government policies and priorities	7.4	14.8	29.6	40.7	7.4	652	5
Environment protection and mitigation costs	7.4	14.8	29.6	40.7	7.4	652	5
Unavailability of equipment	3.7	3.7	29.6	55.6	7.4	719	6
Complex design and technology	3.7	3.7	33.3	51.9	7.4	711	7
Bad or inclement weather	3.7	22.2	22.2	51.9	0.0	644	7
Political situation	7.4	25.9	14.8	40.7	11.1	644	7
Unavailability of skills	3.7	11.1	18.5	63.0	3.7	704	8
Differing site conditions	3.7	18.5	18.5	40.7	18.5	704	8
Unforeseen problems	11.1	14.8	29.6	33.3	11.1	637	9
Lack of contractor's involvement in design	3.7	14.8	29.6	40.7	11.1	681	10
Socio-cultural factors	14.8	14.8	29.6	25.9	14.8	622	10

Source: Field work (2015).

Table 2: RII and I of Factors contributing to Variation in Residential Building Projects

RII= Relative Importance, R=Rank

	RII	Rank
Owner related factors	0.7	1
Consultant related factor	75	2
Contractors related factors	0.7	3
External related factors	61	4

0.7

52

0.7

34

Source: Field work (2015)

4.0 DISCUSSION

The factors contributing to variations in private residential building projects were grouped into four categories as follows: Owner related factors, consultant related factors, contractors related factors and external related factors.

Tables 1a,1b,1c & 1d present the most important factors contributing to variations in private residential building projects as perceived by the three construction participants. The ranking shows that the most important owner related factors contributing to variations as change of plans or scope by owner (RII=0.874), change in specifications by owner (RII=0.815) and financial difficulties of owners (RII=0.785). Consultants rated the top three as follows:

Lack of well detailed and well designed brief (RII=0.837) and inaccurate or poor estimation of original cost (RII=0.830). Contractors ranked poor project management and contract administration, poor site management and site supervision and poor schedule planning and management as major factors contributing to variations. The contribution of external factors contributing to variations were ranked as follows:

Unavailability of local materials (RII=0.711) change in economic conditions (RII=0.689) and change in Government regulations (RII=0.650)

Table 2 was used to determine the most significant contributor to variation in private residential building projects. The table shows that owner related factors with RII= 0.775, are the highest contributor to variation followed by consultant related factor RII=0.761, contractors related factors RII= 0.752 and external related factors RII=0.734.

The findings are valid in that of the building Owners and Contractors are the major initiators of variations in construction projects.

5.0 CONCLUSION

The demand for residential accommodation is on a continuous increase. Governments at various levels over the years have tried to close the gap between the demand for residential accommodation and supply but little success has been achieved due to the ever increasing population in Nigeria. Among the problems that beset residential building construction, variation is a considerable issue, sequel to the above, this study aimed to identify the critical

factors causing variations in private residential building projects. The study carried out a comprehensive literature review, questionnaire survey was conducted among building construction participants involved in residential building construction projects in Lagos State. The finding revealed that: Change in plans or scope by owners, change in specifications by owner, financial difficulties of owners, poor design and or delay in detailed design, lack of detailed and well defined brief, inaccurate or poor estimation of original cost, poor schedule planning & management, poor site management and supervision, poor project management and contract management, unavailability of local materials, change in economic conditions and change in Government regulations as the major factors contributing to the causes of variations in private residential building projects in Lagos State.

RECOMMENDATION

In view of the above findings and with Lagos State Nigeria in mind, the following recommendations are made:

- There must be discipline on the part of clients to adhere to plans or original scope and specifications outlined for the project.
- Adequate arrangement must be made by owners to secure the required funds for the projects.
- Enough time must be given to the production of detailed design before embarking on projects.
- Clients must provide the consultants with detailed, comprehensive and well defined brief.
- Experienced quality surveyors must be engaged in the preparation of estimates and Bills of Quantities.
- Contractors must devote time and employ skill personnel to carry out project Management, contract administration, site management and supervisor schedule planning and management function.

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